COMPANY’S BRAND -- AN INFLUENCE FACTOR FOR SUSTAINABLE SUCCESS

Octavian, Negoiță¹ Anca Alexandra, Purcărea¹ and Olivia Doina, Negoiță¹
1 Faculty of Entrepreneurship, Business Engineering and Management, "POLITEHNICA" University, Bucharest, Romania,
octav.negoiita@gmail.com, apurcare@gmail.com, olivia_pur@yahoo.com

ABSTRACT: In the dynamics of the worldwide contemporary challenges in which companies function, alongside with the impact of phenomena such as globalisation and workforce mobility, an important factor which lead to an organisational long term success could be “the branding process”. As the brand is a central element of any marketing strategy it is essential to be aware of its influence on the strategic planning. The current paper presents a research results from a bibliographic investigation, with the target of clarifying the influence of the brand equity, in defining elements of sustainable success according with ISO 9004 standard. The competitive potential of any company is influenced by the brands held in the company’s portfolio. Brands are definitely valuable managing.

Key words: brand, process approach brand equity, sustainable success

1. INTRODUCTION

The current social and economic environment characterized by a strong global competition face organizations with new challenges in order to ensure a competitive advantage, and sustainable success.

Ones of the most important elements that define the success of an enterprise: profitability, customer approach, market share, all of these are based on the element that has become the critical factor of this decade-processes’ performance: the brand.

Process approach of the organization took such a scale due to the importance of understanding how a situation develops and evolves in order to make a change in organization to be effective and lead to the desired result (Smith, Ralph; 2007). A successful organization, in current economic environment, is an organization that not only understand how to identify and correct his processes, but at the same time is able to use processes strengths and opportunities in order to obtain strategic advantages.

Many specialists (Kotler, 2011; Kotter, 2003; Doyle, 1998), have shown that one of the directions that management must act to ensure a better position on the market is building a brand. A brand can offer additional value to clients through the information that they receive, minimizing the risk in purchasing decisions due to the addition of recognition, and provide an overview of what the product and company are. Kotler (2011) shows that, if a product could be imitated in simple way, is not the same thing with a brand that allows differentiation of goods and services. Brand differentiation can be made on a strong market-based performance.

All organization’ processes: operational, management, support, lies in a value-creating interaction, ensuring leads to the development of the organization. Kotler (2011) stipulates that the process of brand building cannot be regarded as a component of the marketing process. Kotler considers that “a brand is reflected in everything the company does, a holistic approach to brand enforces strategic perspective. The brand has direct implications in all business processes, both influenced and being influenced by them, contributing together to create value. Both of academic specialists and professionals consider that the brand has become an intangible capital of a company, a strategic asset that ensures long-term profitability.

Another important aspect to be mentioned is brand influence on stakeholders. In a globalized economy, brand breaks the barriers of space enabling the company to have great visibility far beyond its reach. Therefore, more and more managers have turned to brand, giving it a strategic importance because it creates long-term assets that allow growth and maintain competitive advantage. It is obviously the major role played by branding in the success of an organization.

2. BRAND AND BRAND EQUITY

According with the specialists (Keller, 2006, Kotler and Pfoertsch, 2011, Aaker, 1991 etc.) we can concluded that brand represents the sum of all tangible and intangible attributes of a product plus the associations that company's marketing activities would bring to it, in the communication process, consumer information regarding all of this activities, consumer perception and, last but not least, the company's image and value (Fig.1).

For consumers, both industries and individuals - the brand is one that provides some important information such as manufacturer's identification, product quality, reduce the risk of unwanted purchases, reducing search time, etc. For producers serves as a means of products identification thus simplifying the procedures for distribution, storage, product inventory, enables the company's accounting records, can provide legal protection for its unique attribute that we sell. Brand provides great value to the product which caused him to be regarded as an intangible strategic capital firm that provides competitive advantage. David Aaker (1991) defines brand equity as “a set of brand assets and liabilities linked to a brand, its name and symbol that add to or subtract from the value provided by a product or a service to a firm and/or to that firm’s customers”. The researcher modeled the brand's equity based on five dimensions: brand loyalty, the degree of knowledge of the brand, quality brand perception, brand associations, other assets belonging to the brand.
Raj Sivastava researcher at the University of Texas defines brand equity as the sum of brand value and brand strengths. Brand strength is the set of associations and behaviours on the part of a brand’s customers, the channel members and the parent corporation that permits the brand to enjoy sustainable and differentiated competitive advantages. Brand value is the financial outcome of management’s ability to leverage brand strength via tactical and strategic action in providing superior current and future profits and lowered risks.

In the literature we can found several metrics that describe the evolution of brand equity and are structured in terms of consumer side, in few categories as it show in Table 1 (Tim Ambler, 2003).

### Table 1. Brand Equity metrics -- consumer (Ambler, Tim, 2003)

<table>
<thead>
<tr>
<th>Brand Equity Metrics (Consumer)</th>
<th>Measured by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiarity</td>
<td>Salience, i.e. familiarity relative to the other brands in the consideration set</td>
</tr>
<tr>
<td>Penetration</td>
<td>Number of customer or number of active customers as a per cent of the intended market</td>
</tr>
<tr>
<td>What they think about the brand?</td>
<td>Brand preference as a per cent of preference of other brands within the consideration set of intention to buy or brand knowledge</td>
</tr>
<tr>
<td>What they feel about the brand?</td>
<td>Customer satisfaction as per cent average for the consideration set</td>
</tr>
<tr>
<td>Loyalty</td>
<td>This may be behavioural (share of category requirements, repeat buying. Retention, churn) and/or intermediate (commitment, engagement or bonding).</td>
</tr>
<tr>
<td>Availability</td>
<td>Distribution, e.g. weighted percentage of retail outlets carrying the brand</td>
</tr>
</tbody>
</table>

### 3. BRAND EQUITY -- FINANCIAL BASED AS A INFLUENCE FACTOR FOR SUSTAINABLE SUCCES

To ensure company’s long term success, although it is considered a strategic asset, the brand must be continuously improved. Scientists have developed various methods to improve the brand value that take into account: customer satisfaction (Doyle, 1994), customer relationship (Keller, 1993, 2003), a market research conducted among a certain segment of consumers which measures confidence and their attitude towards the brand, analysing demand elasticity changes depending on the price (Moran, 1978). It can be consider that improving brand equity is a very complex process, dynamic which can be measure quantitatively through actions on three areas: consumer, financial, marketing (Fig.2). In this paper we will present the brand equity – financial based influence for sustainable success.
Figure 2. Brand Equity – financial based influence factors

Where:

- $V_P$ represents total market financial value, and it can be calculated with:

$$V_P = \sum_{i=1}^{n} V_i$$

Where:

- $V_i$ associated sales for the brand $i$, and $i$ cover all brands acting in considered market.

$C_{Pv}$ represents the market share associated with the brand and it can be calculated by divide total sales of the brand with total value of the market:

$$C_{Pv} = \frac{(V,v)}{(V_p,v)} \%,$$

Where VB is the total value of the brand B sales. It can be calculated with:

$$VB = P \times Q,$$

Where:

- $P$ represents the price of sales for the product and $Q$ is the brand quantitative sales.
- $MC_{Pi}$ - marketing budget share - represent brand’s marketing budget divides by the sum of all brand’s marketing budgets (active brands in the market):

$$MC_{Pi} = \frac{MB_i}{MB_p} \%,$$

Where $P_n$ is the net profit value and it is defined as the difference between the company's revenue and total expenditure and taxes. It is expressed by the formula:

$$P_n = R - C - Cm - Co - I,$$

Where:

- $R$ is revenue.
- $C$ is the cost of realization of assets sold,
- $Cm$ is the marketing costs.

$PB$ - value of gross profit is defined as the difference between the company’s revenue and production costs. It is expressed by the formula:

$$PB = R - C,$$

Where:

- $R$ is revenue
- $C$ are the costs for carrying goods sold

All this factors described above are factors of influence in increasing brand equity.

Keller (2005) posted that from a financial market’s point of view, brands are assets that, like plant and equipment, can be bought and sold. Presumably the price of a brand reflects expectations about the discounted value of future cash flows. In the absence of a market transaction, it can be estimated, albeit with great difficulty (Ambler and Barwise 1998, and Feldwich, 1996), from the cost needed to established a brand with equivalent strength or as a residual in the model of the value of a firm’s assets (Simon and Sullivan, 1993).

For measure brand equity – financial based a method uses the component of market value unexplained by financial assets and results. Tobin’s $Q$ represent the market value of assets divided by their replacement value as estimated by the book is considerate a proxy of the brand equity. Another approach link the customer mind set measures with stock market values. Stern Steward’Brand Economics link Young & Rubicom’s Brand Asset Valuator (BAV) – survey based measure of brand strength, to Economic Value Added (EVA) a financial performance measure (Keller, 2005).

Aaker and Jacobson (1994) using EquiTrend’s find that change in quality (they have proxy perceived quality with brand equity) and thus equity had a significant effect over than above that change in Return of Investment (ROI).
Organizations who experienced the larger gains in brand equity saw their stock return average 30%; conversely, companies with largest loss in brand equity saw stock return average a negative 10% (Keller, 2005). Another study, from Aaker and Jacobson (2001), reveals that changes in brand attitude were associated with stock returns and led accounting financial performance. Awareness not translated into positive attitude did little to the stock price.

Kerin and Sethuraman (1998) have determined the link between brand value and stock value. Rao (2004) reveals in a study that a corporate branding strategy produced higher average return than a multi-brand strategy (Keller, 2005).

Sustainable management for the success of an organization, due to SR EN ISO 9004: 2010, should adopt an approach based on quality management. Organization must develop quality management system to ensure:

- Efficient use of resources
- Making decisions based on concrete evidence
- Focus on customer satisfaction and expectations as well as other stakeholders

Focus on customer satisfaction and their needs is one way of increasing brand equity.

The standard specifies the following actions necessary for sustainable success management:

- Long term planning perspective
- Constant monitoring and periodic review of the environmental organization
- Identify all stakeholders, assess their potential impacts on organizational performance and determine how to meet their needs and expectations
- To anticipate future resource needs
- Establish appropriate processes to achieve organization strategy
- Periodically evaluate compliance with current plans and procedures
- Establish and maintain processes for innovation and continuous improvement

An increase brand equity is primarily awareness, loyalty to the brand which translates into trust from consumers. Just to maintain and increase this element is a way to identify and satisfied all customer requirements, condition for achieving sustainable success.

Maintaining a growing brand equity involves on going assessment of plans and strategies, an analysis of internal and external organization environment to obtain components of sustainable success.

4. CONCLUSIONS

Evaluation of a branding process focuses primarily on measuring the three directions of brand equity: customer, market, financial.

They presented the main indicators that should be considered in evaluating brand value in financial terms. Measurement results indicate both a competitive brand position, market position, especially as its location for company customers: consumers, distributors, shareholders of the company..

Brand equity, the growth of this capital is an important step for any organization in orientation to achieve competitive advantage and sustainable success.

5. REFERENCES

SUSTAINABLE HIGHER EDUCATION FOR THE 21ST CENTURY

Andreea, Stoiciu1 and Eva-Nicoleta, Burdusel2
1 Institute of Management and Sustainable Development, stoiciuandreea@yahoo.com
2 Lucian Blaga University of Sibiu, eva.burdusel@ulbsibiu.ro

ABSTRACT: The aim of the paper is to perform an analysis of the current state of Romanian higher education taking into account the changes, challenges and opportunities for a sustainable higher education system, and performing an integrative and anticipative approach to education. The relevance of the topic is supported by the endeavour of integrating Romanian education in the European higher education and the European research area. The paper shall clarify certain concepts: sustainability in higher education; formal vs. informal vs. non-formal education; degree vs competencies. and reach certain conclusions regarding graduates adaptability to labour market and society requirements.

Key words: higher education, sustainability, excellence, formal/informal/non-formal education

1. PREPARING FOR THE FUTURE

Preparing for the future is more than a mere slogan and it represents both a warning and an incentive for the urgency of adaptiveness and responsiveness to change substantiated by an accurate forecasting of upcoming trends in society with subsequent impact on the educational system in general. „We are in the midst of a crisis of massive proportions and grave global significance. I do not mean the global economic crisis that began in 2008; I mean a crisis that goes largely unnoticed, but it is likely to be, in the long run, far more damaging to the future of democratic self-government: a worldwide crisis in education.” [1] Policy-makers, decision factors and key stakeholders involved in the process of educational law-making are aware that „the pressure for economic growth has led many European political leaders to recast the whole of the university education – both teaching and research – along growth-oriented lines, asking about the contribution of each discipline and each researcher to the economy.” [1]

In his seminal essay „What are universities for?” Keith Thomas competently discusses a highly relevant and topical issue, now more than ever, i.e., the relation of universities and higher education to the needs of society, in view of attaining economic success and technological advance. The most visible aspect here is the urgency that higher education institutions should contribute to the „knowledge economy”. „All publicly funded research at universities should have an identifiable ‘impact’ on our economy and society.” [2] Furthermore, it is imperative nowadays that universities help „individuals to develop their capabilities to their highest potential”, focus on increasing knowledge and understanding, both at individual and community level; as well as contribute to shaping „a democratic, civilized, inclusive society.” [2]

In this context, the relationship between universities and governmental policies has changed radically. Another significant issue for the interdependence between university and society in view of an enhanced correlation of knowledge creation and knowledge capitalization is a focus on competencies rather than degree (e.g., entrepreneurship, cultural awareness and interaction, learning to learn, information literacy, soft skills, etc.) as well as an emphasis on continuing professional and personal development.

The pattern of the pursuit of knowledge for its own sake is no longer viable, instead the utilitarian expectations form society at large seem to prevail. It is here that the above-mentioned essay refers to the „threat posed to the humanities by funding cuts” and „education for profit”. Hence „academic subjects which do not attract numerous students and large research grants are vulnerable ... In practice, this means the humanities.” [2], [3]

In an age subject to ongoing, unprecedented and hard-to-predict changes, societies at large and higher education institutions in particular must assume the challenging task of designing new strategies that are not only able to counteract challenges but also to identify and capitalize opportunities for gaining competitive edge and make a difference of both on the institutional and labour market.

Commissioner Androulla Vassiliou acknowledged in her speech occasioned by the EUA Annual Conference (Palermo – 23 Oct. 2010) that:

"Europe is no longer in smooth waters: the storms of the crisis have battered our economies; we risk being swamped by the rising social costs of dashed hopes, job losses, and clampdowns on public spendings. In such circumstances, investing in our young people, investing in their education is the crucial act that will put our societies back on course [...] I am certain that we can affect our fate for the better by making better use of our resources in education, in particular of our longstanding tradition in higher education, which has seen a great diversity of institutions flourish on our continent [...]. Universities have carried the flame of learning from their earliest days into modern times by evolving with – and often anticipating – the changes in the world around.” [5]

Therefore, the focus here is on universities not only as repositories and disseminators of past knowledge (tradition) but also on the still untapped resources of universities to set the trends for the future development of society by means of the critical mass of academics. Nowadays, human resource has become the most valuable asset for generating sustainable development as well as in view of encouraging creativity, innovation and critical thinking rather than analytical thinking and historical perspective.
Mention should be made that the concept of reform is part of a complex and dynamic process, triggered by societal changes and that need to be addressed by means of changing perspective and adapting the methods to the novel requirements.

The reforms that have recently shaped the Romanian higher education system have paid close attention to the European context, particularly the Lisbon Agenda, the Bologna Process and, more recently, the Europe 2020 Strategy. According to the National Education Law, which came into force in 2011, the vision of the current law is to “promote an education focused on values, creativity […] fundamental knowledge as well as applied knowledge, competencies and skills in view of further use in society and profession.” [art. 2(1)].

Furthermore, its mission is to “train, by means of education, the mental infrastructure of Romanian society, in keeping with the new requirements entailed by Romania’s recent EU membership accompanied by globalization, as well as the sustainable creation of highly competitive national human resource, able to perform efficiently in the current and future society.” [art. 2(2)] [7]

Let us conclude this part by emphasizing the need for a stable and coherent legal framework, ensuring institutional autonomy and decentralization, as well as consultation with the academic community and society stakeholders before adopting and enforcing new education laws.

2. UNDERSTANDING THE FUTURE AND IDENTIFYING NEW STRATEGIES FOR HEIS

According to Eduard de Bono, we need to perform a thorough analysis of the past and be able to design the future: “Universities found it useful to look backwards and … scholarship attained a high value; unfortunately, they have never recovered from that. Design is a matter of putting together what we know in order to achieve what we want; … design is the opposite of analysis and judgment; design may be seen as having an ‘added value’”. [7]

Furthermore, Marshall McLuhan concluded that “we drive into the future with our eyes on the rear-view mirror.” [8]

Therefore, analysis may be considered a rather static process, whereas design is primarily dynamic; thinking ahead, foresight and the ability to anticipate changes and accurately identify measures to counteract challenges will significantly contribute to gaining competitive edge by higher education institution.

Lateral thinking or Blue Ocean strategies represent an alternative to linear, traditional thinking and instead facilitate innovation and creative or critical thinking, thus making a difference for educational organizations on an increasingly competitive market undergoing the constraints of demographic changes and economic crisis.

Higher education institutions need to create new strategies aimed to respond quickly and accurately to complex situations, based not on “what had been” but rather on “what might be”; universities should be more concerned with value creation than information dissemination. “Education has always been concerned with knowledge. Knowledge is easy to teach and test. Is knowledge enough?

When a student leaves school (s)he has to start operating in the future: decisions, choices, alternatives, plans, initiatives … Operacy involves: an examination of the consequences of action, a consideration of relevant factors, assessment of priorities, attention to other people’s interests, a definition of objectives … education becomes a world unto itself … without too much regard for the outer world.” [9]

In this context, let us briefly refer to some considerations included in the Presidential Strategy: Education and Research for a Knowledge Society such as: university differentiation and resource concentration advocating differentiation based on quality criteria at all levels: institutional, study programs and departments. In this respect, the aforementioned Presidential strategy set forth several actions meant to deploy the measure of university differentiation:

- External evaluation of all public and private higher education institutions
- Evaluation of distance higher education
- Evaluation and ranking of study programs
- Universities will proceed to the evaluation of departments and their classification following 5 performance levels
- Establishment of the Romanian Institute for Advanced Studies

The idea of diversity in terms of university mission, as we have already entered the second decade of the 21st century, is fully advocated, encouraged and promoted by Commissioner Androula Vassiliou, in her speech delivered on the occasion of the EUA Annual Conference (Palermo – October 23, 2010):

“In my vision, higher education is at the core of the economic and social matrix that defines our world. Universities are uniquely poised to shape our emerging knowledge-based societies, and are taking on new roles in order to do so.

I understand, too, that there is great diversity among these institutions, both in their orientation and scope: not all higher education institutions have had the same beginnings, or share the same history. But in our complex world, diversity is a strength. In my view, we should invest in this diversity, addressing issues related to quality assurance, funding, accessibility and governance. And in parallel, to take forward the growing consensus on two other issues that affect every university: democratizing higher education and making better use of resources.” [11]

Some of the major goals of a performing university mission should concern:

- the balance that the institution is aiming to achieve in terms of local, national, regional and international positioning, i.e. identity vs. uniformity;
- the balance between teaching and research as well as a continuous improvement of educational processes
- the ability of the higher education institution to relate effectively with society, external stakeholders and labor market
- the relevance of study programs for current and future society needs and the correlation between curricula and competencies (key and transversal)

3. HIGHER EDUCATION OBJECTIVES: ACHIEVING EXCELLENCE BY SUSTAINABILITY

Official documents testify to the acute and urgent need for an informed awareness about formal, non-formal and informal education with a high potential to improve the quality of education and recognition of competencies.
According to the Presidential Strategy: Education and Research for a Knowledge Society:

“Concerning the lifelong education participation rate, Romania comes in last position, with a participation of only 1.6% compared to the EU average of 10.8% […] A culture of lifelong learning and education is missing.

Moreover, we do not have an integrated and coherent vision on all types of education and professional training which individuals may access during their entire life. We do not have institutional mechanisms for certifying and validating learning carried out in informal and non-formal contexts, although the creation of such mechanisms was firmly included on the European agenda. There are no specific incentives for individuals or for employers in order to motivate them to participate in lifelong learning, although the state can only gain from a more educated labour force.” [12]

Mention should be made, in this context, of a recent series of debates rolled out and co-organized by the Institute for Management and Sustainable Development (IMSD), called Grassroots Education / Educatie la firul ierbii and initially organized in September 2011. Its goal was to initiate a public debate among the participants, key stakeholders of the Romanian education field – students, teachers, parents, and representatives of the Government and of the universities, NGOs, companies – on the topic of formal, non-formal and informal education as well as the influence of contemporary society upon personal development. [13]

The participants, mainly students, elaborated a series of conclusions and solutions in view of attaining sustainability and achieving excellence in the Romanian education system, such as:

- better usage of the human and material resources, e.g. improving the skills and the usage of ITC instuments and new technologies
- correlation between the curricula and the needs and demands of the labour market
- creating and implementing a mandatory frame of extra-curricular activities, in order to develop and promote informal and non-formal education and to improve native skills of the students
- improving the library infrastructure as well as the research and development frame, together with the enhancing the practical skills
- creating and implementing a cooperation system between the universities, NGOs and companies, which is able to provide internships and part-time jobs in order for the students to gain competences for the labour market
- encouraging excellence and true value, together with developing volunteering activities in order to improve skills, to better understand the society and its needs.

One of the most important pillars of the sustainable higher education, such as it was concluded from the debates and also such as it is presented in the European and United Nation’s documents is using the new technologies and IT&C instruments in the education process at all levels.

According to the results of an international survey conducted by the United Nation’s group C7 "e-Governance for Sustainable Development" and IMSD the usage of IT&C tools, e-learning services and digital literacy are essential for improving life standards and sustainable development in any field or society.

![Figure 1. Perception of e-learning platform as a part of sustainable development](image1)

The strong relation between the e-services, namely e-learning, and the sustainable development is obvious. All categories of respondents: persons, NGOs, public authorities or SMEs have pointed out on a scale of 0 to 5 that the e-learning services and platforms are very important, the average being over 3,7 out of 5 points. The companies and SMEs which are most connected and most educated in using new technology have assigned the highest score 4,5 out of 5 points. Trading and lifelong learning are highly important for all categories and e-learning has proven to be a highly appreciated solution for all categories in the survey.

![Figure 2. The perception regarding electronic services within education area](image2)

The respondents’ perception regarding the electronic services projects developed within the education field is in majority that these types of services work well. Almost 50% declared that the e-services in education field are quite satisfactory, which indicate an improvement of e-skills and the better development of IT&C infrastructure in the education field. 10% out of the respondents pointed out that one of the biggest issues are the abandoned project, which are costly and do not have real turnover of any kind.

![Figure 3. The perception of the measures taken by public authorities on sustainable development](image3)
The respondents which link directly education with sustainable development pointed out that the public authorities, which are a major stakeholder in these fields, do not take enough measures in order to implement real solutions for the sustainable development overall. 72% of the participants consider that only partial measures have been adopted.

In order to have real results all stakeholders should work together day-by-day for improving excellence and sustainable education, which are key elements in the development of each person and every society.

4. CONCLUDING REMARKS:

- providing a coherent and predictable framework is essential both for children and youth development, as well as for the quality insurance of future generations, since any delay in the implementation of real measures of reform might endanger the our country’s mid to long-term evolution.
- Correlating the educational system with the labour market
- Encouraging students to devote more study time to their congenial subjects or disciplines
- Emphasizing the practical dimension of learning and acquiring competencies
- The educational process should function as a coherent, logically-connected system where the transition from one stage to another is harmonious and defined by connectivity rather by disruptive approaches and methods (e.g. students might have the opportunity to get familiar with some disciplines they will further study thoroughly at university)
- Modernization of material base and technical endowment, e.g. broadband implementation in schools
- Official recognition of non-formal and informal education
- Strengthening the role of libraries, both urban and especially rural ones, as centres of knowledge, development and orientation for students
- Encouraging excellence in educational performance
- Promoting lifelong learning and permanent education
- Improving communication substantiated by a diminished resistance to change within the system
- High responsibility of each key stakeholder

The change from elite to mass higher education has entailed a significant challenge: i.e. university management should shift the emphasis from a quantitative (in terms of student numbers - short-term institutional benefit) towards a qualitative approach (focus on updated study programs and curriculum design in keeping with society demands in view of sustainable development). Universities worldwide have readjusted their patterns, mission and academic culture in order to cope with the demands of changing societies. Nowadays, higher education institutions have to compete for resources (experienced and well qualified staff; research funding) as well as addressability (students; employability market). [3]

To sum up the present study, let us highlight some of the major objectives and principles of a sustainable higher education institution:

- meeting the criteria and standards of excellence in the educational and research processes it undertakes and develops,
- generating qualitative change and preparing the students for the future by empowering them with the required competencies for a knowledge-based society,
- effective operation of the university as an organization and value-added academic processes. [4]

5. REFERENCES

2. Keith Thomas, „What are universities for?”, TLS May 7/2010; p.13; 14
4. Constantin, Opren; Eva-Nicoleta, Burdusel and Camelia, Opren, A Change Management-Based Approach to the Dynamics of Higher Education Institutions, in Revista economica” nr. 4 (51)/2010, pp.217-223 ISSN 1582-6260, Sibiu 2010
NEW CURRICULA DEVELOPMENT
ABSTRACT: Traditionally engineering curricula are input oriented curriculum based on educator-student interaction with the focus on educator’s academic knowledge. However, the paradigm has changed from an input based teaching/learning process to an outcome based process [2]. Aim of the research is to analyze the evaluation of efficiency of an engineering curriculum. The meaning of the key concepts of efficiency, self-evaluation, internal evaluation and external evaluation is studied. Moreover, the study indicates how the steps of the process are related: efficiency of engineering curriculum → evaluation of efficiency of engineering curriculum → empirical study within a multicultural environment. The qualitative evaluation research has been used. The empirical study was conducted within the Seventh Baltic Summer School Technical Informatics and Information Technology, August 12-27, 2011, Riga, Latvia. The findings of the research allow drawing conclusions on the efficiency of the engineering curriculum.

Key words: engineering curriculum, efficiency, self-evaluation, internal/external evaluation.

1. INTRODUCTION
Engineering and the economic, social and environmental dimensions of our life are inter-related as shown in Figure 1.

Figure 1. Engineering and dimensions of life.

Application of engineering innovations in one of the dimensions affects the other two dimensions. Thus, the economic dimension has already changed from the traditional commercial activity to the Internet enabled business. In its turn, speeding up service delivery and distribution-tracking capabilities leads to changes in social and environmental dimensions that include transition from an input based to an outcome based [2] teaching/learning process in engineering curriculum. These organizational changes in complex and constantly self-regenerating environments [8] put a greater emphasis on the evaluation of efficiency of engineering curriculum.

Aim of the research is to analyze the evaluation of efficiency of an engineering curriculum.

The meaning of the key concepts of efficiency, self-evaluation, internal evaluation and external evaluation is studied. Moreover, the study indicates how the steps of the process are related: efficiency of engineering curriculum → evaluation of efficiency of engineering curriculum → empirical study within a multicultural environment.

The remaining part of this paper is structured as follows: Section 2 introduces the theoretical framework on efficiency of engineering curriculum and its evaluation. The associated results of the empirical study will be presented in Section 3. Finally, some concluding remarks are provided followed by a short outlook on interesting topics for further work.

2. THEORETICAL FRAMEWORK
The theoretical framework of the paper involves the meaning of the key concepts of efficiency and evaluation studied.

2.1. Efficiency of Engineering Curriculum
Efficiency of engineering curriculum involves quality and effectiveness as depicted in Figure 2.

Figure 2. Elements of efficiency.

Quality is regarded as the improvement of student engineers’ knowledge, skills and attitudes [19] as shown in Figure 3.

Figure 3. Elements of curriculum quality.

In turn, effectiveness is defined as the educator’s contribution to the student engineers’ knowledge, skills and attitudes [19].
Curriculum is efficient if the inputs (curriculum) produce the maximum output (students’ knowledge, skills and attitudes) [4].

Therein, students’ knowledge, skills and attitudes are the outcome criterion of efficiency of engineering curriculum.

Analysis of efficiency of curriculum includes the comparison of the inputs with the outputs, in other words – assessment, and the context analysis in which the curriculum is implemented, in other words – evaluation.

2.2. Evaluation of Efficiency of Engineering Curriculum

By evaluation, the process of examination and its results are determined.

It should be mentioned that evaluation includes assessment as demonstrated in Figure 4.

![Figure 4. Inter-connections between evaluation and assessment.](image)

Traditionally, assessment reveals student advancement, placement and grades. In its turn, evaluation provides feedback on the worth or value of a course, module or curriculum.

Moreover, evaluations often utilize assessment data along with other resources to make decisions about revising, adopting, or rejecting a course, module or curriculum.

Evaluation includes self-evaluation, internal evaluation and external evaluation [7] as depicted in Figure 5.

![Figure 5. Elements of evaluation.](image)

Self-evaluation is usually used by the students of a course, module or curriculum. Internal evaluation involves internal evaluators, namely, engineering students and educators of the education institution [7].

External evaluation is traditionally presented by experts. By expert a professional who obtains extensive experience based on research in a particular area of study is meant.

The choice of experts is based on two criteria, namely, recognized knowledge in the research topic and absence of conflict of interests [9] as shown in Figure 6.

![Figure 6. Criteria of choosing experts for external evaluation.](image)

The number of experts depends on the heterogeneity of the expert group: the greater the heterogeneity of the group, the fewer the number of experts [15]. Thus, 10 is a good number of experts for the study [9].

3. EMPIRICAL RESEARCH

The empirical research includes the research design and analysis of the pre- and post-survey.

3.1. Research Design

The design of the present empirical research comprises the purpose and question, sample and methodology of the present empirical study. The present empirical study was conducted during student engineers’ Enterprise 2.0 application in the engineering curriculum of Baltic Summer School Technical Informatics and Information Technology to examine efficiency of Enterprise 2.0 application in engineering curriculum.

Its topicality is determined by ever-increasing flow of information and business processes in which an important role is laid to Enterprise 2.0 as a means of getting information and gaining experience. The research question is as follows: Has Enterprise 2.0 application in the engineering curriculum been efficient? The present research involves 35 respondents, namely,

- 24 participants of Seventh Baltic Summer School Technical Informatics and Information Technology at Riga Technical University, August 12-27, 2011, Riga, Latvia, for the case analysis,

- an educator of Baltic Summer School Technical Informatics and Information Technology for the internal evaluation and

- 10 researchers in the field of educational research from different countries for the external evaluation.

All the participants of Baltic Summer School Technical Informatics and Information Technology have got Bachelor or Master Degree in different fields of computer sciences and working experience in different fields related to computing and information technology.

The participants of Baltic Summer School Technical Informatics and Information Technology are from different countries, namely, Latvia, Lithuania, Estonia, Russia, Belarus, Mongolia, Egypt, Germany, Pakistan, Indonesia, Great Britain, China, India, Nigeria, Romania and Mexico, etc. Hence, the sample is multicultural as the respondents with different cultural backgrounds and diverse educational approaches were chosen.

That emphasizes the study of individual contribution to the development of student engineers’ learning outcomes in Enterprise 2.0 application [11].
It should be also mentioned that whereas cultural similarity aids mutual understanding between people [17], the students’ different cultural and educational backgrounds contribute to successful learning and become an instrument of bringing the students together more closely under certain conditions such as appropriate materials, teaching/learning methods and forms, motivation and friendly positioning of the educator [1]. Hence, the group’s socio-cultural context (age, field of study and work, mother tongue, etc.) is heterogeneous.

Interpretative research paradigm which corresponds to the nature of humanistic pedagogy [10] has been determined. Interpretative paradigm is characterized by the researchers’ practical interest in the research question [3].

Figure 7 shows how the qualitative evaluation research proceeded from the phase of exploration of the context analysis aimed at determining the present situation in Enterprise 2.0 application in the engineering curriculum for promoting students’ motivation and their readiness to implement the joint activity, through the description of the practice that analyzes differences in levels of features analyzed and to the phase of generalization of the model that evaluates efficiency of Enterprise 2.0 application in the engineering curriculum for the development of students’ knowledge, skills and attitudes.

**Figure 7. Phases of the qualitative evaluation research.**

The qualitatively oriented research allows the construction of only few cases [12]. Moreover, the cases themselves are not of interest, only the conclusions and transfers we can draw from this material [12]. Selecting the cases for the case study comprises use of information-oriented sampling, as opposed to random sampling [5]. This is because an average case is often not the richest in information. In addition, it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur [5]. Random samples emphasizing representativeness will seldom be able to produce this kind of insight; it is more appropriate to select some few cases chosen for their validity.

### 3.2. Pre-Survey

The present part of the empirical study reveals analysis of engineering students’ learning outcomes in Enterprise 2.0 application within the engineering curriculum of Baltic Summer School Technical Informatics and Information Technology in 2011 through thorough analysis of two surveys of the student engineers’ feedback regarding their needs before and after educators’ contribution.

Baltic Summer School Technical Informatics and Information Technology has been taking part in the Baltic States since 2005. The International Summer School offers special courses to support the internationalization of education and cooperation among the universities of the Baltic Sea Region.

The goal of studies in Baltic Summer School Technical Informatics and Information Technology is to prepare the students for international Master and Ph.D. programs in Germany, further specialization in computer science and information technology or other related fields and learning in a simulated environment. Baltic Summer School Technical Informatics and Information Technology contains a special module on Web 2.0 that includes Enterprise 2.0. The present research is based on a widely accepted conception of Enterprise 2.0 as use of Web technologies for enterprise (business) purposes. Typical Enterprise 2.0 of Web 2.0 techniques and technologies include corporate blogs, wikis, feeds and podcasts [18] as shown in Figure 8.

Analysis of the students’ feedback regarding their needs for Enterprise 2.0 application in the pre—and post-survey was based on the following questionnaire:

- **Question 1:** Do you have your own business and / or enterprise? The evaluation scale of two levels for the question is given where “0” means “no” and “1” - “yes”.

- **Question 2:** Do you plan to start your own business and / or enterprise? The evaluation scale of two levels for the question is given where “0” means “no” and “1” - “yes”.

- **Question 3:** To which extent do modern business and enterprise employ Web technologies? The evaluation scale of five levels for the question is given where “0-20%” means a low level of Enterprise 2.0 application and “80-100%” points out a high level of Enterprise 2.0 application.

- **Question 4:** Please, indicate at least 3 Web technologies used by business and / or enterprise for business applications. The evaluation scale of three levels for the question is given where “1” means a low level of Enterprise 2.0 application and “3” points out a high level of Enterprise 2.0 application.

The pre-survey results of needs for Enterprise 2.0 application reveal that the student engineers do not realize the possibilities offered by Enterprise 2.0 for business properly: one engineering student has got his/her own business, 11 engineering students plan to start their own business and / or enterprise, nine engineering students consider that modern business employs Web technologies to 40–60%, 10 student engineers – 60-80% and five engineering students – 80-100%. Six student engineers indicated one Web technology used by business, three engineering student uses Web technologies to 40–60%, 10 student engineers – 60-80% and five engineering students – 80-100%.

This is a reason why a support system to contribute to students’ learning outcomes in a multicultural study’s context was elaborated. This support system differs from the one offered in the special module of Web 2.0 by other educators as the proposed support system proceeds in a certain sequence.
Theoretical analysis and empirical findings of the research contribute to the following model of Enterprise 2.0 application in engineering curriculum implemented within Baltic Summer School Technical Informatics and Information Technology:

- Enterprise 2.0 application in engineering curriculum is conceptualized as promoting student engineers’ self-confidence and capability to cope with their own problems in all spheres of life in a knowledgeable and enterprising way, fostering students’ enterprise capability [14].
- Educational objective of Enterprise 2.0 application in engineering curriculum is determined as to actively involve the student engineers as prospective employees in the life of Enterprise 2.0 [16] by providing innovative opportunities and organizing student engineers’ cognitive activity.
- Measurable learning outcomes are defined as:
  a) student engineers’ knowledge of the Enterprise 2.0 concept,
  b) student engineers’ skills to use Enterprise 2.0,
  c) student engineers’ attitude towards their participation in activities for their professional development - education, in-service training and learning.
- Enterprise 2.0 application is implemented in the Web 2.0 module of engineering curriculum. The Web 2.0 module examines the advantages and problems of this technology - architecture and management, protocol design, and programming, which makes new social communication forms possible. The Web 2.0 module does not reveal the concept of Enterprise 2.0. However, the Web 2.0 module comprises Enterprise 2.0 technologies. The Web 2.0 module is assigned to 1 credit relevant to the European Credit Transfer System (ECTS). The teaching technology proceeds as following:
  a) Phase 1: Teaching in Enterprise 2.0 application is aimed at a safe environment for all the students considering the essence of constructive social interaction and its organizational regulation. The present phase of Enterprise 2.0 application is organized in a frontal way involving the students to participate.
  b) Phase 2: Peer-Learning in Enterprise 2.0 application is designed for the students’ analysis of an open professional problem situation and their search for a solution. The present phase of Enterprise 2.0 application involves the students to act in peers. A variety of teaching/learning techniques and/or activities with use of Enterprise 2.0 is provided by role plays, simulations, dialogues, prepared talks, discussions, and communication games and information-gap activities.
  c) Phase 3: Learning in Enterprise 2.0 application emphasizes the students’ self-regulation with use of assessment of the process and self-evaluation of the results. The students present their self-evaluation by the end of each class.
- Evaluation of achievement of learning outcomes and curriculum objectives comprises student engineers’ self-evaluation, internal evaluation and external evaluation [7].

3.3 Post-Survey

After having applied Enterprise 2.0 in the Web 2.0 module, results of the post-survey demonstrate the positive changes in comparison with the pre-survey:

- The number of engineering students who plan to start their own business increased from 11 to 16.
- The number of student engineers who considered that modern business employs Web technologies to 40-60% decreased from nine to five, 60-80% - decreased from 10 to nine and 80-100% - increased from five to 10 engineering students.
- The number of engineering students who indicated one Web technology used by business decreased from six student engineers to five, two Web technologies used by business - decreased from three engineering student to one, three Web technologies used by business – increased from 14 student engineers to 15 and five Web technologies used by business – increased from one engineering student to three.
- The number of students who has got his/her own business remained steady – one engineering student.

The present part reveals analysis of the research results in Enterprise 2.0 application within the engineering curriculum of Baltic Summer School Technical Informatics and Information Technology in 2011 through thorough analysis of student engineers’ self-evaluation, internal evaluation and external evaluation. In order to find out how each student’s learning outcomes changed after the Enterprise 2.0 application, analysis of the engineering students’ self-evaluation comprised the structured interviews of three questions:

a) What is your attitude to the Enterprise 2.0 application?

b) What have you learned?

c) How can you apply this knowledge in your professional field?

The aim of the interviews was to reveal the engineering students’ evaluation of the Enterprise 2.0 application for the development of student engineers’ learning outcomes. The student engineers’ expressions from the structured interviews were systematized according to two constructs: the construct of positive evaluation and the construct of negative evaluation.

Comparing the answers of those 24 engineering students in the sample, the structured interviews focused on the engineering students’ positive experience in the Enterprise 2.0 application.

For example, a student reveals the inter-relationship between the positive experience of social interaction and cognitive activity in the Enterprise 2.0 application: “I feel this class to be very useful to me because I am improving my knowledge in the Enterprise 2.0 application”. The student evaluates his/her own learning process: “I think I like the Web 2.0 module, because I have understood how to apply Enterprise 2.0”.

The data were processed applying AQUAD 6.0 software. The determined constructs were systematized into the codes corresponding to a construct, namely, positive and negative evaluation.

Most of the student engineers’ expressions were categorized to the construct Positive Evaluation. Frequencies were determined to reveal the student engineers’ evaluation. The survey showed that the student engineers have given their positive evaluation to the engineering curriculum as demonstrated in Table 1.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Construct domain</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>Positive evaluation</td>
<td>24</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Negative evaluation</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Summarizing content analysis [13] of the structured interviews demonstrates that the Enterprise 2.0 application in the engineering curriculum promotes the development of students’ learning outcomes.
Moreover, the Enterprise 2.0 application contributes to the safe and friendly teaching/learning environment for all the participants and provides opportunities of constructive social interaction and cognitive activity. Internal evaluation involves internal evaluators, namely, engineering students and educators of the educational establishment [7]. Analysis of the internal evaluation of the engineering students’ learning outcomes comprised the data processing, analysis, interpretation and analysis of the results of the pre-survey and post-survey of the student engineers.

In order to determine the developmental dynamics of each student’s learning outcome, comparison of the pre-survey and post-survey results was carried out. The Mean results of the descriptive statistics highlighted in Table 2 demonstrate that the level of the students’ learning outcomes has increased in the post-survey (1.93) in comparison with the pre-survey (1.67).

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-survey</th>
<th>Post-survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>0.45</td>
<td>0.66</td>
</tr>
<tr>
<td>3</td>
<td>3.83</td>
<td>4.21</td>
</tr>
<tr>
<td>4</td>
<td>2.37</td>
<td>2.79</td>
</tr>
<tr>
<td>Mean</td>
<td>1.67</td>
<td>1.93</td>
</tr>
</tbody>
</table>

The results of Mean within the surveys of the students’ feedback regarding their needs for Enterprise 2.0 application reveal that most of the answers are concentrated around Level 2. Thus, there is a possibility to increase the students’ use of Enterprise 2.0 within Web 2.0 technologies. Hence, considering judgment to be part of the art of statistics [6], the conclusion has been drawn that the Enterprise 2.0 application in the engineering curriculum influenced the development of the engineering students’ learning outcomes demonstrated by the difference between the levels of the student engineers’ learning outcomes in the pre- and post-survey.

For the external evaluation 10 researchers from different countries were involved. It should be mentioned that all the researchers who participated in the external evaluation of the research results are professors in the fields connected with educational research. All the 10 researchers have decisively contributed to their fields of research. For example, the present research employs the finding of a researcher on the quasi-concept. Another investigates use of the external and internal perspectives in empirical studies, namely, the external perspective means viewing the world from the researcher’s or scientist’s view, and the internal perspective – from the subject’s view. All the 10 researchers have got extensive research experience. External evaluation of the Enterprise 2.0 application in the engineering curriculum comprised non-structured interviews of one question as following: What is the researcher’s view on the Enterprise 2.0 application for the development of engineering students’ learning outcomes? The aim of the non-structured interviews was to reveal the researchers’ evaluation of the Enterprise 2.0 application for the development of engineering students’ learning outcomes.

The experts’ expressions from the non-structured interviews were systematized according to two constructs: the construct of positive evaluation and the construct of negative evaluation. For example, a respondent considered the organization model of the Enterprise 2.0 application for the development of engineering students’ learning outcome to be a transformative methodology. The researcher stressed the following advantages of the present transformative methodology:

- focus of establishing a system,
- viewing the overall personality of the learner,
- the fact that educators can indeed change the typical classroom environment,
- developing newer constructs that will truly help the student to internalize new material and
- the student having the “ability to create knowledge”.

The data were processed applying AQUAD 6.0 software. The determined constructs were systematized into the codes corresponding to a construct, namely, positive and negative evaluation. Most of the experts’ expressions were categorized to the construct Positive Evaluation. Frequencies were determined to reveal the experts’ evaluation. The survey showed that the experts had given their positive evaluation to the engineering curriculum most frequently as shown in Table 3.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Construct domain</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>Positive evaluation</td>
<td>10</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Negative evaluation</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Summarizing content analysis [13] of the data reveals that the respondents have positively evaluated the Enterprise 2.0 application for the development of engineering students’ learning outcome in the engineering curriculum. Thus, the conclusion can be drawn that the Enterprise 2.0 application enhances development of engineering students’ learning outcomes.

4. CONCLUSIONS

The findings of the research allow drawing the conclusions on the efficiency of the Enterprise 2.0 application in the engineering curriculum for the development of the student engineers’ learning outcomes. Regarding quality assurance, it is evident that the student engineers’ learning outcomes have been enriched.

The engineering students have gained their social experience for the development of their learning outcomes, and thus social experience changed into the means of gaining new opportunities and advantages. Irrespective of levels in the students’ initial Enterprise 2.0 capacity, the Enterprise 2.0 application has become an effective means of acquiring social experience by the engineering students in order to improve their learning outcomes. The Enterprise 2.0 application resulted in the improved engineering students’ learning outcomes.

Therein, the Enterprise 2.0 application has contributed to the development of the engineering students’ learning outcomes. Regarding effectiveness of the educator’s contribution to the student engineers’ learning outcomes, it is evident that the engineering students widened their experience in social interaction and cognitive activity with the Enterprise 2.0 application. The engineering students’ social experience and attitude are positive. That shows that the Enterprise 2.0 application in engineering curriculum influences the student engineers’ learning outcomes.

Moreover, validity of the qualitative evaluation research has been provided by use of the mixed methods’ approach to the data obtaining, processing and analysis. Validity and reliability of the research results have been provided by involving other researchers into several stages of the conducted research.

Table 2. Mean analysis of the pre- and post-survey in 2011.

Table 3. Frequency of experts’ evaluation.
External validity has been revealed by international co-operation as following:

- the research preparation has included individual consultations given by the Western researchers,
- the present contribution has been worked out in co-operation with international colleagues and assessed by international colleagues, and
- the research has been presented at international conferences.

Therein, the researchers’ positive evaluation of the Enterprise 2.0 application in the engineering curriculum validates the findings of the present research.

Thus it might be stressed that engineering curriculum is efficient if it provides student’s personal experience in social interaction as a condition for creation of new knowledge: if students’ needs are met, and a support system - Enterprise 2.0 application in engineering curriculum - implemented in phases of a certain sequence is designed that would secure their social experience in social interaction and cognitive activity, engineering students demonstrate better results of the learning outcomes.

The present research has limitations. The inter-connections between the engineering students’ learning outcomes, Enterprise 2.0 application and the sequence of its implementation have been set. Another limitation is the empirical study conducted by involving educators and students of one tertiary institution. Therein, the results of the study cannot be representative for the whole area. Nevertheless, the results of the research – the Enterprise 2.0 application in engineering curriculum and the qualitative evaluation research design - may be used as a basis of analysis of efficiency of engineering curriculum of other tertiary institutions. If the results of other tertiary institutions had been available for analysis, different results could have been attained. There is a possibility to continue the study.

Further research might include analysis of engineering curriculum based on five phases of the process of teaching and learning: teaching in Phase 1, teaching with elements of peer-learning in Phase 2, peer-learning in Phase 3, peer-learning with elements of learning in Phase 4 and learning in Phase 5. Thus, the present contribution has proposed analysis of efficiency of engineering curriculum and directions of further research.

5. REFERENCES

ABSTRACT: University as a social enterprise has become the dominant response to the challenge of bringing up an engineer as a first-rate technical expert who acts as a social agent, rather than just a technician, with a “broad understanding of the social and philosophical context in which he will work” [3]. Aim of the research is to analyze student engineers’ Enterprise 3.0 application in engineering curriculum. The meaning of the key concepts of university as a social enterprise, engineering curriculum and Enterprise 3.0 is studied. Explorative research has been used. The empirical study was conducted at Riga Technical University, Riga, Latvia, in 2011. Descriptive statistics was implemented for primary data analysis. The findings of the research allow drawing the conclusions on the favourable context of Enterprise 3.0 application in engineering curriculum as the student engineers’ knowledge and attitude towards Enterprise 3.0 application are positive. Direction of further research are proposed.

Key words: social enterprise, engineering curriculum, Enterprise 3.0

1. INTRODUCTION

Europe is facing enormous socio-economic and demographic challenges, including regional disparities, aging populations, high rates of low-skilled adults and of youth unemployment [12]. Particularly, engineers succeed harder to find a job since engineers entering the service area changed from working permanently at a large-scale enterprise to accepting project-related orders of large-scale enterprises by free engineers’ office [5].

Education and training are the key factors for achieving economic growth and social development [12]. In education and training university is a central mechanism that intensifies university-industry partnerships, innovation poles and clusters, innovation management and support services for the development of a sustainable inclusive society [12].

Thus, the European strategy for smart, sustainable and inclusive growth [8] has changed the education paradigm from entrepreneurial university to university as a social enterprise. Particularly, in engineering education university as a social enterprise has become the dominant response to the challenge of bringing up an engineer as a first-rate technical expert who acts as a social agent, rather than just a technician, with a “broad understanding of the social and philosophical context in which he will work” [3].

Aim of the research is to analyze student engineers’ Enterprise 3.0 application in engineering curriculum. The meaning of the key concepts of university as a social enterprise, engineering curriculum and Enterprise 3.0 is studied.

The remaining part of this paper is structured as follows: Section 2 introduces the theoretical framework on university as a social enterprise and Enterprise 3.0 application in engineering curriculum. The associated results of the empirical study will be presented in Section 3. Finally, some concluding remarks are provided followed by a short outlook on interesting topics for further work.

2. THEORETICAL FRAMEWORK

The theoretical framework of the paper involves the meaning of the key concepts of university as a social enterprise, engineering curriculum and Enterprise 3.0 studied.

2.1. A Perspective on Historical Development of Concept of University

A general conception of university is identified as an institution of higher education and research. It should be mentioned that the terms “institution” and “organization” are often used synonymously. Regarding the “university” definition, the term “organization” is further used in the present contribution.

The study of university has a long story. It has started for about 10 centuries ago since the first university in Europe - the University of Bologna - was organized in 1088. The development of the “university” concept has been promoted by the need for overcoming the challenges faced in a certain historical period. Table 1 demonstrates the development of the “university” concept in different historical periods. Analysis of the development of the “university” concept in different historical periods allows determining that the concept of university is obtaining a wider meaning, and the number of its domains is increasing: the initial concept of university was related with knowledge, its epistemology and methodology, thereby comprising only the pedagogical domain, while the contemporary concept of university – university as a social enterprise - is aimed at attaining primary social purposes for smart, sustainable and inclusive growth [8], thereby including social, economic and pedagogical domains.
2.2. University as a Social Enterprise

The concept of university as a social enterprise is based on the synergy between the social, economic and pedagogical domains as demonstrated in Figure 1.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Historical Period</th>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1088-1400 Medieval Universities</td>
<td>The epistemological and methodological focus on knowledge</td>
</tr>
<tr>
<td>2</td>
<td>1400-1800 Early modern universities</td>
<td>A mechanistic orientation to the knowledge construction</td>
</tr>
<tr>
<td>3</td>
<td>1800-1900 Modern universities</td>
<td>Liberal ideas pertaining to the importance of freedom</td>
</tr>
<tr>
<td>4</td>
<td>1900-1990 National universities</td>
<td>Common culture and common standards of citizenship</td>
</tr>
<tr>
<td>5</td>
<td>1990-date Entrepreneurial university</td>
<td>Cultural innovation [10]</td>
</tr>
<tr>
<td>6</td>
<td>1998-date University as a social enterprise</td>
<td>Primary social purposes</td>
</tr>
</tbody>
</table>

**Table 1. Concept of University in different historical periods.**

**Figure 1. Domains of university as a social enterprise.**

The social domain is characterized by primary social purposes [7], the pedagogical domain – by social experience, and the economic domain - by social profit. It should be mentioned that the term “social experience” means the unity of knowledge, skills and attitudes while the term “social profit” is considered as the synergy between financial profit and social capital as shown in Figure 2.

**Figure 2. Elements of social profit.**

Thus, university as a social enterprise is defined as according to certain common norms, over some period of time, shared social purpose oriented organization that provides the joint process of studies and enterprise for each participant and increases opportunities of gaining social experience and social profit.

This definition of university as a social enterprise allows concluding that engineering curriculum, enterprise and, consequently, Enterprise 3.0 application are inter-connected.

It should be noted that enterprise is defined as an individual complex capability to identify, generate and realize new socially valuable opportunities in the personal, professional, cultural, economic and other contexts of the social life [17]. Enterprise 3.0 application means use of Web technologies for enterprise (business) purposes [4], and curriculum in tertiary education is determined as a central, organizing stance [18].

2.3. Modelling Enterprise 3.0 Application in Engineering Curriculum

Modelling Enterprise 3.0 application in engineering curriculum comprises analysis of the following curriculum components: its aim, objectives, content, process of teaching and learning as well as evaluation as depicted in Figure 3.

**Figure 3. Curriculum components.**

Hence, components of engineering curriculum presented in Figure 3 have been taken into consideration while modelling the following Enterprise 3.0 application in engineering curriculum:

Enterprise 3.0 application is aimed at promoting student engineers’ capability to identify, generate and realize new socially valuable opportunities in the personal, professional, cultural, economic and other contexts of the social life [17].

The objectives of Enterprise 3.0 application in engineering curriculum are to engage student engineers’ Enterprise 3.0 application by providing innovative opportunities and organizing student engineers’ cognitive activity [2].

Student engineer’s learning outcomes are measured by
- student engineers’ knowledge of the Enterprise 3.0 concept,
- student engineers’ skills to use Enterprise 3.0 and
- student engineers’ attitude towards Enterprise 3.0 application.

Enterprise 3.0 application is implemented by use of the following teaching technology [2] as demonstrated in Figure 4:
- **Phase 1 Teaching** of Enterprise 3.0 application is aimed at a safe environment for all the students considering the essence of constructive social interaction and its organizational regulation. The present phase of Enterprise 3.0 application is organized in a frontal way involving the students to participate.
- **Phase 2 Peer-Learning** of Enterprise 3.0 application is designed for the students’ analysis of an open professional problem situation and their search for a solution. The present
The empirical study consisted of the following stages: studies and curriculum objectives comprises student engineers’ self-evaluation, internal evaluation and external evaluation [11].

- **Phase 3** Learning of Enterprise 3.0 application emphasizes the students’ self-regulation with use of assessment of the process and self-evaluation of the results. The students present their self-evaluation by the end of each class. It should be mentioned that evaluation of the achievement of learning outcomes and curriculum objectives comprises student engineers’ self-evaluation, internal evaluation and external evaluation [11].

**Figure 4.** Teaching technology of Enterprise 3.0 application in engineering curriculum.

## 3. **Empirical Research**

The empirical research includes the research design, the survey description and analysis of its results, findings of the research.

### 3.1. Research Design

The design of the present empirical research comprises the purpose and question, sample and methodology of the present empirical study. The present empirical study was conducted during student engineers’ Enterprise 3.0 application in the engineering curriculum at Riga Technical University to analyze the context of Enterprise 3.0 application in engineering curriculum. Explorative research has been used in the empirical study [20] as explorative research is aimed at developing hypotheses, which can be tested for generality in following studies [16].

The empirical study consisted of the following stages:

1. exploration of the context of use of Enterprise 3.0 through analysis of the students’ feedback regarding their needs for Enterprise 3.0 application,
2. data processing, analysis and data interpretation,
3. analysis of the results and
4. elaboration of conclusions and hypothesis for further research.

The research question is as follows: What are the student engineers’ needs for Enterprise 3.0 application in engineering curriculum?

The present research involves 15 student engineers at the Faculty of Power and Electrical Engineering of Riga Technical University, Riga, Latvia, in 2011.

All the student engineers at the Faculty of Power and Electrical Engineering of Riga Technical University have got Bachelor or Master Degree in different fields of engineering sciences, and eight student engineers - working experience in different fields related to computing and information technology. The student engineers at the Faculty of Power and Electrical Engineering of Riga Technical University are from different parts of Latvia –

Kurzeme, Vidzeme, Zemgale and Latgale. Hence, the sample is multicultural as the respondents with different cultural backgrounds and diverse educational approaches were chosen. That emphasizes the study of individual contribution to the development of student engineers’ learning outcomes in Enterprise 3.0 application [14]. It should be also mentioned that whereas cultural similarity aids mutual understanding between people [19], the students’ different cultural and educational backgrounds contribute to successful learning and become an instrument of bringing the students together more closely under certain conditions such as appropriate materials, teaching/learning methods and forms, motivation and friendly positioning of the educator [1]. Hence, the group’s socio-cultural context (age, field of study and work, mother tongue, etc.) is heterogeneous.

The qualitatively oriented research allows the construction of only few cases [16]. Moreover, the cases themselves are not of interest, only the conclusions and transfers we can draw from this material [16]. Selecting the cases for the case study comprises use of information-oriented sampling, as opposed to random sampling [9]. This is because an average case is often not the richest in information. In addition, it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur [9]. Random samples emphasizing representativeness will seldom be able to produce this kind of insight; it is more appropriate to select some few cases chosen for their validity.

Interpretative research paradigm which corresponds to the nature of humanistic pedagogy [13] has been determined. The interpretative paradigm creates an environment for the development of any individual and helps them to develop their potential [13]. The core of this paradigm is human experience, people’s mutual everyday interaction that tends to understand the subjectivity of human experience [13]. The paradigm is aimed at understanding people’s activity, how a certain activity is exposed in a certain environment, time, conditions, i.e., how it is exposed in a certain socio-cultural context [13]. Thus, the interpretative paradigm is oriented towards one’s conscious activity, and it is future-oriented [13]. Interpretative paradigm is characterized by the researchers’ practical interest in the research question [6].

### 3.2. Survey and Its Results

The survey to analyze the students’ feedback regarding their needs for Enterprise 3.0 application was based on the following questionnaire:

- **Question 1:** Do you have your own business and/or enterprise? The evaluation scale of two levels for the question is given where “0” means “no” and “1” - “yes”.
- **Question 2:** Do you plan to start your own business and/or enterprise? The evaluation scale of two levels for the question is given where “0” means “no” and “1” - “yes”.
- **Question 3:** To which extent do modern business and enterprise employ Web technologies? The evaluation scale of five levels for the question is given where “0” means “0%-20%” means a low level of Enterprise 3.0 application and “80%-100%” points out a high level of Enterprise 3.0 application.
- **Question 4:** Please, indicate at least 3 Web technologies used by business and/or enterprise for business applications. The evaluation scale of three levels for the question is given where “1” means a low level of Enterprise 3.0 application and “3” points out a high level of Enterprise 3.0 application.
The results of Question 1 on needs for Enterprise 3.0 application reveal that only one engineering student amongst 15 respondents runs his/her own business as shown in Figure 5.

![Figure 5. Results of Question 1 (Running a business).](image)

The results of Question 2 of the questionnaire used in the survey show that 10 engineering students plan to start their own business and/or enterprise as depicted in Figure 6.

![Figure 6. Results of Question 2 (Planning to start a business).](image)

The results of Question 3 demonstrate that two engineering students consider that modern business employs Web technologies to 40-60%, six student engineers – 60-80% and seven engineering students – 80-100% as revealed in Figure 7.

![Figure 7. Results of Question 3 (Enterprise 3.0 application).](image)

Five student engineers indicated two Web technology used by business, nine engineering student - three Web technologies used by business and one engineering student – five Web technologies used by business as demonstrated in Figure 8.

3.3. Findings of the Research

The student engineers’ results and, consequently, learning outcomes from the questionnaire were systematized according to the construct of Enterprise 3.0 application and its three domains as shown in Table 2:

- the construct of student engineers’ knowledge of the Enterprise 3.0 concept,
- the construct of student engineers’ skills to use Enterprise 3.0 and
- the construct of student engineers’ attitude towards Enterprise 3.0 application.

The data were processed applying SPSS 17.0 software. The determined construct domains were systematized into the codes corresponding to a domain. It should be noted that only positive answers were taken into consideration for the analysis: in Question 1 and 2 answers which were marked as “1”, in Questions 3 answers that were evaluated from one to five, and in Questions 4 answers - from one to three. Table 3 demonstrates the number and percentage of the positive answers from the questionnaire completed by the student engineers.

All of the student engineers’ answers were categorized to the construct Student engineers’ knowledge of the Enterprise 3.0 concept. Frequencies were determined to reveal the student engineers’ needs for Enterprise 3.0 application. The survey showed that the student engineers have positively evaluated their knowledge of the Enterprise 3.0 concept. Student engineers’ attitude towards Enterprise 3.0 application has a positive evaluation, too. However, student engineers’ skills to use Enterprise 3.0 have been positively evaluated by only 7% of the student engineers among the respondents who took part in the survey.

The summarizing content analysis [15] of the data reveals that the students’ feedback regarding their needs for Enterprise 3.0 application reveals that the student engineers’ knowledge and attitude towards Enterprise 3.0 application are positive. However, there is a need for the increase of the student engineers’ skills to use Enterprise 3.0.

### Table 2. Inter-relationship between construct, construct domain, questionnaire and learning outcomes

<table>
<thead>
<tr>
<th>Construct</th>
<th>Construct domain and learning outcome</th>
<th>Number of the question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise 3.0 application</td>
<td>student engineers’ knowledge of the Enterprise 3.0 concept</td>
<td>3 and 4</td>
</tr>
<tr>
<td></td>
<td>student engineers’ skills to use Enterprise 3.0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>student engineers’ attitude towards Enterprise 3.0 application</td>
<td>2</td>
</tr>
</tbody>
</table>

### Table 3. Frequency of the student engineers’ positive answers

<table>
<thead>
<tr>
<th>Construct</th>
<th>Construct domain and learning outcome</th>
<th>Number of answers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise 3.0 application</td>
<td>student engineers’ knowledge of the Enterprise 3.0 concept</td>
<td>15 and 15</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>student engineers’ skills to use Enterprise 3.0</td>
<td>1</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>student engineers’ attitude towards Enterprise 3.0 application</td>
<td>10</td>
<td>66%</td>
</tr>
</tbody>
</table>
4. CONCLUSIONS

The findings of the research allow drawing the conclusions on
the favourable context of Enterprise 3.0 application in the
engineering curriculum as the student engineers’ knowledge
and attitude towards Enterprise 3.0 application are positive.

Moreover, validity and reliability of the research results have
been provided by involving other researchers into several
stages of the conducted research. External validity has been
revealed by international co-operation as following:

- the research preparation has included individual
consultations given by the Western researchers,
- the present contribution has been worked out in co-
operation with international colleagues and assessed by
international colleagues, and
- the research has been partly presented at international
conferences.

Therein, the findings of the present research are validated by
other researchers.

The present research has limitations. The inter-connections
between university as a social enterprise, engineering
curriculum, Enterprise 3.0 application and the sequence of its
implementation have been set. Another limitation is the
empirical study conducted by involving the students of one
tertiary institution. Therein, the results of the study cannot be
representative for the whole area. Nevertheless, the results of
the research – the model of Enterprise 3.0 application in
engineering curriculum and the explorative research design
may be used as a basis of analysis of the context of Enterprise
3.0 application in engineering curriculum of other tertiary
institutions. If the results of other tertiary institutions and
Enterprise 3.0 application in engineering curriculum had been
available for analysis, different results could have been
attained. There is a possibility to continue the study.

Thus, the following hypothesis has been put forth: Enterprise
3.0 application in engineering curriculum is successful if it is
aimed at promoting student engineers’ capability to identify,
generate and realize new socially valuable opportunities in the
personal, professional, cultural, economic and other contexts of
the social life [17].

Another hypothesis has been proposed: student engineers’
learning outcomes in Enterprise 3.0 application develop if

- student engineers’ needs are met, and
- support system, namely Enterprise 3.0 application,
implemented in phases of a certain sequence is designed.

Prospects for development include further modelling of
Enterprise 3.0 application in engineering curriculum. Particularly, use of Enterprise 3.0 in engineering curriculum
has to be increased as the student engineers’ knowledge and
attitude towards Enterprise 3.0 application have been
determined to be of a higher level.

Further research tends to focus on the search for relevant
methods for evaluation of each criterion of the development of
student engineers’ learning outcomes in Enterprise 3.0 application as well as data obtaining, processing, analyzing and
interpretation in an empirical study within a multicultural
environment.

Empirical studies in other tertiary institutions are proposed to
be carried out. Another direction of further investigation is
considered as evaluation of efficiency of Enterprise 3.0
application in engineering curriculum. A comparative research
of different countries could be carried out, too.

It should be mentioned that the contemporary concept of
university – university as a social enterprise - aimed at
attaining primary social purposes for smart, sustainable and
inclusive growth [8] is being further developed as sustainable
development includes three domains - economic, social and
environmental - as shown in Figure 9.

![Figure 9. Domains of sustainable development.](image)

However, university as a social enterprise comprises the social,
economic and pedagogical domains, thereby the environmental
domain has not been taken into consideration. Thus, Table 4
that shows the development of the concept of university in
different historical periods has been complemented with the
seventh stage called “Sustainable University” focused on
sustainable development. The definition of sustainable
university remains as an open point for further research.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Historical Period</th>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1088-1400 Medieval Universities</td>
<td>The epistemological and methodological focus on knowledge</td>
</tr>
<tr>
<td>2</td>
<td>1400-1800 Early modern universities</td>
<td>A mechanistic orientation to the knowledge construction</td>
</tr>
<tr>
<td>3</td>
<td>1800-1900 Modern universities</td>
<td>Liberal ideas pertaining to the importance of freedom</td>
</tr>
<tr>
<td>4</td>
<td>1900-1990 National universities</td>
<td>Common culture and common standards of citizenship</td>
</tr>
<tr>
<td>5</td>
<td>1990-date Entrepreneurial university</td>
<td>Cultural innovation [10]</td>
</tr>
<tr>
<td>6</td>
<td>1998-date University as a social enterprise</td>
<td>Primary social purposes</td>
</tr>
<tr>
<td>7</td>
<td>2012-date Sustainable university</td>
<td>Sustainable development</td>
</tr>
</tbody>
</table>
REFERENCES


BUILDING INSTITUTIONAL AND HUMAN CAPACITY FOR SUSTAINABLE DEVELOPMENT - CASE STUDY: BULGARIA

Zbigniew, Bochniarz¹ Krustina, Mandova² and Rodica Stefanescu³
1 University of Washington, Seattle, USA, zbibg@uw.edu
2 ETP Foundation-Sustainable Development Projects, Sofia, Bulgaria, etp@mbox.digsys.bg
3 Ecological University, Bucharest, Romania, stefanescu.rodica@yahoo.com

ABSTRACT: The systemic transformation that took place in Central and Eastern Europe (CEE) during the last decades opened real opportunities to implement the concept of Sustainable Development (SD) in the region. The paper presents an overview of the theoretical foundation and a vast practical experience with building institutions and human capital for SD in Bulgaria. The paper describes the process of designing institutions for SD in CEEC, particularly in Bulgaria, and the results of these efforts in moving from the crisis situation to a sustainable path of development. The most important factor contributing to successful transformation of the new EU members from CEE - thus to more sustainable path of development - was investment in human capacity, mostly in the business sector. The Bulgarian case study illustrates the challenges, successes and failures of building institutional and human capacity for SD.

Key words: sustainable development, institutional capacity, human capacity

1. INTRODUCTION – THE PROBLEM

Like the rest of Central and East European countries (CEEC), Bulgaria inherited from the previous system a multidimensional crisis, with economic, ecological, social and political components. The system based on centrally planned economy and communist party monopoly reached its capacity to meet internal and external needs and challenges. In the late 80’s, national economies of CEEC were in stagnation or decline and only statistical manipulations hid those facts (Brzezinski, 1989, Rosati and Mizsei, 1989). All of them experienced the “economy of shortage,” which was the classical feature of centrally planned economies (Kornai, 1980). The United Nations Development Programme (UNDP) commissioned a regional report Capacities and Deficiencies for Implementing Sustainable Development in Central and Eastern Europe (UNDP, 1992) for the Earth Summit in Rio de Janeiro. The report stated that the whole region suffered from serious environmental pollution and eco-system degradation leading to severe economic, social and ecological losses (Bochniarz, 1990). The research of the Center for Nations in Transition (CNT) at the University of Minnesota showed that air pollution in CEEC was alarmingly high, for instance $1,000 of GNP production yielded air particulates approximately 60 times higher than in Western Europe. In addition, emissions of SO2 and NOx in CEEC were 30 and 18 times higher respectively than in the European Communities. The quality of surface and ground water also deteriorated from the 1960s to the end of the 1980s in most CEEC (op.cit.)

The declining quality of the environment threatened not only the basic ecosystem but also contributed to growing mortality and morbidity rates in the most polluted areas (Bobak et al, 1995). As a result, life expectancy had also declined in the whole region (Bochniarz, 1990; DaBerdeleben, 1991). Pollution and environmental degradation created severe threats to both human health and economic well-being. The situation in the late 1980s led to social apathy and unrest demonstrated, among others, by the Solidarity movement (Solidarnosc) in Poland in 1980, and Ecoglasnost in Bulgaria.

2. RESPONSE TO THE PROBLEM - SYSTEMIC TRANSFORMATION

The response to the multidimensional structural crisis included launching a systemic transformation of the totalitarian political system, dismantling centrally planned economy, and introducing new environmental and social institutions and policies since spring 1989 in CEEC. Poland was the first country in Central and Eastern Europe (CEE) to start roundtable negotiations leading to partially free election (33% of seats) to the Parliament (Sejm) and 100% free to Senate on June 4, 1989. The CEE “domino” started falling with Hungary being the next, moving to East Germany, Czechoslovakia, Bulgaria and reaching Romania at the end of that year. The leading and the most outspoken opposition force in Bulgaria was Ecoglasnost, which started its activities in 1987 and soon became a nation-wide organization. They were quite successful in the 1st election in 1990, staffing many top governmental positions and influencing designing policy process and pushing the environmental agenda at the initial stage. For instance, the first democratically elected President of Bulgaria Dr. Zhelyu Zhelev, who was associated with the movement, delivered one of the “greenest” addresses at the Earth Summit in 1992. Unfortunately, Ecoglasnost was not able to sustain their strong political position in 1991 election and the environmental agenda started its decline in Bulgaria.

Fortunately, there were many other forces interested in keeping the environmental issues at the top of the political agenda. The international conference “Environment for Europe” gathered 34 environmental ministers from Europe, United States, Brazil and Japan (Dobris Conference, 1991) and led to a series of such conferences every 2-3 years, with larger number of participants and some interesting policy documents, such as Environmental Action Programme (EAP) for CEE produced by the 2nd Conference in Luzern 1993. In addition to those
multilateral initiatives, there were some other programs supported by major donor countries and private foundations. One of those was a series of projects initiated by CNT in 1987 on “Economic Mechanisms for Environmental Protection in Market and Planned Economies,” which produced policy recommendations for the Polish Ministry of Environment in September 1989 and served as a renowned launching pad for the multi-country project “Building Institutions for the Global Environmental Challenge”. The latter produced, in collaboration with CEE partners, four comprehensive “blueprints” for institutions and policies focusing on sustainable development for Poland (1990), Czechoslovakia (1991), Hungary and Bulgaria (1992). The Bulgarian blueprint contained 83 recommendations for reaching sustainable development and was distributed among members of parliament, government officials, regional and local governments, and NGO representatives all over the country.

This rather modest action research project attracted many prominent scholars and civic leaders on the American side, such as Professors Richard Bolan (institutions), Leonid Hurwicz (Nobel Award in Economics 2007), Vern Ruttan (economics & institutions) and Edward G. Schuh (economics & policy); Doctors Tom Fiutak (conflict management), Marie Livingston (environmental economics); and civic leaders Jonathan Lash (World Resource Institute, law) and Richard Liroff (World Wildlife Fund, law). On the Bulgarian side, the speakers represented academic, public, civic and future business leaders such as for instance: Dr. Siemion Bozhankov (adviser to the President of Bulgaria & ambassador), Dr. Venko Beshkov (Deputy Minister of the Environment), Dr. Kristalina Georgieva (World Bank leader & currently EU Commissioner), Anton Antonov aand Anna Petkova (Ecoglasnost & media), and Hristo Mihailovski (Deputy Minister of Economy, currently major Bulgaria auditing & rating firm) and Evgueni Popov (major international pension fund). In addition to several academic and civic leaders from CEE, this international team prepared a comprehensive policy document that inspired many institutional and policy actions taken by Bulgarian government and communities, e.g. an independent energy efficiency and conservation think-tank in 1993.

Unfortunately, the process of implementation of the blueprint for sustainable development in Bulgaria did not go as fast as in other CEE countries such as Poland and Czechoslovakia (Mandova, 2007). One of the major reasons for slow implementation was a lack appropriate human capital equipped with the knowledge and skills to carry out challenging institutional and policy reforms. This deficiency was already highlighted in the UNDP CEE Regional Report (1992) stating that while the technical, scientific and mathematical skills were relatively high in the region, the social sciences, particularly environmental economics, institutional design, and management were very weak at the beginning of transformation, particularly in Bulgaria, Romania and Albania. The Report also indicated that this deficiency of human capital was due to structural problems in the CEE educational system. One of the key problems was the misallocation of priorities in the education process—too many resources allocated to the transfer of knowledge and too little to the development of appropriate interactive skills and attitudes of participants. The graduates were “loaded” with facts and information but they did not develop the appropriate skills and attitudes to apply knowledge in a collaborative process. Furthermore, the emphasis on basic natural and technical sciences discriminated against the social sciences and kept them isolated from the mainstream of Western science. The report also identified the severe lack of market-economy, managerial, and environmental knowledge in public sector decision-makers. Another significant barrier to sustainable development identified by the UNDP Report was a serious institutional gap between the requirements of modern market economies, civil society, and sustainable development and existing institutions in nations in transition.

In order to address those issues, many foreign assistance programs were launched to help CEE to implement ambitious transformation processes and move those countries on the path of sustainable development. Two of them – the Environmental Training Project (ETP) for Central and Eastern Europe (1992-2001) and Management Training and Economic Education (MTEE-1991-2000) - had these authors involved in building human capital in CEE. The learning from these projects will serve as the basis for further analysis and conclusions.

3. IMPLEMENTING THE TRANSFORMATION PROCESSES: SUCCESSES AND CHALLENGES

At the beginning of the transition, the strategic goal of the greatest leaders of the Central European transformation, such as Vaclav Havel and Lech Walesa, was to restore democratic political systems and to introduce modern market economies. The complexity of institutional and policy reforms necessary to build sound market economies after 50 years of distortions caused by the communist system and WWII was unknown to the political leaders and top economic experts (Kornai, 1990). There was neither theory nor practical experience on how to conduct such a radical transformation. It was a process of learning-by-doing. The foreign experiences from mature market economies were not applicable to CEEC. Although foreign experts were available to assist those countries in designing and implementing reforms, an urgent need to build endogenous human capital became apparent. It was a great challenge for CEE academic institutions to produce the human capital necessary to meet the needs of a democratic society with a market economy. The emerging system was based on completely different principles; the existing knowledge, skills, and attitudes instilled by the previous educational system, as well as the practice of a centrally planned economy were obsolete and useless to large extent.

Human capital, like all forms of capital, requires continuing re-investment in its renewal, due to the depreciation and obsolescence of knowledge and skills caused by rapid technological progress, globalization, and new scientific discoveries (Becker, 1995; Bochniarz & Bolan, 2004). The systemic changes in CEEC forced their governments and societies to shift their investment priorities in the educational sector to respond to this challenge. Ironically, the impetus for this shift in priorities came from bottom up – business and families - rather than their governments. The families and businesses started to bear a significant portion of the burden of financing modern education. This financing occurred mainly at private colleges and business schools, and often took the form of tuition-based continuing education, particularly in executive education in business and management. Business and government’s co-financing of higher education resulted in significant increases of enrolment at universities throughout CEEC. One of the leaders financing higher education in CEE was Poland (Pawłowski, 2004). Their statistics indicate that business and management education student enrolment has increased more than 10 times over the first 16 years of transformation, thereby making this group the largest field of
education in Poland with over 550,000 (2004/5) students, while the overall number of students has increased only 5 times reaching the 2 million level (2004/5). The most dynamic growth occurred in executive business and management programs (part-time and weekend students), represented by the Master of Business Administration (MBA) programs. This group increased about 20 times during that period. The unusually rapid increase in business education was driven by the desire of actual and potential managers to renew or learn the knowledge and skills necessary to be able to succeed in a dynamically developing economy. The result of the 15 years of continuing investments in human capital building significantly contributed to the substantial economic performance of the CEEC that became new members of the European Union (EU). That result indicates that such enormous investments in human capital were necessary to make the new institutions perform effectively and they paid off (Archibald et al., 2005, 2009).

The case of the Center for Nations in Transition (CNT) from University of Minnesota, which became an international leader in designing and delivery educational projects with over 44,000 participants in CEEC (including 14,000 Ukrainians and over 2,500 Bulgarians) offered interesting lessons to other transforming countries and to the world. A particularly important role was played by a core of about 2000 CEE faculty members, who participated several times in workshops offered through CNT projects and who, over the last 10 years, trained many hundreds of thousands of people in seven CEEC. The CNT-initiated graduate and post-diploma (PDS) programs produced over 3,000 MBA, MPAs, MABMs, and PDS graduates. CNT facilitated the development over 500 new courses at collaborative institutions and over 100 joint management and economic publications. An evaluation conducted few years ago found that eight of the nine masters programs and 12 of the initial 15 PDS programs became sustainable and were still delivered either in their original form or in a transformed mode, adjusted to the changed conditions (Bochniarz, 2007). The informal network of over 3,500 companies and institutions was functioning in partnerships with academia, and with the core cadre over 200 professors able to teach MBA, MPAs, MABMs and PDS courses. CNT succeeded with facilitation of the accreditation of two of the Masters programs, including the Association to Advance Collegiate School of Business (AACSB) accreditation for Warsaw Executive MBA (WEMBA), and secured top positions in the country rankings.

Equally important to the new curricula in academic programs were the methods of delivery, with strong emphasis on practical skills, particularly soft skills, and collaborative attitude building. It was new for CNT CEE partners, who used to focus on knowledge transfer first. This interactive and team-based delivery was also implemented in short executive workshops, which produced many practical results. One of the first such events happened in Bulgaria at the ETP workshop on River Basin Management, organized together with the Ministry of the Environment in September 1993. The workshop had 31 participants – representatives of companies, NGOs, municipalities, regional and national government institutions. At the end of the workshop, the participants, who received the Bulgarian blueprint and were also inspired by successful examples from abroad, recommended that a pilot river basin council for the Yantra River be set up. On January 20, 1994 an Agreement for coordinating the activities for establishing and assisting the Yantra River Basin Council (YRBC) was signed between ETP, the Ministry of Environment, the Lovech District Governor and the National Water Council. In the following years after the establishment of the YRBC, ETP, through the ETP Foundation (after its court registration in 1995), organized training activities, meetings, and public hearings to increase the visibility and efficiency of the YRBC.

The pilot YRBC was the first river basin council established in Bulgaria with the purpose to introduce a new regional approach to water management in the process of decentralization, restructuring of water companies, establishment of market economy and creation of new, democratic governance of the Bulgarian society. The positive experience of the YRBC gained national importance and contributed to the adoption of the National Strategy for Water Management in Bulgaria (1999), and the new Water Law (July 1999). The YRBC serves as a model for defining the functions of the basin councils in Bulgaria, their rights and obligations, statute, structure and their relationship with the national government institutions.

There were many other examples of practical workshops results: designing and implementing new regulations, such as the Law on Limiting the Harmful Effect of Wastes on the Environment (September 30, 1997); capacity building for introducing new institutions and implementing new policies, e.g. Eco-Management and Audit Scheme for Municipalities as a Tool for Local Agenda 21; and an Initiative for the Aarhus Conference – implemented by Bulgarian ETP Foundation with other ETP originated think-tanks in CEE from 1998.

In the final evaluation of the implementation process of the Bulgarian blueprint after 14 years (April 2006) the author stated that out of 83 recommendations, 60 were fully completed (72%), 19 partially completed (23%), and only 4 not completed (5%) (Mandova, 2007). She also emphasized that a slow implementation process at the beginning has been changed due to two major factors – significant investment in human capital and signing the pre-accession agreement with EU.

All of these impacts were possible due to many factors, including the CNT designing process that was based on such elements as a good understanding of the local context and cross-cultural differences, followed by respecting local traditions and values. CNT always aimed toward top world-quality programs by using the University of Minnesota experience and inviting to the project consortia of top American and CEE universities. Another important element was partnering with major stakeholders in order to meet their expectations and build mutual trust. Honest partnering was the most critical element in this process, requiring time and patience in developing a shared and inspiring vision. Difficult but necessary was also encouraging and facilitating institutionalization and accreditation of the graduate and/or PDS programs. The CNT CEE partners often did not understand the significance of either institutionalization (e.g. granting a recognized degree or PDS diploma) or accreditation of the joint program (e.g. MBA) at the beginning of projects, but they quickly learned and became champions in performing these processes.

Another important lesson learned in CEE is modesty in evaluating own contributions, encouraging and recognizing local partners’ matching contributions, and honesty in evaluating mutual performance. These were critical elements in establishing mutual trust – social capital, identifying real commitments to joint projects, addressing deficiencies, and correcting real and avoiding potential mistakes in the implementation process. Finally, presenting transparency in financial matters and fair allocation of fund – CNT invested between 40-50% of project funds directly into building local capacities, contrary to consulting firms, which, if they invested any resources did not exceed 10-20%. CNT helped develop an
attitude of pride in co-ownership with local partners, which was critical for local sustainability.

At the macroeconomic scale, the impact of those graduates with new knowledge and skills was significant. According to the theory of increasing returns of investment in specialized human capital developed by three Nobel Prize winners – [Lucas, 1989; Schultz, 1993; Becker, 1995] – those 10 CEEC, which joined EU and invested a lot in human capital should experience faster than those without such investment. The data from 1994 until 2007 indicates that they were growing at average 4% annually while the 15 old EU countries experienced about 2% annual growth. Then the financial crises and follow up economic recession verified their sustainability, as well as ability to initiate appropriate policies. The 2008 was still good for the most of 10 CEEC, with average 4.5% annual growth of GDP comparing with 0.6% for EU 15. Three Baltic states started to experience negative growth but the hardest hit came in 2009, when the all EU 27 declined by 4.2% while the 10 CEE negative growth was about half of that – 2.4%, but for the Baltics was the most disastrous year with about 18% decline. Contrary to many Western EU member states, most of the 10 CEE took quick steps to adjust policies often with painful measures. Thanks to the effective policy responses by 2011, 10 CEEC experienced 4.2% annual growth – almost 3 times faster than for the rest of EU. The CEEC also increased life expectancy by 3-5 years since transformation, reduced by half infant mortality and cut significantly all major types of pollution, particularly, SO2 (70%), NOx 40-50%, particulate matters by 70% (Archibald et al., 2009). This is an important lesson that often harsh transforming processes and significant investment in human capital pays back.

4. CONCLUSIONS AND RECOMMENDATIONS

Bulgaria and other CEEC made significant progress and are moving toward a sustainable path of development. The question is; do faster economic growth and significant investment in human capital secure sustainability in the coming decades of the 21st Century? Unfortunately, the answer is No. Despite their significant achievements, CEEC are lagging behind the leading countries in competitive and innovation ranking. Bulgaria was ranked 74, being ahead only of Romania (77), while the other CEEC were ranked higher but not with impressive positions: Estonia 33, Czech Republic 38, Poland 41, Lithuania 44, Hungary 48, Slovenia 57, Latvia 64, and Slovakia 67 (World Economic Forum, 2011-2012). For the advanced economies, the major source of becoming competitive is innovation. The situation does not look too optimistic for Bulgaria and other CEEC according to the Global Innovation Index (2011) – the most innovative was Estonia (23), followed by Hungary (25), Czech Republic (27), Slovenia (30), Latvia (36), Slovakia (37), Lithuania (40), Bulgaria (42), Poland (43) and Romania (50).

These results are difficult to explain, taking into account the significant influx of new graduates during the last twenty years; it seems that it did not make CEEC more innovative and competitive. Unfortunately, there is not sufficient data to assess how many of those educated in economics, management, and law went to business and public sectors, and how their education correlates with their ability to respond effectively to new challenges coming from competing economies. This is not only the challenge to business sector but to also to the public sector. The WEF 2011-12 Report indicates many barriers for making CEEC more competitive and innovation in public administration.

The two most competitive economies - Switzerland and Singapore - are not that highly ranked in human capital; however, the Nordic countries are also at the top of competitive economies but experience high ranking in human capital, high above CEEC. (World Bank Knowledge Index, 2011). That could mean that to be innovative and competitive requires more than the highest levels of education. Equally important could be to have good information and communication technologies (ICT), economic incentives, or other conditions such as e.g. social capital.

The challenge is how to capitalize on those huge increases in graduate numbers over last 20 years to create more innovative and competitive economies in CEEC. A deeper analysis is needed regarding the quality of the graduates and their basic competencies, as well as their ability to respond to contemporary needs in business and public administration. Several factors could have reduced the positive impact of the quantitative increase in the number of graduates:

1. The number of students enrolled in various programs exceeded the number of the most talented students able to meet the highest quality standards, which led to a declining level of the general performance.
2. Despite high enrolments, CEE universities did not make sufficient investment in hiring new faculty members and developing their academic competences. The incentive structures did not always reward high performing academics. Universities did not invest enough in other educational capacities including buildings, information infrastructure, teaching materials, and others. The faculty/student ratio remained high or increased even more, making difficult to secure a high quality of education, particularly at the graduate level where applied research is key.
3. Although many new colleges and universities, particularly private ones brought a lot of fresh energy, entrepreneurship and new academic capacities, most of them entered the education market without sufficiently prepared faculty, institutional experiences and accumulated tradition.
4. The three-year undergraduate degree programs introduced as the result of the Bologna Process has significantly less demanding requirements than a traditional Anglo-Saxon four-year bachelor degree; it is arguable that they can produce equivalent competencies.
5. The large number of students and the conservative character of many CEE universities prevented significant changes in curriculum design and delivery methods from a traditional teacher-centered approach to a student-centered one.

The first four reasons contributing to the decline of the average quality standards are self-explanatory and do not require further analysis. The fifth reason is much more complex and concerns the fundamentals of the education process, such as philosophy of teaching, basics of curriculum design and delivery methods. The best way to explain this might be a comparison between American and European higher education.

There is a significant difference between American and European universities in terms of curriculum design and delivery methods, particularly in determining the basic proportions between three basic elements of the educational process: knowledge, skills, and attitudes. In Europe, the dominant element of the process is still knowledge transfer, with less time allocated for practical skill-building and appropriate attitude development. Knowledge coming from theory rather than practical cases implies a teacher-centered
approach, with a usually quite passive method of transfer. The graduate leaves the university equipped with a vast volume of knowledge, but often without sufficiently developed practical skills with which to apply it. These “soft” skills are particularly not appreciated in European academia, because they are not usually the subject of scientific publication – the base of academic promotion – and they are often time-consuming to learn for both teachers and students, creating serious disincentives. The impact of the application of soft skills in practice after graduation, as well as the results of the process of building them, are the most critical to developing appropriate attitudes – the fundamental condition for future collaboration on the job, in different communities and in cross-sectoral settings.

In North America, the right proportions of knowledge, skills, and attitudes in curriculum content and time allocation are viewed as critical in curriculum design. The basic philosophy behind the American teaching process is pragmatism. Investing in new knowledge without developing appropriate skills to implement it is a waste of resources. Developing one’s skills without the attitude to share and cooperate with other individuals or teams is also ineffective and inefficient in resolving complex and multidisciplinary contemporary problems. The American approach assumes an active student involvement in developing new knowledge as one’s discovery process leads to internalization as one’s own concept. The teacher serves as a facilitator or guide in the interactive exploration process rather than the source of new knowledge. The role of the teacher is to create a certain level of discomfort – the case study – that mobilizes students to use their critical thinking to find new ideas and solutions to problems. The student group/class is treated as a learning community where they can openly exchange ideas, challenge and learn from each other, and explore their different professional experiences and backgrounds.

The design of the education process assumes that students have instant access to the Internet, where they can explore any new knowledge in the field, and challenge the lecturer if she/he uses outdated concepts from old textbooks. The teachers should acknowledge the fact that the acceleration of discoveries and immediate access to information provided by the Internet potentially renders knowledge obsolete quickly, and they should require students to supplement textbook readings with new articles and/or reports from academic the Internet. Students are also encouraged, particularly in social science, to read articles from competing schools of thinking, e.g. neoclassical vs. Keynesian explanations of economic crises, or environmental vs. ecological economics approaches to climate change. Reading and discussing practical cases instead of an abstract theory from a textbook helps students to understand behind the theoretical concept towards its potential application. In addition, guest lecturing by experienced practitioners connects relevant theoretical concepts with real life. Special project competitions within a university e.g. the Environmental Innovation Challenge for interdisciplinary undergraduate student teams or the Global Social Entrepreneurship Competition (GSEC) – both initiated by the University of Washington (UW) - teach students to work together, be innovative and compete. Semester-long team field projects and diploma projects are a requirement for a master’s degree, e.g. the Public Policy Clinics at many schools of public affairs and individual student projects. Both forms of applied research focus on resolving local or regional problems are the best examples of practical applications hard and soft skills in the real world. Completion of the diploma field project is usually followed by a public presentation to the major local/regional government or NGO stakeholders and often serves as a springboard for new jobs. In order to succeed with the project, students invest much time and effort in acquiring hard skills – mostly quantitative methods of statistical data processing and/or modeling. They also invest in getting familiar with soft skills – mostly qualitative - such as: communication (written, verbal, and informal), entrepreneurship, leadership, teamwork and problem solving to successfully complete their projects and secure their future jobs. Team projects and collective case-solving are the most popular forms of shaping collaborative attitudes, in addition to mentoring junior or less experienced students and challenging their peer presentations to practicing soft skills.

The best, and to some extent the most extreme examples of the American way of teaching are the 100-year-old Master of Business Administration (MBA) and the more recent Master in Public Administration (MPA) programs. These professional graduate programs are not recognized as graduate programs but rather as post-graduate studies in many European countries, and for this reason are treated as inferior by the conservative part of faculty. In the US and Canada, contrary to most European countries, these programs lead to building strong practical skills, critical thinking, and collaborative attitude, with students being in the center of the educational process. These programs, considered part of a professional education shape both good cooperation and fair competition – ingredients necessary for building social capital. The common feature of the most innovative and thus competitive economies like Sweden, Denmark and Finland- is rich human and social capital – the critical component to building strong industrial clusters and network-based communities. This is the case of all Nordic economies, which successfully combined a high level of R&D with investment in education & ICT, while maintaining a high level of social capital and cluster-based development policies. Similar patterns are followed by Switzerland, Singapore and The Netherlands. This is also the case of the United States – the 5th most competitive economy (Schwab, 2011).

The CEE academic community should respond quickly to the emerging needs and problems of the public administration, as they did with MBA programs at the beginning of the 1990s (with significant assistance from US and Canadian universities). They should creatively apply the best experiences of the 1990s with appropriate MPA-like programs and specialized training, which keep in mind the following principles:

1. Designing a balanced MPA program with the right proportions between knowledge, skills and attitude building
2. Teaching the public administration officers and staff the basics of innovation and competitiveness from globally-recognized programs such as MOC
3. Opening universities to practitioners to act as guest lectures
4. Encouraging collaborative efforts with faculty exchanges and joint MPA programs through universities from the top competitive economies
5. Including faculty achievements in developing innovation as criteria toward evaluating their performance and promotion
6. Motivating faculty to conduct applied research on the innovation and competitiveness of their own communities, cities and regions
7. Spearheading the public-private dialogue to improve innovation and competitiveness of their local and regional communities.

There are many other stakeholders who should be involved in this issue, but if the CEE Governments and academia take the lead in radically reforming public administration, it will transform into an opportunity for innovation-based development and sustaining competitiveness. It does not matter how absurd the current parliamentary debates are or how far out of touch many politicians are, if there is a strong professional administration. The most competitive economies, such as Switzerland, Singapore, and the Nordic countries, are excellent examples of how powerful a force public administration can be.

The chance for CEE to sustain relatively good economic performance over last 23 years is to convert existing barriers in public administration into opportunities to become an agent of change and support for innovation-based economic development through implementation of already delayed necessary institutional and structural reforms.

5. REFERENCES


ABSTRACT: To keep up with the dynamics of nowadays researches and technologies, study programmes - particularly master programmes - need to continuously evolve. Additionally, rigid regulations drive the structure and content of such programmes. Adding competitiveness to these as a must, one can easily infer that building (or updating) a study programme is not an easy task. Moreover, expectancies and requirements from industry might even interfere with specific rules that study programmes have to be compliant to. This paper introduces an approach to overpass the challenges above, by employing the TRIZ-M framework. Problem definition, needs, performances, constraints, technical conflicts and innovation vectors are the key ingredients of the framework that has been used to support the development of a competitive master study programme in Robotics at the Technical University of Cluj-Napoca.

Key words: competitiveness, master programme, TRIZ-M, innovation

1. INTRODUCTION

The mission of master study programmes is to provide advanced interdisciplinary background and to train specialists able to address practical problems in the fields where the study programmes prepare them. Master study programmes are aimed to ensure the continuation of undergraduate studies and can be correlated with one or more undergraduate programmes.

Development of curriculum, materials and tools for teaching and learning in a master study programme is a big challenge because lots of aspects have to be considered, like the national regulation frame of master studies (e.g. requirements of the Romanian Agency for Quality Assurance in Higher Education (ARACIS) dealing with assessment and accreditation of master studies) as well as the needs of the industry in the surrounding geographic areas and the very dynamic socio-economic conditions in Europe and worldwide.

Under the regulations in force, the minimum period of running a master programme in engineering sciences is 3 semesters, with a corresponding of minimum 90 ECTS study credits [1]. To obtain temporary operating authorization for a master programme, curricula must include fundamental disciplines, specialized disciplines, and complementary disciplines, all being further grouped into compulsory and optional disciplines, in accordance with specific regulatory requirements settled at national level [1].

Disciplines from the curriculum must be compatible with the curricula and programmes of similar studies in the European Union states, because the interchangeability of disciplines is specifically expressed in the ECTS study credits and must be ensured for international mobility of students. The volume of face-to-face classes has to be at least 14 hours per week; one semester having 14 weeks.

The remaining time until the level of 26-28 hours per week is the minimum amount of time allocated for individual work. The ratio between the number of course classes and applied activities has to be 1:1, being admitted variations of ± 25% [1]. At the end of each semester, at least four types of assessments have to be completed, of which at least 50% as exams [1]. Each master study programme must be supported by an appropriate research infrastructure.

Thus, the higher education institution that wants to develop a new master study programme must demonstrate that it has its own research labs in the field of the master programme. Also it must demonstrate that the lab facilities meet the requirements of the addressed research themes and the existing equipments allow to do research at international standards.

To be accredited by ARACIS, a master study programme must demonstrate the existence of its own research plan, which is included in the strategic plan of the faculty and, respectively, in the institutional strategic plan [1]. Finally each master study programme has to prepare their students so that at least 50% of the graduates will be employed in the respective area of competence in maximum two years after graduation [1].

Therefore, development of a competitive master study programme, which fulfils both the requirements imposed by regulatory institutions and the specific requirements coming up from industry, is a challenging issue.

Stelian, Brad¹ Mircea, Fulea² Bogdan, Mocan³ and Emilia, Brad⁴
1 Technical University of Cluj-Napoca, stelian.brad@staff.utcluj.ro
2 Technical University of Cluj-Napoca, mircea.fulea@staff.utcluj.ro
3 Technical University of Cluj-Napoca, bogdan.mocan@muri.utcluj.ro
4 Technical University of Cluj-Napoca, emilia.brad@muri.utcluj.ro

1. INTRODUCTION

The mission of master study programmes is to provide advanced interdisciplinary background and to train specialists able to address practical problems in the fields where the study programmes prepare them. Master study programmes are aimed to ensure the continuation of undergraduate studies and can be correlated with one or more undergraduate programmes.

Development of curriculum, materials and tools for teaching and learning in a master study programme is a big challenge because lots of aspects have to be considered, like the national regulation frame of master studies (e.g. requirements of the Romanian Agency for Quality Assurance in Higher Education (ARACIS) dealing with assessment and accreditation of master studies) as well as the needs of the industry in the surrounding geographic areas and the very dynamic socio-economic conditions in Europe and worldwide.

Under the regulations in force, the minimum period of running a master programme in engineering sciences is 3 semesters, with a corresponding of minimum 90 ECTS study credits [1]. To obtain temporary operating authorization for a master programme, curricula must include fundamental disciplines, specialized disciplines, and complementary disciplines, all being further grouped into compulsory and optional disciplines, in accordance with specific regulatory requirements settled at national level [1].

Disciplines from the curriculum must be compatible with the curricula and programmes of similar studies in the European Union states, because the interchangeability of disciplines is specifically expressed in the ECTS study credits and must be ensured for international mobility of students. The volume of face-to-face classes has to be at least 14 hours per week; one semester having 14 weeks.

The remaining time until the level of 26-28 hours per week is the minimum amount of time allocated for individual work. The ratio between the number of course classes and applied activities has to be 1:1, being admitted variations of ± 25% [1]. At the end of each semester, at least four types of assessments have to be completed, of which at least 50% as exams [1]. Each master study programme must be supported by an appropriate research infrastructure.

Thus, the higher education institution that wants to develop a new master study programme must demonstrate that it has its own research labs in the field of the master programme. Also it must demonstrate that the lab facilities meet the requirements of the addressed research themes and the existing equipments allow to do research at international standards.

To be accredited by ARACIS, a master study programme must demonstrate the existence of its own research plan, which is included in the strategic plan of the faculty and, respectively, in the institutional strategic plan [1]. Finally each master study programme has to prepare their students so that at least 50% of the graduates will be employed in the respective area of competence in maximum two years after graduation [1].

Therefore, development of a competitive master study programme, which fulfils both the requirements imposed by regulatory institutions and the specific requirements coming up from industry, is a challenging issue.
2. THE PROBLEM

Probably the most important (or the most often issued) requirement for a master study programme is to “produce” competitive graduates. Apart from this, such a programme should meet the requirements imposed by specific regulations (the education-related legislation, the national frameworks) and internal university rules. It is also driven by financial aspects in terms of revenues and costs. To “produce” competitive graduates, the master study programme should be as flexible as possible to particular needs of both students and industry. This requires continuous evolving in order to effectively adapt to the state-of-the-art (or emerging) technologies and to specific market trends. The need for flexibility is especially critical in the technical domains. Companies (e.g. the regional stakeholders), who are the end “beneficiaries” of master programmes (by employing MSc graduates), usually state their expectations loud and clear, many times claiming that the knowledge and expertise accumulated in the master programmes by graduates are not best fitting with industry requests. For instance, such claims were recently raised up during the workshops for building an IT cluster in the Cluj region [3], many participants stating that the regional IT companies should be directly involved in curricula design and in the teaching process of specific master programmes for improving the end results. On the other hand, master programmes need to obey the rules and constraints of the Ministry of Education and ARACIS [1]. Moreover, getting the infrastructure needed for the corresponding academic activities is many times a challenge for universities. Specific dedicated equipment is often expensive and difficult to get, considering the internal bureaucracy, lack of national funding in research and educational infrastructure, as well as other funding issues that many master coordinators encounter. The staff involved in teaching activities needs to meet specific criteria, among which a PhD title and papers published in journals [4]; thus, most of the experts from companies cannot be involved in the teaching process at master programmes. As a supplementary remark, due to economic and personal reasons, nearly all master students get a job along with the master programme they attend. Hence an atypical challenge for the academic staff – how to motivate students to allocate the adequate time and to keep them interested and motivated in learning and working properly in the master studies. To overpass these problems, structured innovation for problem solving has been considered. It is briefly introduced in the next section.

3. METHODOLOGY

The innovative development of the framework for running a master programme is referring to:

- Identification of various barriers and constrains in setting up the study programme to increase its adaptability to market needs,
- Formulation of solutions that solve as better as possible the conflicts that emerge from barriers and constrains.

The roadmap contains the following stages: a) problem definition; b) problem analysis; and c) solution formulation. In the stage of problem definition, objectives and performance indicators have to be defined, and actors involved have to be identified together with their key requirements and expectations. In the stage of analysis, constrains and desired results are formulated, as well as challenges are defined. In the stage of solution formulation, generic vectors of innovation are firstly determined.

They come up from the application of TRIZ-M method [5] in relation with the pairs of conflicting problems (challenges) identified in the analysis stage. Generic vectors of innovation highlight proper routes where innovative solutions to the conflicts can be formulated. The second step of the last stage concerns with solution formulation.

4. APPLICATION EXAMPLE

The effectiveness of the methodology for setting up the master programme in Robotics at the Technical University of Cluj-Napoca has been experimented. The expected results in engineering the study programme are: a) high flexibility and adaptability to various requests coming up from students and industry; and b) high student satisfaction with respect to each course unit, both with respect to the whole study programme and to the working environment in the university. Metrics to measure performance are: a) speed of adaptation to industry requirements (unit of measurement: weeks); b) student satisfaction (unit of measurement: scale from 1 to 10). Actors involved in the engineering process are: a) students; b) industry (by means of representatives); c) teaching staff; d) study program manager. Students expect course units that are oriented on practical problems, with topics required by employers and with immediate applicability into practice, with theoretical support only in relation with practical issues. Employers expect curricula oriented towards local needs, and graduates with practical skills. Academic staff would like to teach students advanced theoretical subjects that are useful in research (e.g. for preparing potential PhD candidates). The programme manager would like to attract as many as possible students, to work well with highly skilled teaching staff (both from theoretical and practical points of view), and to have the industry support. In this context, the following set of specific constraints has been identified:

- Limited time (teaching and study hours) allocated to a master study programme,
- Many students have a job and have little available time in a work day,
- The infrastructure (mainly dedicated equipment) of a university might not be best suited to the programme needs,
- The curricula needs to be structured according to rigid rules, imposed by national authorities (e.g. ARACIS),
- Students come from various bachelor programmes and therefore have slightly different technical background and expertises,
- Academic staff recruitment is very strict (very few alternatives),
- Restrictions, imposed by national frameworks (e.g. ARACIS regulations), for the teachers / trainers (e.g. PhD title, published research papers in the specific domain, academic title),
- Curricula adaptation can be done only by applying a difficult and time-consuming procedure.

Market surveys on representative samples of companies and BSc graduates have been completed in order to define the competences and skills expected from a graduate of such master programme. Results of these surveys are not the subject of this paper. However, they were necessary in order to formulate the major challenges that have to be exceeded for reaching a superior level of competitiveness for the master programme in Robotics. Ten major challenges have been released for this case:
Challenge 1: High flexibility in modifying curricula and syllabus versus slow process for modification approval,

Challenge 2: High flexibility in modifying curricula and syllabus versus barriers from some teaching staff who do not always accept a fast adaptation to new requirements,

Challenge 3: Need to deliver specific competences versus lack of qualified teaching staff on some topics of interest,

Challenge 4: Theory versus practice,

Challenge 5: As many as possible training classes versus limited number of hours specified in curricula,

Challenge 6: Rigid schedule in the official timetable versus need for adapting to various student timetables,

Challenge 7: Course requirements versus students with different backgrounds,

Challenge 8: Need for cutting edge, diversified and sufficient training resources (software, equipment, books, manuals, etc.) versus limited resources of the university at a certain moment,

Challenge 9: Speed of changes versus speed to re-train the teaching staff for delivering new subjects and to deliver training for students on the latest technologies,

Challenge 10: Vocational approach versus traditional approach.

Application of TRIZ-M method on the above challenges led to several generic vectors of innovation. According to TRIZ-M methodology, a first step is to associate generic parameters to the particular conflicts. Thus, the following results have been obtained in the case of the ten challenges:

Parameters for challenge 1: speed versus pressure. Generic vectors of innovation: system to be able of making multiple functions; use “resonance frequency”; transition from one level of implication to a superior one; from a homogeneous structure to a composite one.

Parameters for challenge 2: adaptability versus effort required to involve dynamic elements. Generic vectors of innovation: from a continuous action to a periodic one or impulse; change flexibility, density or volume; fluid construction; inversion.

Parameters for challenge 3: capacity versus complexity. Generic vectors of innovation: equipotentiality; act on more directions in the same time and explore the opposite side of the problem; use “fields” instead of “rigid” elements; mediation.

Parameters for challenge 4: amount of substance versus involved engagement. Generic vectors of innovation: change flexibility, density or volume; from linear approaches to non-linear ones; local quality.

Parameters for challenge 5: dynamically involved volume versus amount of substance. Generic vectors of innovation: fluid construction; flexible interfaces; nest-in-nest.

Parameters for challenge 6: system stability versus convenience in use. Generic vectors of innovation: additive and change of transparency; change flexibility, volume or density; flexible interfaces.

Parameters for challenge 7: adaptability versus easiness to perform. Generic vectors of innovation: segmentation; inversion; “porous” structures.

Parameters for challenge 8: capacity versus amount of substance. Generic vectors of innovation: change flexibility, volume or density; transition to superior levels of implication.

Parameters for challenge 9: speed versus system stability. Generic vectors of innovation: use “fields” instead of “rigid” elements; homogeneity; segmentation; use “resonance frequency”.

Parameters for challenge 10: convenience versus system complexity. Generic vectors of innovation: additives and change of transparency; simple and cheap copies; equipotentiality; act on more directions in the same time and explore the opposite side of the problem.

Based on the generic vectors of innovation (GVI), the following effective solutions have been formulated:

Objective 1: High flexibility in modifying curricula and syllabus. Adopted solutions: a) Generic definition of chapters within syllabuses for easy adaptation of their contents [GVI: system can perform multiple functions]; b) Approval of annual modifications based on the feedback from students and companies (annual questionnaires) [GVI: use “resonance frequency”]; c) Students are allowed to choose the semester research projects and tutors [GVI: use “resonance frequency”]; d) Use supplementary materials for individual study and change the weight of various problems in the course unit (if it is necessary) [GVI: transition to a superior level of motivation]; e) Optional course units and optional chapters within syllabuses, including the lab and project work [GVI: from a homogeneous structure to a composite one].

Objective 2: Fast adaptation of the academic staff to new requirements. Adopted solutions: a) Sign performance agreement with conditions referring to clear orientation towards student requirements (extracted from questionnaires at the end of each semester) [GVI: from continuous action to periodic actions or impulse]; b) Allowance to teach a course unit based on the feedback from students [GVI: from continuous action to periodic actions or impulse]; c) Detailed requirements about course unit structure (ratio “applications/theory”) [GVI: change flexibility, density or volume]; d) PBL teaching method [GVI: change flexibility, density or volume]; e) More teachers involved on the same course unit (e.g. modules) [GVI: fluid construction]; f) Use teaching staff and infrastructure from other universities where useful, based on collaboration agreements (i.e. in this case, two course units are done by University “Politehnica” Timişoara, Romania, and Hamk University, Finland) [GVI: fluid construction]; g) Periodic internship of teachers in companies [GVI: inversion].

Objective 3: Delivery of customized skills, according to company requests. Adopted solutions: a) Course unit focus on projects and applications taken from industry [GVI: equi-potentiality]; b) Semester research projects proposed by industry [GVI: equipotentiality]; c) Invitation of experts from industry for thematic workshops [GVI: action on more directions in the same time and explore the opposite side of the problem]; d) Student assessment based on their projects and semester homework with the consultation of experts from industry [GVI: use “fields” instead of “rigid” elements]; e) Students must develop dissertation projects proposed by industry [GVI: mediation]; f) Perform of some lab work within companies – based on cooperation agreements [GVI: mediation].

Objective 4: From theory to practice. Adopted solutions: a) Teaching based on PBL [GVI: change flexibility, density or volume]; b) The course unit is thought as a support for projects and lab work; students are examined only on the results in projects and lab work [GVI: from linear approaches to non-
5. CONCLUSIONS AND DISCUSSIONS

The continuously evolving technologies that support nearly any technical domain have set a continuous pressure on master programmes towards competitiveness. Yet, updating (or designing from scratch) a master programme’s curricula in order to adequately meet the market needs, is not at all an easy task. In this context, traditional approaches in designing a master programme, mainly based on reactive measures, are no longer effective. To overpass this drawback, innovation methods like TRIZ-M can be successfully employed, aiding study programme developers in addressing organizational constraints, regulation barriers, and psychological inertia.

Although a specific framework – with precise steps and approaches – has been proposed for reshaping master programmes, the creativity and freedom of the academic staff responsible of maintaining such programmes is not narrowed, but actually enhanced. Thus, barriers such as strict regulations and “traditional” lack-of-flexibility in curricula setting can be innovatively addressed, as the case study introduced in this paper has demonstrated. The very positive feedback from the last two generations of graduates of the master study programme in Robotics at the Technical University of Cluj-Napoca and from the industry in the region has shown the effectiveness of the framework applied to design for adaptability and competitiveness this programme.

Some challenges in using the proposed framework do also exist. The most important one is that failing in properly identifying (and formulating) barriers and constraints will significantly lower the relevance of the output. Increased attention is therefore required for this step. Also, for getting adequate results, experience with TRIZ-M is highly recommended (properly identifying TRIZ-M parameters and contextually interpreting innovation vectors is a must for maximizing the framework results).

6. ACKNOWLEDGEMENTS

This paper was supported by the project ROBOTIQ: 28382, project co-financed by the European Social Fund through the Sectoral Operational Programme Human Resources Development 2007-2013.

7. ACRONYMS

ARACIS: Romanian Agency for Quality Assurance in Higher Education
ECTS: European Credit Transfer and Accumulation System
GVI: Generic Vectors of Innovation
PBL: Problem-Based Learning/Project-Based Learning
RNCIS: National Register of Qualifications in Higher Education
TRIZ-M: Theory of Inventive Problem Solving for Process Management

8. REFERENCES

1. ***, Quality assessment activities guide for university programs and higher education institutions - ARACIS, (2010).
EFFECT OF LEISURE ACTIVITIES ON THE ATTRACTIVENESS OF THE STUDY AREA AND STUDY MOTIVATION OF STUDENTS

Norbert, Grünwald¹ and Oana, Dumitraşcu²
1 University of Applied Sciences, Technology, Business and Design Wismar, rektor@hs-wismar.de
2 University of Applied Sciences, Technology, Business and Design Wismar, oana.dumitrascu00@gmail.com

ABSTRACT:
With a main purpose of analysing the effect of leisure activities on the attractiveness of the study area and study motivation of students, a comparison study of three universities has been developed. The study is focused on the University of Applied Sciences, Technology, Business and Design Wismar, University of Applied Sciences Kiel and University of Applied Sciences Flensburg. For these universities a study has been carried out of the leisure opportunities in the area of recreation, vocational preparation, sports facilities and student satisfaction in terms of the university image and their involvement in leisure activities. The study has been accomplished using the survey method. Based on this method, the marketing research is presented and the gathered data is evaluated through univariate and bivariate analysis. As a result of the study conducted, it is the student’s opinion that the offers of leisure activities of the universities present some gaps and its awareness is low. Thus, it is recommended to fulfil the student’s needs in regards to leisure activities by a diversified offer and enhanced advertising. Following these recommendations the motivation and the satisfaction of students will be improved.

Key words: leisure activities, study motivation, study attractiveness

1. INTRODUCTION

East German universities are confronted with a lack of capacity utilization due to demographic changes since the 1990s and the migration of population from the new to the old federal states of Germany.[1] Prospective students are on one hand, inadequately informed, concerning the study opportunities and career opportunities and on the other, uncertain about their personal skills and interests. In case of a study choice, these factors pose a risk of alienation for the decision making, or even the risk of dropping out from the study programme.[2] To avoid this risk, the attraction and retention of students increases its importance.

The image of a study placement is influenced by the university’s good reputation, its facilities, its proximity to home but also by the leisure activities and the general atmosphere. These factors affect the study motivation of students, but also the decision making process of prospective students in choosing their university.[3]

The present article deals with the effect of leisure activities on the attractiveness of the study area and study motivation of students of the University of Applied Sciences, Technology, Business and Design Wismar, University of Applied Sciences Kiel and University of Applied Sciences Flensburg, located in the north of Germany. The results are based on a survey, conducted in the winter semester 2011/2012, where students from all disciplines of the three universities participated. The collected data was analysed with the purpose of identifying problems and discussing recommendations.

2. OBJECTIVES

The general objective of this study is to analyse the impact of the leisure facilities at the three universities in Flensburg, Kiel and Wismar on the attractiveness of the study area and study motivation of students. Furthermore, conclusions were drawn in which way leisure activities are perceived by the students. For this purpose, in a comparative study of the three universities 120 students were questioned regarding the level of recreational activities and their impact on the attractiveness of the study area and study motivation of students. The analysis of this study is the demonstration of approaches and future recommendations.

Specific objectives of the study:
- Assessment of student participation in leisure activities: Are the surveyed students involved in the leisure activities in claim? What factors cause their non-participation?
- Assessment of leisure services in the area of sport and determining the possibilities of sports activities
- Evaluation of the offer of extra-curricular activities in the perspective of career
- Assessment of leisure services in the recreation area
- Determine the differences and similarities of the leisure facilities at the three universities
- Recommendations for University Wismar

3. RESEARCH METHODOLOGY

The marketing research process is divided into four phases. First, a study destination is recognized and defined. The research goal is determined by taking into account the initial situation. In the second phase a research plan is developed and the data is collected – gathering data is done through secondary and primary research. After that, the collected data is analysed and interpreted. The data analysis is done using various statistical analysis programmes. In the final phase the results are presented and communicated. The findings will be presented in a genuine and meaningful way to decision makers.[4]
Using secondary research, specific data that already existed as informative material is examined. Certain information regarding the universities of Kiel, Flensburg and Wismar were collected through secondary research. Existing information was used, such as information in the field of leisure activities in sports, in the view of the career and the field of recreation available on the website, posters and brochures of universities, etc. The collection of secondary data facilitates the incorporation into the problem and the development of the primary data. In primary research, the data was obtained using the technique of questioning. First of all, exceptional issues have been clarified by surveying experts. The unavailable information about the universities was provided supplementary by specific university contacts. A large amount of information is generally provided by the collected data.[4] By the data evaluation, the data was checked, sorted and analysed. The required information was compressed, so that decisions were made.[5] The collected data has been processed using the SPSS programme and analysed. To identify the relationships between the collected data, various methods are used, such as univariate and bivariate analysis.[6] Through univariate analysis, individual variables are analysed. The bivariate analysis examines the relationships between two variables. It explains how a change in the characteristic values of one variable can lead to the change of the characteristic values of another variable.[7]

4. THE COLLECTED DATA

The target group of the study are students enrolled in the winter semester 2011/2012 at the University of Applied Sciences, Technology, Business and Design Wismar, University of Applied Sciences Kiel and University of Applied Sciences Flensburg, where the surveyed were chosen randomly. A total of 120 students were questioned, where 40 students from the University of Wismar, 40 from the FH Kiel, and another 40 from the Flensburg University of Applied Sciences. 41.7% of the 120 respondents were female and 58.3% male. The majority of respondents are enrolled in the bachelor programme, 11.7% participate in a master programme and 3.3% in a diploma programme. The majority of the 120 respondents study in the fifth semester, while fewer study in the third and first semester. 62.5% of surveyed students at the University of Wismar and 45% of students at the University of Applied Sciences Kiel learn in the fifth semester, while at the University Flensburg 35% of respondents study in the first and 30% in the third semester.

5. DESCRIPTION AND EVALUATION OF THE RESULTS

Based on the analysis of the data, it can be found that in comparison to the University in Kiel and the University in Flensburg, at the University of Wismar proportionally fewer students participate in leisure activities. Generally, students participate in sports activities and are less interested in other activities. However, even the participation in sports activities in comparison to the other two universities is less.

In total, respondents spend 13.99 hours per week in lectures and labs, 13.03 hours per week are used for recovery, 9.5 for homework and preparation, 8.66 hours for socialization - like Facebook, telephone, Internet - and 6.26 for a job. In average, the students make 4.43 hours sport, they spend 4.15 hours on the road to university or job and 1.57 hours they involve themselves in voluntary work. The students at the University of Wismar invest more time in homework and preparation compared to the subjects of the other two universities. They also exercise less, have not so many lectures and labs, and they spend less time on their way to university, home or work. On weekends, 55% of respondents remain in Wismar, 70% and 85% in Kiel, Flensburg. Since almost half of Wismar's students leave the city on weekends, and don’t spend a lot of their time exercising, certain gaps in various sports result.

\[ N_{\text{Total}} = 120 \]
\[ n_{\text{Wismar University}} = 40 \]
\[ n_{\text{Kiel University}} = 40 \]
\[ n_{\text{Flensburg University}} = 40 \]

Figure 1: How much time do you spend with the following activities per week? How do you spend your weekends?

The students who expressed themselves with “neutral” or “probably not” to the statement “are you satisfied with the university?”, weren’t influenced by leisure activities in choosing their university. By contrast, the subjects who agreed with this statement have been influenced to 20% and the subjects who totally agreed, to 9.7%. Therefore, it can be concluded that a high level of satisfaction depends on the improvement of leisure services. (See Figure 1: How much time do you spend with the following activities per week? How do you spend your weekends?)

5% of the respondents of the University of Wismar, 7.5% and 2.5% of the Kiel University and Flensburg University do not participate in sports activities. The students at the University of Wismar are less interested in other activities. 15% of these students would introduce more activities related to interdisciplinary collaboration as well as sailing, swimming, handball, hockey, events in the musical direction; as well student associations or politics would also be important to them. 20% of respondents of Kiel University, which would introduce a leisure activity desire sailing, but also hiking and squash. For 20% of the subjects at the Flensburg University, which would introduce an extracurricular activity, climbing is important, with 25%, but also swimming, handball, squash, university sports teams, cultural events and board games. (see Figure 3: Is there a leisure activity that you would like to introduce at your university?)
5% of the respondents of the University of Wismar, 5% and 7.5% of the University Kiel and University Flensburg are not aware of the offer in the area of professional preparation. Nearly three-quarters of respondents of the University of Wismar have a good or very good opinion about the offer in view of the career, at the Flensburg University and Kiel University only half of the respondents share the same opinion.

(see Figure 4: General opinion about the leisure activity offer in the career perspective)

Based on the analysis of the data, it is clear that participation in extra-curricular activities in the area of professional preparation is the highest at the Wismar University and the lowest at the Flensburg University.

The student’s awareness in the area of career centre at the University of Wismar is higher, and more respondents have a good or very good opinion about it. In the area of language, Kiel’s University offers more attractive and diversified services.

Out of the participants there are 7.5% students from the University of Wismar, 10% and 2.5% from the Kiel University, Flensburg University not familiar with the offer in the field of recreation. A quarter of respondents have expressed a good opinion about the recreational facilities of the university, no one has a very good opinion and the majority is neutral. The consideration of the opinions of the respondents shows that they are not very happy with the offer in the field of recreation.

(see Figure 5: General opinion concerning the leisure activity offer in the field of recreation)
After analysing the participation and opinions of the surveyed students regarding the recreation facilities it is clear that the services which each of the universities offer present gaps. However, the student participation in leisure activities at the Kiel University is larger and the offer more attractive, especially in the area of cultural events, theatre, music and artistic events.

Considering the opinion of the respondents of the universities in terms of sports offer, in the area of professional preparation and in the field of recreation it is seen that more respondents of the Flensburg University have a good or very good opinion. University Kiel and University of Wismar are similar overall and less well estimated.

6. CONCLUSIONS

According to the analysis of the collected data it can be stated that the participation of students from the University of Wismar in extra-curricular activities compared with the other universities analysed is rather small. In general, students spend their time with lectures and labs, recreation, homework, projects, jobs and socialization. Reason of not participating in leisure activities is often a time problem.

In the name of the authors it is recommended to improve the university marketing by improving the advertising of the latest leisure activities offer - with the help of flyers, posters, oral publicity- for attracting more students in leisure activities.

The majority of surveyed students at the University of Wismar had a neutral opinion about the sports offer at the university and are not well informed. The offer is not sufficiently known among students, and because of its lack of diversity it is not adequately attractive. The other two universities are able to provide a more diversified and more attractive offer. Since the students are ready, according to their own statement to spend 13.63 € per month for sports and they would like new sports to be introduced. It is recommended the introduction of a monthly contract in the amount of 10 to 15 Euros, in which the offered sports are included. To make the sport offer more attractive, a project for modernisation and expansion of the sports hall should be developed. The basic fee of 10-15 € per month would involve not only the existing sports but also a growing range of new services (offered by the sports centre of the university itself or in cooperation with companies which are active in sports), to the gradual approach to the other universities.

For a higher fee, the city location on the Baltic Sea and the city flair should be taken into consideration, by developing the offer of water sports, very important for students. In collaboration with the University of Wismar, the attractiveness of the city with the image as a nautical city could be increased. For an extra fee, sailing, swimming, diving and surfing should be added to the university offer.

The offer in the area of professional preparation at the University of Wismar, in comparison to the other two universities is more known. This should be retained by targeted advertising for increasing the participation of the students.

In the area of recreation, the offer is rather low compared with other universities and the students are not satisfied with it. Culture, music and theatre have not been developed enough, so that related organisations and student clubs, various events, competitions, exhibitions could be spread out. Students with common interests could bring their ideas in order to expand and express their talents, interests and potential.

In order to extend the offer in the recreation area, trips with professors and students should be organised. Common activities could be, for example, a barbecue or a boat ride. City visits should be organised by the International Office, where all students can participate.

Since most students have classes in the morning, it is anticipated that the proposed extra-curricular activities should be offered more in the afternoon. In order to improve the quality of leisure opportunities and the needs of students, periodically review questionnaires about leisure activities of the university should be filled out by students. For a better control of the effect of leisure activities on the attractiveness of the study area and study motivation of students, it is advisable to carry out this research each semester, with the purpose of increasing the attractiveness of leisure activities and better match with the needs of the students.

Due to the increasing attractiveness of leisure activities, through advertising and marketing, the image of the university would be improved and more prospective students could be added, the students will be more satisfied, so that the study motivation and the attractiveness of the study location would increase.

7. REFERENCES


ABOUT THE ROLE OF THE MATHEMATICS IN THE ENGINEERING EDUCATION

Bogdan, Nicolescu¹ and Tiberiu, Macarie²
1 University of Pitesti, bogdan.nicolescu@upit.ro
2 University of Pitesti, tiberiu.macarie@upit.ro

ABSTRACT: It is evident that the development of future generations with the right skills and knowledge, for a career in engineering at all levels, is essential for the future economic prosperity of any country. Moreover, in the future we will need professional engineers with greater interdisciplinary understanding, and with more specialist skills. So, we will need a deeper understanding of the sciences that underpin the art of engineering, and we will therefore need to know which are the mathematical skills needed to apply these sciences. Because advances in the use of information technology and computers have transformed engineering analytical techniques, production and management processes, it raises some questions: What is and will be the role of mathematics in the education of engineering? What mathematical skills are needed for the engineers of tomorrow, and how and when these might best be acquired? This paper is dedicated to an objective analysis of the positioning of mathematics courses to those of specialized training mechanical engineers. Both authors share their extensive experience in teaching mathematics and science of mechanical engineering at the Faculty of Mechanical Engineering.

Key words: engineering education, mathematics, mechanical engineering

1. INTRODUCTION

It is a well known fact that engineering has created and continues to create wealth and development for every nation. In the actual development phase of mankind we cannot indicate any domain of human activity that did not benefit from at least one of the engineering science accomplishments.

The engineering science’s can no longer be considered in the restrained context of the ‘construction of a purely industrial society’, as it was in the past century. These go beyond the boundaries of other sciences, such as mathematics, physics, biology, medicine, ecology, economics etc. The interactions and the inter-influences between engineering and the other sciences have, as a result, developed a deeper knowledge and understanding of our Universe. Furthermore, the major climate changing, the development of new technologies to produce unconventional energy, the production of new materials that satisfy the modern technologies, the food supply problem for the human race in the globalisation process etc., have become huge challenges for the engineering science’s. That is where the need for the training of capable engineers who can overcome all of these challenges has comes from.

In each and every country the problem of the educational system reform for engineers is made more acute from the perspective of changes and objectives of the future human race development, as well as from the perspective of the educational technology, especially in order to design the optimum curriculum, adequate and flexible that can be adopted for training an engineer with necessary competences in a certain direction of activity.

These problems are very seriously, professionally and responsibly taken into account by the universities, as well as by the economic and business environment, in order to be in line with the governmental policies of each state. Furthermore, they consider the coherency, the harmonisation and the resonance of the curriculum for the different fundamental disciplines (mathematics, physics, chemistry, biology etc) and the technical disciplines. The main problem is the one of the knowledge level, of the abilities and skills that a high school graduate must have in order to go to an engineering university and get an appropriate level of training in order to become a competent engineer who can integrate professionally and prove his worth to society.

The problem regarding the technology of education for engineers is viewed differently in each country in order to comply with the educational traditions, with the existing economic and industrial development level. To support this statement, we mention a few of the research studies done in various countries more or less developed, G. Rogers (2005), T. Kelley & all (2008), P. J. Williams (2001), R. Banerjee & all (2007). These researches study the problem of training for the engineers in the existing context of knowledge and the future needs for development and economic stability.

We should also note that everywhere in the world research centres exist for engineers’ education, national and/or international engineer’s organisations that are dealing with the optimisation of the engineering education. For example, at the EU level there is the European Society of Engineering Education that, in 2011, proposed the foundation of the European Engineering Deans Council (EEDC) composed by the leaders of the engineering education university institutions.

Unfortunately, we have to observe that in our country, for all we know, there are no such research studies and no governmental policies for that. This is also proven by the inexistence of a national research and development centre for the engineers’ education [14]. The polytechnic universities or those that have studies for engineers are the only ones that assume and have this responsibility, and the result of engineers’ education is manifested only implicitly through the competences that their graduates acquire, judged only through
the level of professional integration for the engineers into our labour market [15]. Is this good or bad, could it be better, what is to be done? These are questions that should be answered not only by the nation education system and the universities, but also by our entire society.

The authors propose in this paper to only present a problem. An extremely important one linked to the engineers’ education. In other words, in the imposed (agreed) context by the ARACIS for a plan for the mechanic engineers training, in particular, for the engineers with the AR speciality from the Pitesti University, what is the ratio for mathematics?, what should be the content for the mathematical disciplines in order to sustain and help the specific competencies of the engineers who take these courses? This problem is looked at from the point of view of the engineer teacher, who teaches the speciality disciplines, such as the dynamic of the automobile, as well as the maths teacher, who teaches for example mathematic analysis and/ or special mathematics.

2. ENGINEERING DEGREES AND THE PLACE OF MATHEMATICS

From the engineer teacher’s point of view and the educational governing body who decides the training curriculum within the polytechnic universities, the mathematic training courses for future engineers are believed to be part of their fundamental preparation. In this sense the mathematical training is covered during the first two years of initial studies. During this two year period the student studies the disciplines of linear algebra, analytical and differential geometry, mathematical analysis, special mathematics and numerical methods. In the first year of study 20% of the course is dedicated to mathematical studies and in the second year this is 10% of the course. The other disciplines studied use to a lesser or greater extent the mathematical principles learnt.

The engineering profession, indifferent of its field, is generally practical in regards to the concrete activity of engineering. This results in a multitude of specialisation and diversification in theory and application of engineering science. Mathematics is the basis and supporting pillar for the engineering science used.

At the same time the technical disciplines are important considerations which assure the initial foundation for various fields of engineering. Technical disciplines through their content and specific application require a mathematical base in order to know, understand and use them according to the functional limitations of different devices and components, to determine a stable or a changing regime within the limits of admissible functions in order to measure a system’s complexity to a greater or lesser extent.

The necessary mathematical calculations encompass many different aspects in function of the discipline specificity, degree of application and not least, the teachers training.

An important and difficult problem to solve is linked to the development degree of mathematical notions taught within the polytechnic universities, their degree of applicability in solving real technical situations, but their use in the modelling of real phenomenon, sometimes extremely complex, that are the base of the numerical simulation for these phenomenon.

Starting with the natural teacher’s desire to do his job at the best level in order to give the students the most competences for their future profession, to fulfil the labour market requirements, a continuous collaboration and communication is required between the engineering and mathematical departments within a university, in order to establish not only the ratio between mathematics and technical disciplines, but also the content of them.

Without such an approach there is a risk for both sides:

- either the content of mathematical disciplines has no use for the engineering profession,
- or the technical disciplines use mathematical apparel that has not been taught within the mathematical disciplines.
- In both situations, the student looses being a victim of this false conflict.

What can we do?

The answer is not easy to give, but at least some directions can be established, assuming that the existing ratio for the hours dedicated to mathematical disciplines cannot be changed.

The experience shows that until now, that in general the technical universities graduates found jobs and the employers rarely criticised the mathematical knowledge. It is more common for the employers to criticise the insufficient training in other domains, such as technical drawing, communication, lack of practical skills, lack of modern programming knowledge or simulation etc.

The second direction is the permanent, constructive and efficient dialogue between the teachers for mathematical and technical disciplines, so that each one of them to adapt their course to real technical situations. It is possible that over the years the content of a technical course must change a lot (for example in the computer programming field). This implies important changes in the content of mathematical disciplines as well.

This problem is almost a general problem and its resolution involves agreement and collaboration between the technical and mathematical teachers. The dialogue is not an easy part, because they must overcome the discussions concerning the number of hours, the routine and sometimes the egos. But taking into account the final objective, the effort of this dialogue is worth while.

The third direction is communication and exchange of experience between the polytechnic universities in the form of transferring best practices. It is a known fact that marked differences exist between curriculums of the universities. The exchange of best practices is welcomed.

The fourth directions elevate the level of the knowledge and mathematical skills of the students in the pre-university level. Even if the exigency of the national baccalaureate has risen in the past two years, but it is insufficient. We observe that students in their first year of study remain with a lower level of knowledge and skill necessary in mathematics. This fact has a direct relevance in a large number of students who do not graduate mathematical disciplines in the first two years of engineering.

3. MATHEMATICS IS AN ESSENTIAL TOOL FOR KNOWLEDGE AND RESEARCH IN ENGINEERING SCIENCES?

In many instances during our mathematical lessons students query why they need to learn mathematics to be an engineer. Their question is natural taking into account their lack of knowledge and skills in mathematics after graduating from high school and become students at the polytechnic
universities. Otherwise such kinds of questions are also asked by the students within the faculty of engineering across the world. Therefore the academic community reacts trying to give more and more satisfactory answers [4], [6], [7], [8].

A few times, during the maths courses, whether they were for the first year of study – for example mathematical analysis or differential geometry - or for the second year – special maths or numerical methods - students have asked us what is the use of all these notions, concepts in the engineering profession? Their question is natural, especially for the students who had a technological profile during high school.

But what can a maths teacher respond, especially when he must, needs to teach all the different things throughout his course - for example the Gateaux derivate, the Fréchet derivate for vector fields, ordinary differential equations for which they formulate the Cauchy problems, i.e. imposing the initial conditions, equations with partial derivates to which we attach initial boundary problems, Fourier analysis, asymptotic analysis etc.

The maths teacher must teach following the natural logic of mathematics and often, if not always, does not have the time or, unfortunately, does not even try to link all these to their engineering applications. So, the maths teachers are much attracted by the concept of mathematics being ‘pushed’ rather than ‘pulled’ into the engineering context.

In other words, at university level the mathematical training process, such as it is conceived and applies, for the engineering students does not take into account and overlooks the most important step of the educational process, that is to say the mathematical modelling of real life. In this case, ‘the mathematical modelling of real life’ must be understood when teaching mathematics to the engineers starting with the processes, phenomenon, dynamics, transformations that study or are being taught and researched by the technical disciplines from the curricular area specific to the engineering domain.

One of the multiple possible examples is the one for the theory of the ordinary differential equations, which is anyway linked to the chapter for dynamics from the mechanical discipline. The dynamic of the automobile discipline can be considered as application mechanic and, in consequences, uses as a research instrument the theory of ordinary differential equations, reduced to Newton’s second law, written as

\[
a\ddot{\mathbf{x}} = \tilde{\mathbf{f}}(t, \mathbf{x}, \mathbf{v}),
\]

where \( t \) is the time and \( \mathbf{x} \), \( \mathbf{v} \) and \( \mathbf{a} \) are, respectively, space, velocity and acceleration of the vehicle gravity centre. Why is it that our students do not recognise, associate and, therefore use the properties of Newton’s equation presented, during the mathematical course, in the form

\[
\frac{d^2\mathbf{x}}{dt^2} = \tilde{\mathbf{f}}(t, \mathbf{x}, \frac{d\mathbf{x}}{dt}),
\]

where  \( t \) is the time and \( \mathbf{x} \) is the space function, \( \frac{d\mathbf{x}}{dt} \) and \( \frac{d^2\mathbf{x}}{dt^2} \) are, respectively, the first and second derivate of the space, during the technical disciplines? It is that they forgotten the mathematical knowledge or it is that they never understanding the meanings of these mathematical things?

An other example is related with teaching and learning for the students from engineering faculties the partial differential equations only in the formal mathematical framework which consisted in theorems of existence and/or uniqueness, properties of a priori estimates for solutions of the initial boundary problems. These are a big mistake. For example, the Dirichlet problem for Poisson’s equations, i.e. \( \Delta u = f \), should be developed in the course of several lectures, seminars and laboratory analysis of mathematics in its various real applications of fluid mechanics, electromagnetic field theory, magneto-hydrodynamics, aerodynamics etc.

Thus, the mathematics teachers must reveal the usefulness and purpose of the mathematical modelling, they must focus on building of the physical solutions of such initial boundary problems, either in the exact analytical form, if it possible, or in the numerical forms, and in the end they must interpret physically this solutions. In these way, mathematics teachers would gain students’ interest in learning of purely mathematical methods, such as change of variables method, variable separation method, spectral methods Fourier-Bessel type, finite element method, boundary method etc.

But, it is possible to do in such? The answer is no. Why no, is an other problem linked and by the new restrictions imposed by the Bologna policy. In our opinion, firstly, the mathematical curriculum from the engineering university must be flexible and integrated specifically with the technical disciplines existing in the initial training plan that give not only general engineering competencies, but also the specific ones to every engineering domain of activity. On the other hand, the mathematical educational activities must be adapted to the training level for every student who comes to university. Concentrating on the student, as an educational concept, in the educational activity is not valid only for the pre-university level [5], [11]. It must be applied at university level as well. Is it because, at university level, we do not anymore take into account the H. Freudenthal’s mathematical education theory [2], [3] in which “the mathematics for everyone” and “the mathematics as human activity” are concepts that should be as well applied at university level?

Furthermore, if in the past, the engineer had to learn mathematics for the practical goals of his activity (calculus, design etc), nowadays, he is only an user of the computer, which means that he only has to applied some specialised software for resolving objectives of his engineering activities. For example, software like MATHCAD, FLUENT, EUCLID etc. are usually present in the engineering activities. But, the engineer has to learn mathematics as a ‘logical way of thinking’ for his current activities and for the research ones. That is why, it is interesting what is happening with the use of FLUENT software for the aerodynamic optimisation of the automobile body. FLUENT has developed an optimisation section for the shape of the automobile, but it starts with a standard geometrical shape, for which has the algorithm of air movement simulation. That makes the geometrical modifications of the vehicle body to be minor, and so, nowadays, most car building companies are lead to almost the same geometry of the models within the same range.

Unfortunately, the debate about the kind of mathematics needed by future engineers, with a shift towards the use of software packages and data handling “on the job” is completed in terms of engineers yet to be reflected in mathematics courses that remain based only on algebra and calculus.

The logical way of thinking and researching based on mathematical modelling is the best and the most productive, but also very difficult. Clearly, the role of form through engineering education our students must be assumed by all teachers, whatever subject they teach, but in a coherent curriculum, well done, appropriate to the current requirements of knowledge and technologies [9], [13].
Unfortunately, the reality today for mathematics content courses for the faculties of engineering, especially in the "philosophy" Bologna, consists in simplification, in dilution of the scientific content, and therefore the mathematics outcomes are unnecessary for the technical disciplines. Moreover, the same phenomenon is true for contents of the technical disciplines, more regarding theoretical aspect of engineering sciences.

Ensure harmonization, continuity and consonance of technical disciplines with the contents of the disciplines of mathematics is indeed a matter of collaboration, communication and team work of teachers of mathematics and engineering professors. However, collaboration between mathematics teachers and engineers assumed, on the one hand, the ability and competence of the teachers of mathematics in applied mathematics for engineering sciences, and by the other hand, must exist ability and competence of the teachers for the technical disciplines in use of the mathematical models for own engineering fields and these mathematical models must be also presented in the engineering handbooks.

In the literature [3], there are many reports on a range of subject designs and teaching methods that demonstrate adaptations to the needs of 21st Century engineering students, and these include among others the following recommendations: using computer based methods such as web-based delivery, computer algebra systems and interactive software; using flexible delivery, and support through tutoring and drop-in centres that are provided to address the issue of variability in students’ mathematical preparation; taking a multidisciplinary approach in various ways, such as team teaching of subjects designed by mathematicians and engineering academics working together; using problem based learning strategies.

Instead of the conclusions, we can say:

1. We need to recruit and retain students on engineering courses, which means that it is natural for academics to focus on the mathematics problem at the interface between school and university.

2. We must accept that mathematics plays an important role in professional engineering practice by the "computational mathematics", which is perceived as a tremendous opportunity, pushing forward the boundaries of engineering design. Within this, mathematics as explicit work by individual engineers has evolved into mathematics as a distributed activity across design teams and the computers that support them.

3. The apparent contradictions of mathematics as problem or opportunity in engineering education, it is necessary to consider the different uses of mathematics in engineering practice and researches: the direct usefulness of mathematical techniques and ideas to practice and their indirect usefulness - the ways in which mathematics contributes to the development of engineering expertise and judgment.

Mathematics is and will remain a crucial aspect, purpose, goal in engineering education, but we must answer to a set of questions facing mathematics education for the engineers:

What types of mathematical knowledge do engineers need at the each level, i.e. bachelor, master, doctoral?

How can the minimum level of mathematical knowledge that remains essential to engineering practice be characterised? On what does this knowledge rely?

How does computer technology change this situation?

When and how should mathematics be taught for the each level of the studies?

Unfortunately, we have to notice that in our country there are lacks of the research reports on the state of education for engineers, e.g. like the report [1] from a country without the big industrial expectations. Moreover, we have not an institutional national framework for research in science education [9], [11]. By continuity, we must put together all three levels of pre-university education, i.e. primary, secondary, lyceum, with the university education, in general, with the education for engineers, in particular.

4. REFERENCES


ABSTRACT: It is currently important for Russian technical universities to develop internationally recognized educational programmes in the field engineering and technology. But the essential requirement of the national accreditation system in Russian Federation is the strict conformity of higher education educational programmes to the national. Is it possible to design curricula in line with the national standards as well as with international requirements? Practical approach to the development of curricula that meet the requirements of both standards is considered. The EUR-ACE Framework Standards for the Accreditation of Engineering Programmes were taken as a benchmark for comparison of the national standards and international requirements. The aim of this research is, first of all, to compare the requirements of Russian national standard in the field of informatics and computer science and EUR-ACE standards; secondly, to elaborate an approach to the justification of the conformity of national and international requirements in practical cases and, at last, to demonstrate the practical implementation of the proposed methodology of curricula design.

Key words: curriculum design, EUR-ACE standards, educational programme

1. INTRODUCTION

It is currently important for Russian technical universities to develop internationally recognized educational programmes in the field engineering and technology. But the essential requirement of the national accreditation system in Russian Federation is the strict conformity of higher education educational programmes to the national standards – the Federal State Educational Standards of Higher Education (FSES). Do the requirements of the national standards fit the requirements of the international ones? Is it possible to design curricula in line with the national standards as well as with international requirements?

The EUR-ACE Framework Standards for the Accreditation of Engineering Programmes were taken as a benchmark for comparison of the national standards and international requirements. The EUR-ACE Standards are adopted by recognized European organizations and well known in Russia.

Within the TEMPUS project “Engineering Curricula Design aligned with EQF and EUR-ACE Standards” the methodology (proposed by Tomsk Polytechnical University) for creation of programmes meeting both Russian and European standards is developed. Curricula design for the master degree programme “Intelligent Systems and Technologies” based on this methodology is considered as a practical example of the methodology implementation.

The aim of this research is, first of all, to compare the requirements of Russian national standard in the field of informatics and computer science and EUR-ACE standards; secondly, to elaborate some approach to the justification of the conformity of national and international requirements in practical cases and, at last, to demonstrate the practical implementation of the proposed methodology of curricula design.

2. GENERAL REQUIREMENTS COMPARISON

Results of the comparative analysis of the general requirements of Federal State Educational Standards (FSES) and EUR-ACE Framework Standards (EUR-ACE FS) give the grounds for assertion that both documents corresponds each other very well: all EUR-ACE accreditation criteria are included as requirements in the FSES. But they are grouped in another manner, they are distributed in different parts of the document and surely they have other formulations but not the sense.

We found out only 3 more or less essential distinctions between two sets of requirements of the documents: 1) basic terminology; 2) concept of objectives; 3) learning outcomes’ classifications.

Basic terminology. In EUR-ACE FS the term learning outcomes is used and in FSES – the term competencies with the same meaning. Contextual analysis shows that the term competencies in FSES is a full synonym for the term learning outcomes.

Concept of programme’s objectives. This concept is one of keystones in EUR-ACE approach. But it is ignored by FSES: there is no "objectives terminology" in the whole document. Hence, there are no any requirements to define educational objectives and mechanisms of their achievements. This may produce certain difficulties in curricula design if one follows the EUR-ACE approach on the base of FSES requirements. But the absence of the "objectives terminology” doesn’t mean curricula “without objectives”. There are enough milestones and orienting points in the FSES where characteristics of educational and professional activity fields, requirements to learning outcomes and to curricula structure are described. These sections’ materials may be very helpful when design curriculum.

Classification basis for learning outcomes. The crucial point of both Russian national and European approaches to higher
education curricula design is the learning-outcomes-based approach. Both documents establish quite similar systems of learning outcomes which graduates have to demonstrate. But these outcomes are classified by various bases and they have various formulations. As a result there is no simple one-to-one correspondence between them. Hence the problem is what learning outcomes system as starting point for curricula design to choose if anybody wants to apply a programme for national accreditation and for European accreditation as well? This issue is considered in details in the following section.

3. LEARNING OUTCOMES CONFORMITY

Russian universities have two ways to develop programmes, which conform to both systems of requirements. The first way is to base on the national standard but taking into account the EUR-ACE recommendations. The second way is vice versa to base on the EUR-ACE standards. The first way is preferable for Russian universities simply because of strict compulsion of the state accreditation. But in any case it is necessary to have a tool to demonstrate conformity of the programme’s attributes, in particular, learning outcomes set, to both national and European requirements. To reveal conformity of two learning outcomes systems and to find out distinctions we made use of a relations’ matrix, as in the following example.

Table 1. Relations’ matrix
for EUR-ACE and FSES professional learning outcomes

<table>
<thead>
<tr>
<th>EUR-ACE generalized professional learning outcomes</th>
<th>Knowledge</th>
<th>Understanding</th>
<th>Engineering Analysis</th>
<th>Engineering Design</th>
<th>Investigations</th>
<th>Engineering Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSES professional learning outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Research activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) ability to use modern (prospective) research methods and solutions of professional problems on the base of knowledge of world trends of the field of study</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teaching (optional to research) activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) ability to take part in teaching in the field of study on the base of knowledge of teaching methods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Constructional design activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) ability to design and implement plans of information systems building of enterprises and their departments on the base of Web- and CALS-technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) ability to elaborate technical specifications and to take part in design of soft- and hardware</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) ability to choose methods and to develop algorithms for control problems solutions and for design of automation objects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology design activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) ability to use modern technologies of program complexes design with the CASE tools aid, to control a quality of designed software</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Managerial activity:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) ability to manage teams of soft- and hardware designers of information and automation control systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We examined the learning outcomes from the Federal Educational Standard in the field of Informatics and Computer Science. A full list of learning outcomes (competencies) contains 14 statements divided into 2 parts: 7 professional competencies and 7 general competencies (transferable skills). The idea of the comparison technique is illustrated by Table 1 with generalized learning outcomes.

We examined the professional learning outcomes and transferable skills separately. Therefore, we should make an analysis of two relations’ matrices of as minimum 7×16 and 7×6 size. But quite often it is reasonable to use more detailed matrices of bigger sizes.

The main results of this examination are the following:

1) Systems of learning outcomes in Russian national and EUR-ACE standards are comparable, but a tool for revealing the conformity of these systems is necessary;
2) the relations’ matrix may be an efficient tool for comparison, in-depth study, elaboration of learning outcomes for a concrete future programme and demonstrating of learning outcomes conformity to both national and European standards;
3) the relations’ matrix makes easier to find out misalignments and “mistakes” in learning outcomes systems, it allows to find out which learning outcomes to add to conform the EUR-ACE standards or how to reformulate learning outcomes statements from national standard.

4. GENERAL SPECIFICATIONS OF THE PROGRAMME

According to proposed methodology based on the ABET two-loops model of the design and continuous improvement of programmes there are 5 steps in the design process: 1) general concept of programme; 2) programme objectives; 3) learning outcomes; 4) curriculum design; 5) tools for assessment. First two steps are quite unusual for Russian universities practice. There are no requirements to formulate a general concept or to elaborate programme objectives in the National standard. Usually these categories exist implicitly.

It was decided to design according to EUR-ACE Standards the master degree programme “Intelligent Systems and
Technologies” in the field of Information Technology and Computers. The WG, created for this task, discussed the issues of the concept and educational objectives with all interested parties. It was recommended that the programme concept should be formulated in 4 statements: General statement; Basis for professional competence; Special features of the programme; Graduates’ employment. As the result the General Concept of the Programme was formulated as follows.

**General statement.** The “Intelligent System and Technologies” is a master degree programme in the field of Information Technology and Computers. It is developed to provide preparation of masters in engineering and technology area – highly skilled experts in the field of intelligent systems and control technologies.

**Basis for professional competence.** Professional abilities of graduates as the foundation for future professional competence are based on the in-depth theoretical knowledge, knowledge of a state, trends of development and implementation of intelligent systems and technologies, knowledge of application of artificial intelligence for designing of information systems, knowledge of new information technology for solving problems of control on the base of artificial intelligence methods and techniques implementation.

**Special features of the programme.** High adaptation ability of graduates to various conditions of design-constructual and design-technological professional work on design, producing, implementation and operation of intelligent information systems in various applications (the basic spheres of a production cycle, financial and economic information systems) is maintained by advanced skills of research (and additionally of teaching) in professional area.

**Graduates’ employment.** The programme graduates can successfully work at scientific research institutes, at manufacturing enterprises, at management and service organizations, in business, including foreign enterprises, organizations, companies and firms.

Note, that we consider competence as a complex integrative ability to execute a certain productive (creative) professional activity according to established requirements. The competence is grounded on the mastered content of education (knowledge, abilities skills, experience of creative activity, experience of the moral and ethical evaluation and on previous experience of this activity, preliminary professional experience). Competence arises, develops and improves in the course of the related professional activity.

Next step is to elaborate the programme’s objectives. For the starting point the description of the professional field from the FSES was taken. Finally the objectives were formulated as follows.

Programme’s graduates should be competent:

O1) in research activity in the field of new advanced intelligent systems and technologies at domestic and foreign research centres, and in teaching in this professional field;

O2) in design and technological design activity on implementing of modern control systems and technologies at enterprises, including international joint enterprises;

O3) in management of research, design, implementation and commercial operation of modern intelligent systems and technological complexes.

5. **LEARNING OUTCOMES AND MODULES DEVELOPMENT**

The list of learning outcomes (competencies) from the national standard was taken as the basis for the development of programme’s outcomes. The careful analysis of the list, its alignment with EUR-ACE learning outcomes gave the final set of 13 (5 general and 8 professional) outcomes. The programme’s learning outcomes are:

**General outcomes** (transferable skills):

P1/1. Ability to develop individual intellectual skills

P1/2. Ability to autonomous study of modern research methods, to change scientific and industrial character of professional field of activity

P1/3. Ability to use Russian and foreign languages for professional communication

P1/4. Ability to demonstrate activity, including risk situations, to accept responsibility

P1/5. Ability to get autonomically new knowledge, abilities and skills with the aid of IT and use them in practice, including new fields of knowledge, not directly connected with field of activity

**Professional outcomes:**

P2/6. Ability to use modern (prospective) research methods and solutions of professional problems on the base of knowledge of world trends of the field of study

P2/7. Ability to take part in teaching in the field of study on the base of knowledge of teaching methods

P2/8. Ability to design and implement plans of information systems building of enterprises and their departments on the base of Web- and CALS-technologies

P2/9. Ability to elaborate technical specifications and to take part in design of soft- and hardware

P2/10. Ability to choose methods and to develop algorithms for control problems solutions and for design of automation objects

P2/11. Ability to use modern technologies of program complexes design with the CASE tools aid, to control a quality of designed software

P2/12. Ability to manage teams of soft- and hardware designers of information and automation control systems

P2/13. Ability for professional exploitation of modern equipment and devices (according to objectives of master degree programme)

Checking this set against programme objectives showed that the learning outcomes system is full enough (Table 2).
demonstrated also that traditional curriculum design with European recommendations, seems to be successful. But it has Russian university, which meets both national standards and technology is reasonable to add with the design of the learning development of state-of-art master degree programme in engineering education clearly. With expertise, practitioner engineering activity and allows to stress the profile of main idea of allocation is to determine the profile of the programme. It seems Russian standard basis is more convenient for this purpose, because it indicates kinds of engineering activity and allows to stress the profile of engineering education clearly. With an expertise, practitioner led evaluation and previous experience analysis as methods of allocation we obtained roughly 50% for research (with teaching), 20% for constructional and technology design each, and 10% for management.

The same methods—expert assessment and practitioner led assessment, verification against previous experience were used for design of modules structure (courses and their credits). The last step in this design was the courses’ learning outcomes development. The iterative procedure of WG and faculty members’ discussions was implemented as a method of consensus achieving.

6. SUMMARY

Summing up the study of the implementation of the methodology for curricula’s design with conformity to Russian and European standards for engineering education we may make a conclusion that the methodology works.

We may conclude, first of all, that both sets of the requirements—of Russian national and European EUR-ACE standards—match each other very well and there are only few essential distinctions. These are easily removable distinctions, but programmes’ designers should take them into consideration when developing educational programs and curricula.

The development of state-of-art master degree programme in Russian university, which meets both national standards and European recommendations, seems to be successful. But it has demonstrated also that traditional curriculum design technology is reasonable to add with the design of the learning outcomes in order to follow the requirements of the EUR-ACE Standards.

7. ACKNOWLEDGEMENTS

The authors are grateful to TEMPUS Programme for the financial support of this investigation within the TEMPUS project «ECDEAST: Engineering Curricula Design aligned with EQF and EUR-ACE Standards» and thanks Dr. Oleg Boev, Tomsk Polytechnical University, Russia, for his creative ideas concerning the project.

8. REFERENCES

CHALLENGES FOR CURRICULA DEVELOPMENT: A STUDY CASE ON ERASMUS MUNDUS MOBILITY WITH ASIA PROJECT

Ioana A., Mircea M., Marin Daniela, Preda Liliana G., Popescu Călin C., Bucur

1 “Lucian Blaga” University of Sibiu, dana.preda@ulbsibiu.ro

ABSTRACT: Developing the Erasmus Mundus mobility projects, in the academic institutions, is an important factor to expanding opportunities for learning, enhancing partnerships and improving the research and lifelong learning activities. Beyond the visible advantages, projects of this type involve many procedures regarding the documents flow and the new requirements imposed to the professors. This paper presents a case study regarding a Six Sigma Project proposed to improve the management of Erasmus Mundus mobility projects in University Lucian Blaga of Sibiu.

Key words: Project Management, Six Sigma, Erasmus Mundus

1. INTRODUCTION

Erasmus Mundus is a cooperation and mobility programme in the field of higher education that aims to enhance the quality of European higher education and to promote dialogue and understanding between people and cultures through cooperation with Third-Countries.

This programme contributes to the development of human resources and the international cooperation capacity of universities in Third Countries by increasing mobility between the European Union and these countries.[5]

“Lucian Blaga” University of Sibiu (LBUS) developed the Erasmus Mundus mobility projects with Bangladesh, India, Pakistan, Cambodia, Laos, Nepal, Vietnam and Filipines.

As all projects, the international projects involve the production and control of documentation.

There are many types of documents with varying purposes, natures and life cycles.

These kind of international projects involve not only the production and control of documentations, but also the control of the educational process.

Starting to identify and assess existing types of problems in LBUS, there were designed and implemented controls that have ensured corrective actions to improve the educational act for foreign students.

2. METHODOLOGY

The methodology used for this case study is a Six Sigma based methodology. Six Sigma is a flexible and comprehensive methodology (Figure 1) for sustaining, achieving and maximizing the success for any organisation.

Six Sigma is driven in a unique way by a very close understanding of customer needs, meticulous use of facts, data, and statistical analysis, and thorough attention to managing, improving, and reinventing all the processes. [2]

Figure 1. Six Sigma Methodology

Six sigma improvement process includes a series of steps, grouped by type of activity. The main objective of this methodology is to implement a measurement-based strategy that focuses on process improvement and variation reduction. The modality chosen to implement the objectives is through applying the Six Sigma improvement projects methodology.

2.1. Defining the problem

After a comprehensive analyses developed in university concerning Erasmus Mundus mobility projects during the last 3 years, were identified 25 categories of issues. From these 25 identified problems, 7 main problems were selected for evaluation. The selection was made by the International Relations Department consultants and 10 professors from different faculties who are working with foreign students. The problems selected for evaluation are:

- the number of Erasmus Mundus Students to courses are not enough to create a special group;
- Erasmus students don’t speak Romanian or the level of their understanding is very low;
- Content of curricula should be adapted to the international requirements;
- The time of professors are overload;
- Insufficient number of English speakers between professors from different fields of study;
- Lack of support courses in foreign languages;
- Temporary the jobs are stuck.
For the preparing of the evaluation matrix the following criteria were identified:

- Chronicity – the correction of the most frequent problem;
- Importance – the most important problem;
- Duration – the correction of the most frequent problem;
- Impact
- Urgency – a project is urgent if it makes the organization weak in front of competition;
- Risk – which is the main risk;
- Change resistance – if it is possible is recommended to choose the project which will intake the lower resistance;
- Measurable – the project must be launched only when we will have all the necessary information.

In order to evaluate the problems will be given a score from 1 to 8, where: 1 – low importance; 8 – high importance. Selection criteria are weighted according to their importance (Table 1).

Based on the scores from the Table 1, the main problem is “Content of curricula”.

Table 1. The evaluation matrix

<table>
<thead>
<tr>
<th>Problem</th>
<th>Weight</th>
<th>Chronicity</th>
<th>Importance</th>
<th>Duration</th>
<th>Impact</th>
<th>Urgency</th>
<th>Risk</th>
<th>Change resistance</th>
<th>Measurability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of Emman Mulas Students to courses</td>
<td>5</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Emman students don’t speak Romanian</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Content of curricula</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Time teachers work overload</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Insufficient number of English speakers professors</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Lack of support courses in foreign languages</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>Temporary stock jobs</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>30</td>
</tr>
</tbody>
</table>

According to this aspect, the main problem for the improvement project was defined as follows: “Reduction with 80% of delays in refund claims settlement.”

2.2. Measuring and analysing

The process of identifying the causes started from organizing a brainstorm session. The results consist in the creation of a cause-effect diagram (Figure 3). This chart showed the main groups of cases and allowed the team to focus on root cause search. The identification of causes has been done after a brainstorming session, too.

Defining the limits was the phase which indicated where the beginning is and where is the end of the project.
After the identification of causes, the improvement team began the collection of required data to creating the Pareto Chart.

For Pareto analysis it was made a simple questionnaire that will measure the frequency of cases identified.

The questionnaire was based on the causes and sub-causes identified through cause-effect diagram.

Also it is given the importance of a weight causes using a scale 1 - 3 - 9, where 1 - issue less important, 3 - important question, 9 - very important question.

In order to analyze the questionnaire results, a summary table was created.

Table 2. Pareto data table

<table>
<thead>
<tr>
<th>The group of causes</th>
<th>Cause</th>
<th>Frequency</th>
<th>Weight</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>Inadequate</td>
<td>10</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Difficult to access</td>
<td>8</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Lack of equipment</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>“Only exhibit”</td>
<td>7</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Improper kept</td>
<td>6</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Too complex equipment</td>
<td>6</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Improper used</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Outdated</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Insufficient initial endowment</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Improperly conducted procurement</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Materials</td>
<td>Non existent course support in English</td>
<td>60</td>
<td>9</td>
<td>540</td>
</tr>
<tr>
<td></td>
<td>Nonexistent practical guide in English</td>
<td>59</td>
<td>9</td>
<td>531</td>
</tr>
<tr>
<td></td>
<td>Un-updated bibliography</td>
<td>27</td>
<td>3</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Inadequate for the project purpose</td>
<td>12</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Incomplete practical guide</td>
<td>12</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Inadequate practical guide</td>
<td>12</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Difficult to understand</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Insufficient consumables</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Under dimensioning</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Methods</td>
<td>Lack of know-how</td>
<td>16</td>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Inappropriate recruitment criteria</td>
<td>28</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Too bureaucratic</td>
<td>6</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Inadequate</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Organizational</td>
<td>Deficient communication between foreign students and professors</td>
<td>25</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>environment</td>
<td>Deficient communication between foreign and Romanian students</td>
<td>23</td>
<td>3</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Various bureaucratic procedures</td>
<td>18</td>
<td>3</td>
<td>54</td>
</tr>
<tr>
<td>Students</td>
<td>Organisational culture</td>
<td>7</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Spoken language</td>
<td>23</td>
<td>3</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Cultural differences</td>
<td>21</td>
<td>3</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Daily schedule too busy</td>
<td>21</td>
<td>3</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Tendency to compare with their own culture</td>
<td>20</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Cultural shock</td>
<td>19</td>
<td>3</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Inappropriate nonverbal interpretations</td>
<td>17</td>
<td>3</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Stereotypes and preconceived ideas</td>
<td>31</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Anxiety and stress</td>
<td>5</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Teachers</td>
<td>Overloaded schedule</td>
<td>60</td>
<td>9</td>
<td>540</td>
</tr>
<tr>
<td></td>
<td>Non English speaker</td>
<td>57</td>
<td>9</td>
<td>513</td>
</tr>
<tr>
<td></td>
<td>Not fit properly in curriculum</td>
<td>27</td>
<td>3</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Undocumented</td>
<td>11</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Unmotivated</td>
<td>32</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Does not capture the attention of students</td>
<td>7</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Improvise</td>
<td>7</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>

Using this data the team has created the Pareto chart.

With this chart will be established and highlight the main causes.

The Pareto diagram shown in Figure 3 emphasizes the main groups of causes and allows the team to focus to the root cause identification.

![Figure 3. Pareto Chart](image)

### 3. IMPROVEMENT

#### 3.1 Identifying the alternatives

To evaluate the alternatives for improvement related to these criteria, the team used as a tool of quality matrix for selecting the alternatives. The identified improvement alternatives are presented in Table 3.

Table 3. Improvement alternatives

<table>
<thead>
<tr>
<th>Cause</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-existent course support in English</td>
<td>Translation and adaptation of hand outs;</td>
</tr>
<tr>
<td></td>
<td>Acquisition of books from other universities;</td>
</tr>
<tr>
<td>Overloaded schedule</td>
<td>Relieving the complementary tasks of teachers/mentors of foreign students;</td>
</tr>
<tr>
<td></td>
<td>Secondment of teachers from other faculties;</td>
</tr>
<tr>
<td></td>
<td>Employing new teaching staff;</td>
</tr>
<tr>
<td>Non-existent practical guide in English</td>
<td>Translation of practical guide in English;</td>
</tr>
<tr>
<td></td>
<td>Acquisition of practical guides in English;</td>
</tr>
<tr>
<td>Un-updated bibliography</td>
<td>Implementing a system for updating a database for specialized works;</td>
</tr>
<tr>
<td></td>
<td>Access to world literature;</td>
</tr>
<tr>
<td></td>
<td>Developing a system to motivate teachers and students to keep up news in the field;</td>
</tr>
<tr>
<td>Non English speaker</td>
<td>Intensification of Romanian language courses for foreign students;</td>
</tr>
<tr>
<td></td>
<td>Additional testing the understand ability of English;</td>
</tr>
<tr>
<td></td>
<td>Use of other language (French, German, etc.).</td>
</tr>
</tbody>
</table>

#### 3.2 Evaluating the alternatives and design the improvement plan

The evaluation criteria for the alternatives identified in Table 3, were: the total cost, the impact, the cost-benefits relationship, change impact, uncertainty regarding the efficacy. To evaluate the improvement alternatives, we use the selection alternative matrix, where the following weights were used: 3-high favourable impact; 2-favourable impact and 1-low favourable impact.

#### 3.3 Control

In this phase the team designed and implemented controls elements to ensure that corrective actions have been used and maintained. These activities are highlighted in the control chart (Table 4).
4. CONCLUSIONS AND INTENTIONS

A quality management system is the essential component for the general management in any organization and must allow actions and procedures for continuous improvement.

In order to develop and to increase the competitiveness, the university, must improve the performance and to promote the excellence in education. All of these are sustained by the implementation of a management system or by using different tools and techniques from quality management to improve the quality processes, both in the educational process and the administrative sector.

Using the quality management concepts and the specific tools and techniques, represent an intelligent method to lead the business. Starting to identify and assess existing types of problems, there were designed and implemented controls that have ensured corrective actions to improve the educational act related to foreign students.

5. REFERENCES

QUALITY MANAGEMENT IN ENGINEERING AND BUSINESS EDUCATION
ABSTRACT: Quality Assurance (QA) of Higher Education (HE) is a major objective of the “Bologna Process”. However, QA often tends to assess more the “process” than the “contents” of the education: therefore, especially in subjects that lead towards a “profession” (“engineering” first among them), the practice of “accreditation” is also increasing throughout the world. “Accreditation” can follow the “programme” and the “institutional” approach, that are not in contrast, but can usefully complement each other. “Programme accreditation” of an engineering programme can be identified with the process “to ensure the suitability of that programme as the entry route to the engineering profession”, and defined as “pre-professional accreditation”. Recent European initiatives along these lines will be illustrated: (i) the EUR-ACE® system for the “European accreditation of engineering programmes”; (ii) the “European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance” (EASPA); (iii) QUACING, the new Italian Agency for QA and Accreditation of engineering programmes.

Key words: quality assurance, engineering education, accreditation, EUR-ACE

1. BACKGROUND: THE “BOLOGNA PROCESS” AND QUALITY ASSURANCE IN HIGHER EDUCATION

The “Bologna Process” started with a “Joint Declaration of the European Ministers of Education”, signed by the Ministers of 29 European countries convened in Bologna (Italy) on 19th June 1999. The process has then proceeded through a series of biennial Conferences (the latest one held in Bucharest on 26-27 April 2012) that at present involve the European Commission and 47 countries (from Portugal to Kazakhstan), forming the “European Higher Education Area” (EHEA). The objectives of the Bologna Process have been clarified and expanded by the “communiqués” of the successive Conferences, but the main objectives stated in the 1999 Declaration are still valid, and extracts from that Declaration can summarize them well:

- Adoption of a system of easily readable and comparable degrees ... in order to promote European citizens’ employability and the international competitiveness of the European higher education system.
- Adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market at an appropriate level of qualification. [The communiqué of the 2007 London Conference referred for the first time to “an EHEA based on a three-cycle degree system”, adding the third cycle, the Doctorate.]
- Establishment of the system of credits ..... 
- Promotion of mobility by overcoming obstacles to the effective exercise of free movement ... for students, ... for teachers, researches and administrative staff ... 
- Promotion of European co-operation in quality assurance with a view to develop comparable criteria and methodologies
- Promotion of the necessary European dimensions in higher education, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programmes of study, training and research.

Quality assurance (QA) of higher education (HE), already mentioned in the 1999 Bologna Declaration, has gradually become a major concern of the “Bologna Process”. The turning point was the 2005 Ministers’ Conference in Bergen, that adopted the “European Standards and Guidelines for Quality Assurance in the European Higher Education Area” (better known with the acronym “ESG”)[1]. At present, QA Agencies (or analogous bodies) exist in practically every country of the European Union (and in most EHEA countries) and are listed in an ad-hoc official “European Quality Assurance Register of Higher Education” (EQAR). Indeed, this is great progress since a couple of decades ago, because QA greatly contributes to the improvement of HE. The ESG distinguish between “Internal Quality Assurance”, practiced within each Higher Education Institute (HEI), and “External Quality Assurance” by a third-party independent body. However, if not properly intended and applied, these procedures may have great limitations, and even become a hindrance. For instance: within ESG Part 1 on “Internal Quality Assurance”, Section 1.3 “Assessment of students” specifies that “Students should be assessed using published criteria, regulations and procedures which are applied consistently” and that “Student assessment procedures are expected to:

- be designed to measure the achievement of the intended learning outcomes and other programme objectives; ...”

but the ESG nowhere define the “intended learning outcomes”. Only in later ENQA documents (such as [2]), one can read that:
“Learning outcomes (LOs) are statements of what a student should know, understand and/or be able to demonstrate after completion of a process of learning.” Assessment of students is not mentioned at all in Part 2 of the ESG, that deals with External Quality Assurance”: essentially QA of the HE Institutions, of which I do not deny the importance; however, I do believe that too often it tends to assess more the “process” than the “contents” of the education. To avoid this, I maintain that it is necessary to formulate explicit learning outcomes, specific for each discipline (and sometimes for sub-disciplines or “branches”). [A distinction should also be made between “intended LOs” (sometimes called “programme outcomes”) and “achieved LOs”. How to assess the latter is one of the biggest open problems of QA, still far from a satisfactory solution, that I believe will engage experts and organizations for years to come. But I do not want to deal with this question, that is currently tackled by the very ambitious “AHELO” (Assessment of Higher Education Learning Outcomes) project supported by the OECD Directorate for Education.]

2. “FIELD-SPECIFIC” VS. “GENERAL” QA; “INSTITUTIONAL” VS. “PROGRAMME” EVALUATION; ACCREDITATION

Here there comes the distinction between “field-specific” and “general” QA approaches, that in turn lead naturally to “institutional” and “programme” evaluation and accreditation. Institutional and programme approaches share most of their “technical” instruments and procedures: self evaluation reports, peer reviews, benchmarks vs. reference points, etc.; but, as an ENQA Report of a few years ago recognised, while the institutional approach assesses the internal monitoring and QA arrangements, allows for more flexibility in terms of structure, content and implementation of study programmes, and emphasises the autonomy and the primary responsibility of the Institutions for their quality, the contents of programmes are not thoroughly examined. The latter is a great liability, especially in fields like engineering. In the closing Conference of the EUR-ACE SPREAD project (25 October 2010) the invited speaker from the European University Association (EUA) recognized that in QA procedures there is “no discontinuity between institutional and programmes levels, where both are consistent with ESG”, and that programme approaches are “particularly relevant for disciplines relevant to public health and safety”, like engineering, and which - I add - in several countries require a “licence” to be practiced. Therefore, I strongly maintain that the two approaches are not in contrast, but can complement each other: the choice should never be “either - or”, but how best to combine the two approaches in order to optimize the results while limiting the burden placed on the HE Institutions and their members.

In short, I would say that “institutional accreditation” is essential to guarantee the “quality” of the educational process, since only well-structured HE Institutions can provide reliable education; while “programme accreditation”, on the basis of accepted learning outcomes, is essential to assure “relevance for the job” besides “academic quality” of educational programmes.

Indeed, field-specific QA approaches accentuate the need for aligning the goals of educational programmes with the expectations of the stakeholders, and underline that Higher Education Institutions, while in principle autonomous, are nevertheless accountable to their constituents, which includes an obligation to demonstrate the “relevance” of their output. Thus, as underlined in several papers, e.g.[3], field-specific QA systems give credibility and concreteness to the whole “Bologna”/EHEA system. For the EU countries, the link to the relevant social and economical issue of employability is further stressed and strengthened by the “Directive for Recognition of Professional Qualifications” [4], at present (2012) under review.

However, in higher education several definitions of the word “accreditation” are possible, that may involve its significance and relevance: indeed, “accreditation” means different things for different users. It is therefore appropriate to state that by this term we refer to the definition given in the EUR-ACE Framework Standards [5] (of which I will speak later), that in turn derives from definitions included in several recent national Engineering Standards:

“Accreditation of an engineering educational programme is the primary result of a process used to ensure the suitability of that programme as the entry route to the engineering profession”, by means of

- Periodic assessment against accepted standards
- Peer review of written and oral information by trained and independent panels including academics and professionals by verifying the achievement of agreed outcomes

In this definition, written for engineering but extendable to other professions by replacing the word “engineering”, “accreditation” is strictly related to a field-specific QA approach, in which the aims and contents of the educational programmes are specified, and combines together - as already hinted - assurance of “academic quality” and of “professional relevance”. Therefore, it can neither be simply qualified as “academic accreditation” nor, on the other hand, as “professional accreditation”, because “academic education” may be not sufficient to be “licensed” for a profession (e.g., in several countries to be qualified as “engineer” a graduate of an accredited programme must fulfil further, more or less formalized “professional training” requirements, fixed by professional, not academic, organizations). In order to avoid confusions, “accreditation”, defined in this way, can be referred to as “pre-professional accreditation”.

It can be maintained that, although the word was not used, the practice of “accrediting” HEI programmes as the standard entry route for a profession was started in the 1800s by the Professional “Chartered” Institutions in the UK, while in France a law of 1934 introduced the “habilitation” (now translated “accreditation”) for engineering schools and degrees, awarded by the “Commission des Titres d’Ingénieur” (CTI) and a prerequisite for the use of the title “Dipl. Ingénieur”.

Hence, “pre-professional accreditation” is particularly relevant in engineering. However, my feeling is that of its relationship (and strict interdependence) with the QA of engineering education have not been yet studied in detail by QA “specialists”, and that not all consequent problems have been solved.

In any case, the situation today is much better than few years ago, when engineering programmes of British Universities had to undergo two separate processes (largely duplicating each other) for quality assessment by the National QA Agency and “pre-professional accreditation” by the relevant Professional Institutions. However, very recently in France the CTI had again some difficulties to re-affirm the peculiarity of engineering education and its traditional “habilitation” versus the French newly established QA Agency AÉRES, before CTI and AÉRES reached a substantial agreement.
3. THE EUR-ACE® SYSTEM

A recent achievement along the line of “pre-professional accreditation” is the EUR-ACE® system for the “European accreditation of engineering programmes” at the Bachelor and Master levels, envisaged by the EU-supported “EUR-ACE” project (2004-2006) and run by the “European Network for the Accreditation of Engineering Education” (ENAEE). “EUR-ACE” is a decentralized Europe-based accreditation system of educational programmes as entry route to the engineering profession (“pre-professional accreditation”): a common quality label (EUR-ACE® label) is awarded to programmes that satisfy a common basic set of standards (“EUR-ACE Framework Standards for the Accreditation of Engineering Programmes”) [5] and are accredited by an Agency fulfilling appropriate Quality Assurance prescriptions, in particular the already quoted “European Standards and Guidelines for Quality Assurance in Higher Education” (ESG). ENAEE, the “European Network for Accreditation of Engineering Education”, founded in 2006 at the successful conclusion of the “EUR-ACE” project, has registered the EUR-ACE® trademark and authorizes qualified Agencies to award the EUR-ACE® label.

The EUR-ACE system obviously follows the “programme approach” to QA and the ENAEE “General Policy” [6] clearly states:

“ENAEE strongly supports a field-specific approach and programme accreditation, considering it essential to fulfil the need of aligning the goals of educational programmes with the expectations of the relevant stakeholders and ensuring their relevance for the labour market.”

and also that:

“Programme accreditation does not exclude institutional accreditation: on the contrary, it may become easier if an overall system of QA authorizes only quality HE Institutions to deliver academic degrees.”

The EUR-ACE Framework Standards identify 21 “programme outcomes” (or “learning outcomes”) for First Cycle degrees and 23 for Second Cycle degrees, and provide a common reference framework serving as the basis for the award of the common European EUR-ACE® quality label: a framework flexible enough to accommodate national differences and even different “profiles”.

(Do not equivocate: the term “Standards” refers to the set of outcomes to be satisfied, and does not imply any “standardization” of the national educational systems, that in the “Bologna” spirit must be “harmonized” and made “transparent”, not “uniform”. Indeed, Europe is a continent of many cultures, whose diversity is valued as a great asset.)

Thus, the EUR-ACE accreditation system is essentially a bottom-up system aiming at a “European Recognition of National Accreditations”: national (or possibly regional) agencies accredit the educational programmes, and ENAEE authorizes (“meta-accredits”) them to add the EUR-ACE® label to their accreditation, after checking that their procedures and requirements satisfy the EUR-ACE Framework Standards (hence the ESG). Thus, the authority for accrediting remains with national bodies, but by agreeing a pan-European meta-framework there is the opportunity to build up cross-border recognition. The ultimate objective of the EUR-ACE system should be a multi-lateral mutual recognition agreement of engineering degrees, but a number of operative and legal obstacles must still be overcome before this objective can be reached.

Note that, in accord with the EUR-ACE Framework Standards and the European Qualification Framework [7], the EUR-ACE® label distinguishes between First-Cycle (FC) and Second-Cycle (SC) degrees (sometimes referred to as “Bachelor” and “Master” degrees in engineering). The SC label is awarded also to degrees obtained via “Integrated Programmes” (i.e. “long-cycle” programmes leading directly to a Second-Cycle degree). Consequently, the EUR-ACE-authorization (“meta-accreditation”) specifies if the Agency is authorized to deliver FC and/or SC labels. Each EUR-ACE label is awarded to a specific programme by means of a certificate signed by the ENAEE President and by an official of the Accrediting Agency. The graduates of an EUR-ACE-accredited programme can define themselves as either “EUR-ACE® Bachelor” or “EUR-ACE® Master”, respectively if they have obtained a First-Cycle or Second-Cycle degree.

As of October 2012, nine Agencies based in nine countries throughout the European Higher Education Area are authorized to deliver EUR-ACE® labels. They are:

- CTI (Commission des Titres d’Ingénieur), France;
- ASIN (Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics), Germany;
- Engineers Ireland;
- Ordem dos Engenheiros, Portugal;
- AEER (Association for Engineering Education in Russia);
- Engineering Council, United Kingdom;
- MÜDEK (Association for Evaluation and Accreditation of Engineering Programs), Turkey;
- ARACIS (Agency for Quality Assurance in Higher Education), Romania
- QUACING (Agency for Quality Certification and EUR-ACE accreditation of Engineering Programmes), Italy.

(ARACIS and QUACING have been authorized on 13 September 2012).

The award of EUR-ACE® labels started in 2007: at present, approximately 1000 labels have been awarded: they are listed on the ENAEE web site (www.enaee.eu or www.eur-ace.eu). And since some of the eight authorized Agencies can accredit outside their home country, a few EUR-ACE® labels have already been awarded also outside the nine countries (e.g. in Belgium and Switzerland).

Note that, at least for the time being, the EUR-ACE® labels are limited to First-Cycle and Second-Cycle engineering degrees, but ENAEE is monitoring the possibility and opportunity of accrediting other engineering programmes, including Third-Cycle (Doctoral) and Continuing Education programmes.

Up to now, ENAEE has received applications to be authorized to award EUR-ACE® labels by several more bodies, including:

- SKVC, Centre for Quality Assessment in Higher Education, Lithuania;
- OAQ, QA Agency, Switzerland;
- KAUT, Accreditation Committee for Technical HE Institutions, Poland;
- NVAO (Accreditation Organisation of Netherlands and Flanders);

These applications are now undergoing the process of evaluation by ENAEE, that involves consideration of submitted
documentation and site visits to verify compliance and actual application of the Standards: it is hoped that within a few months most of, if not all, these Agencies will be able to join the EUR-ACE system.

Moreover:

- CTI has signed an agreement with AEQES (the evaluation agency for the HEIs of the French Community of Belgium) that will allow CTI to accredit and award EUR-ACE® labels to French-language Belgian HEIs (as already done for programmes of the bi-lingual Belgian Military Academy, Brussels).
- FINHEEC, the “Finnish Higher Education Evaluation Council”, is studying, with the collaboration of “mentors” nominated by ENAEE, an internal structure aimed at the EUR-ACE accreditation of engineering programmes.

EUR-ACE is arising great interest in other countries too (e.g. Austria, Spain, Denmark, Hungary, ...): thus, the perspectives to make it a truly pan-European system look good.

4. “EUROPEAN QUALITY LABELS” AND OTHER INITIATIVES IN “FIELD-SPECIFIC” APPROACHES; EASPA

EUR-ACE has been quoted by the European Commission as an example of good practice in its 2009 “Report on progress in quality assurance in higher education” [8] and in the publication “The EU contribution to the European Higher Education Area” [9], issued in the occasion of the 2010 “Bologna Anniversary Conference”.

Besides EUR-ACE, other “European Quality labels” (also denoted as “quality seals”) have been recognized by the European Commission. Five were presented at the ENQA Seminar “European Quality labels and Quality Assurance” held in Brussels on 2/12/2011 [10]:

- ECTN Eurobachelor (Chemistry)
- EUROinf (Informatics)
- Polifonia (Conservatoires; Music)
- EFG, euro-ages (Geology)
- EUR-ACE (Engineering)

The interest of the European Commission towards the “quality labels” appear to be highly variable. Also some influential members of ENQA are strongly in support of unspecified QA against “sectoral” approaches.

However, several initiatives testify the growing interest of HE circles and stakeholders towards “field-specific” approaches to QA and accreditation. To quote just a few:

- “TechnoTN”, the “Archipelago of Thematic Networks in the fields of Sciences and Technology”, is an example of positive collaborations and exchanges of experience within and between subject- and branch-specific networks and associations. Between 2004 and 2007, four “TechnoTN Fora” had been organized; the fifth Forum has taken place in Antwerp in May 2012.

- A “Joint Statement of the European Networks for the Accreditation of Chemistry-, Engineering-, Informatics- and Medical Study Programmes” was submitted to the 2007 HE Ministers’ Conference, held in London.

- A Conference “Defining Quality - The Relevance of Field-specific Approaches to Quality Assurance in Higher Education” was held in November 2009 in Bonn, organized by ASIN and sponsored by ENAEE and a number of other networks.

- The “International Network of Quality Assurance Agencies in Higher Education” (INQAAHE) has promoted a series of meetings of leaders of European disciplinary networks and of professional and specialized accreditors.

The INQAAHE-promoted meetings have lead to the foundation in November 2011 of the “European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance” (EASPA), the European analogous of the older American “Association of Specialized and Professional Accreditors” (ASPA).

The EASPA founding document (“Düsseldorf declaration”) [11] reads: “The European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance constitutes a pan-European platform of quality assurance in Higher Education that comprises the European Association for Public Administration Accreditation, the European Association of Conservatoires, the European Chemistry Thematic Network Association, the European Countries Biology Association, the European Federation of Geologists, the European Network for Accreditation of Engineering Education, the European Physical Society, the European Quality Assurance Network for Informatics Education as well as the International Food Association”; underlines the EASPA’s members “common goal to maintain and develop European-wide disciplinary learning outcomes, competence profiles and qualification frameworks as well as corresponding quality assurance tools thereby making an important contribution towards the development and implementation of academic and professional mobility within the European Higher Education Area”; state that they “have undertaken the development of subject-specific criteria and procedural guidelines, European learning outcomes as well as competence profiles and qualifications based on which academic and professional mobility in the respective discipline may be facilitated”, resulting in quality criteria “complementary to the outcomes defined in the Framework for Qualifications in the EHEA, adopted in Bergen 2005, and the European Qualifications Framework for Lifelong Learning, adopted by European Parliament and Council in 2008. In line with the approach established by the EU-funded Tuning project for the design, implementation, and evaluation of degree programmes, they reflect the state of the art in their respective disciplines and the competences graduates must have acquired in order to be able to take up their chosen profession. The development and improvement of these quality criteria involves intensive consultation with experts from academia, scientific societies industry as well as other relevant stakeholders. Thus it is assured that these criteria do not only reflect the state of the art from an expert’s point of view but also meet with the widest possible acceptance without compromising the quality requirements.” Consequently, EASPA members’ “work not only provides criteria for the accreditation or quality evaluation of transnational programmes and highly international disciplines for which appropriate criteria did previously not exist, but contributes to the harmonisation of the European Higher Education Area by providing a sound basis for the mutual recognition of qualifications awarded by institutions of higher education throughout the EHEA.”

The “Düsseldorf declaration” has been presented to the Bucharest HE Ministers’ Conference (26-27 April 2012).
5. A PECULIAR BUT EXEMPLARY SITUATION: ITALY

In Italy, a QA system for Higher Education is not yet in force, notwithstanding that Italy participates since the very beginning to the Bologna Process and has signed all Ministers’ Communiqués. A Law of 2006 defined A.N.V.U.R. (National Agency for the Evaluation of Universities and Research Institutes) but change of political background in 2008 delayed its implementation, and the Board of A.N.V.U.R. took formally office only on 2 May 2011.

ANVUR started to organize the evaluation of research with the programme denoted “VQR 2004-2010”, but did not take any action for evaluation of Higher Education, waiting for the definition of its tasks and competencies in relation to evaluation and accreditation of Universities and study programmes. The relevant “Decreto Legislativo” has been published on 8 March 2012 [11], but the connected rules and procedures are not yet clear.

The main points of this decree can be summarized as follows:

Art.2: ...this decree regulates:

a) the introduction of a system for initial and periodic accreditation of the institutions and of the study programmes;
b) the introduction of a system of evaluation and of assurance of the quality, efficiency and efficacy of didactics and research;
c) the strengthening of the system of self-evaluation of the quality and the efficacy of the teaching and research activities of the Universities. ....

Art.4: The national system ... articulates into:

a) a system of internal evaluation in each University,
b) a system of external evaluation of the Universities,
c) a system of accreditation of the institutions and of the study programmes.

Art.5: 1. The system for initial and periodic accreditation quoted in Art.2 has for object:

a) the institutions;
b) the University study programmes.

2. “Initial accreditation” is defined as the authorization to the University by the Ministry to activate institutions and study programmes... It implies verification of the “ex ante” indicators defined by ANVUR ...

3. “Periodic accreditation” is defined as the verification of the requirements of quality, efficiency and effectiveness of the developed activities. ... it is carried out at least every five years for the institutions and every three years for the study programmes ... and is based on the verification of the requirements of item 2 above, on further “ex ante” indicators defined by ANVUR and on the results of the evaluation in Art. 9 and 10.

Art.9: Monitoring of indicators and periodic accreditation: 1. The activity for monitoring the application of the indicators mentioned in Art.5 ... , aimed at verifying the continuing respect of the indicators ... is developed by ANVUR according to criteria to be determined ....

Art.10: Definition of criteria and indicators: 1. ANVUR, within 120 days ... defines criteria and indicators for the periodic evaluation of the efficiency, of the economic-financial sustainability of the activities and of the results attained by each University in didactic and research, and for quality assurance ...

2. Criteria and indicators, elaborated in coherence with the standards and the guidelines defined by ENQA (Standards and Guidelines for Quality Assurance in the European Association for Quality Assurance in Higher Education)[sic], take into account the qualitative objectives defined by the Presidential Decree 1/2/2010, n. 76 and the general guidelines for the triennial planning of universities.....

Note the difference between the above definitions of “accreditation” and the definition adopted by ENAEE/EUR-ACE: in particular, “initial accreditation” is just the authorization, given by the Ministry following a report by ANVUR, to start or continue a HEI or a study programme, while it is not yet clear what “periodic accreditation” will be. Moreover, nowhere in the Decree there is a mention of the “content” nor of learning objectives of the programmes.

Quite different was (and is) the idea of “accreditation” within Italian Academic circles.....

The “Conference of (Italian) Engineering Deans” (CoPI) has been for many years very active and proactive towards “accreditation”:

• Already in 1999 CoPI presented In a public Conference a proposed “National System for Accreditation of Engineering Education” (SINAI).

• In the following year CoPI conducted a pilot project on accreditation of “Diplomi Universitari” in Engineering (the 3-year programmes that for a few years run in parallel with the traditional 5-year “Laurea”).

• In 2003, the CoPI proposal was elaborated into the document “Progetto per la definizione e la sperimentazione dei criteri e delle modalità di accreditamento dei Corsi di Studio in Ingegneria” that contained the following definition of the Standards for accreditation: “the Standards, besides fulfilling Ministerial prescriptions, must be able to make valid and credible the learning outcomes of the study programmes and guarantee an appropriate level of competences of the graduates.”

Unfortunately, the 2003 project had no concrete development, but CoPI has been active (and supported these ideas) throughout the EUR-ACE exercise since its very beginning in 2004.

In the meantime, with the active collaboration of CoPI, the Italian “Conference of University Rectors” (CRUI) developed its “Modello CRUI per l’Assicurazione e la Valutazione della Qualità dei Corsi di Studio” that, after having been tested between 1998 and 2003 in the pilots projects “Campus” and “CampusOne”, is currently used in a continuous activity of “certificazione della qualità” of Italian HE programmes.

Also the Italian Industrialists’ Association CONFINDUSTRIA prompted for the establishment of a QA/accreditation system aimed at guaranteeing the quality and competences of Italian graduates, in particular in the technical fields.

Thus, CoPI decided to go forward, together with the interested parties, towards an Agency for the “EUR-ACE Accreditation” of Engineering Education, leaving the “legal” aspects and the relations with ANVUR and Ministry to later steps: this action led on 13 December 2010 to the foundation of the “Agenzia per la certificazione della qualità e l’accreditamento EUR-ACE dei corsi di studio in ingegneria - Agenzia QUACING”. Founding members of QUACING were CoPI, Fondazione CRUI (the Rectors’ Conference Foundation), CNI (National Engineers’ Council: the official Engineers’ representative body) and, as
industrial representatives suggested by CONFINDESTRIA, Finmeccanica (a major national holding), C.R.F. (the FIAT Research Center) and ANCE (National Association of Building Enterprises). A 10-member Board and a Steering Committee, fully responsible for technical matters, including accreditations, have been nominated.

An “Appendix” to the “Regolamento” (By-Laws) of QUACING contains the Learning Outcomes that must be satisfied by accredited programmes: they are the translation, with minor variations, of the “EUR-ACE Framework Standards”.

QUACING has run its first evaluations of 15 programmes (7 “Laurea”, i.e. FCD; 8 “Lauree Magistrali”, i.e. SCF) of Milan & Turin Technical Universities (“Politecnicì”), that have been completed in June 2012. All 15 programmes were awarded the “quality certification”: 14 programmes have also been awarded the FC or SC EUR-ACE® label, while one FC programme has not been awarded the label, because its curriculum was not designed as an “entry route to the engineering profession” but only as a pivot point in the academic career towards a higher degree.

In fact, in the meantime QUACING had applied to be authorized to award the EUR-ACE FC and SC labels. The EUR-ACE Label Committee - in accord with ENAEE rules - nominated a Review Team of three experts, who monitored the 15 evaluations to verify whether QUACING structure, rules and procedures met all requirements: they were deemed satisfactory, and on 13 September 2012 the ENAEE Administrative Council authorized QUACING to deliver FC and AC EUR-ACE® labels.

6. CONCLUDING REMARKS
Since the 2005 Ministers’ Conference in Bergen, that adopted the “European Standards and Guidelines for Quality Assurance in the European Higher Education Area”, Quality Assurance (QA) of Higher Education (HE) has become a very major objective of the “Bologna Process”, the process that aims at harmonizing HE throughout Europe. At present, QA Agencies (or analogous bodies) exist in practically every country of the European Union (and in most of the 47 countries of the European HE Area - EHEA), and the “European Quality Assurance Register of Higher Education” (EQAR) has been established. This is indeed a great positive progress, because of the contribution that QA can give to the general improvement of Higher Education.

However, traditional, undifferentiated QA tends to assess more the “process” than the “contents” of the education: therefore, especially in subjects that lead towards a “profession” (“engineering” first among them), the practice of “accreditation” is also increasing throughout the world. Accreditation approaches can be distinguished into “programme” and the “institutional” approaches can be followed, that however are not in contrast, but on the contrary can usefully complement each other. More specifically, “programme accreditation” of an engineering programme can be identified with the “primary result of a process used to ensure the suitability of that programme as the entry route to the engineering profession”, and defined as “pre-professional accreditation”: this approach is aimed at evaluating at the same time “academic quality” and “relevance for the job market” of educational programmes.

Recent European initiatives along these lines have been illustrated in this lecture: (i) the EUR-ACE® system for the “European accreditation of engineering programmes” at the Bachelor and Master levels, run by the “European Network for the Accreditation of Engineering Education” (ENAEE) since 2006; (ii) the “European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance” (EASPA), the European analogous of the older American “Association of Specialized and Professional Accreditors” (ASPA), founded in 2011; (iii) the specific Italian Agency for “Quality Certification” and Accreditation of engineering programmes QUACING, established in 2010. It is thus evident that “programme accreditation” is gaining an increasingly major role for Higher Education besides the more traditional procedures of Quality Assurance.

7. ACKNOWLEDGEMENT
This is a revised and expanded version of a lecture presented at the International Symposium “Innovation and Quality in Engineering Education”, Valladolid, Spain, April 2012.

8. REFERENCES
5. EUR-ACE® Framework Standards; European Network for Accreditation of Engineering Education (ENAEE), 2009; www.enae.eu
10. ENQA Seminar, Brussels 02/12/2011 www.inqaahe.org/internationalisation-and-qa/presentations
11. EASPA - The European Alliance for Subject-specific and professional Accreditation and Quality Assurance: “Düsseldorf declaration”; www.easpa.org
THE IMPACT OF CARBON FOOTPRINTING IN ROMANIA

Lucian-Ionel, Cioca¹ and Maria-Viorela, Codoi¹
¹ “Lucian Blaga” University of Sibiu, lucian.cioca@ulbsibiu.ro

ABSTRACT: Carbon footprinting became an important term for surprisingly many people in the last years. It is very important that people learn what effects may have carbon footprinting on their lifes and how it’s produced. The term “carbon foot printing” is just a name which is the result of global warming potential. Carbon footprinting is considered a very popular buzzword in Romania in the last year. The carbon footprint measures total greenhouse gas emissions caused directly and indirectly, by a person, organization, event or product. In Romania the carbon emissions are the consequences of burning of fossil fuels and manufacturing of cement, and the value of CO2 emissions in 2008 was 94,660(kt). People can do training or courses to learn more about the meaning of carbon footprints, their impact on the environment and calculation of the carbon footprint by measuring the CO2 equivalent emissions.

Key words: carbon footprints, CO2 emissions, Romania, impact, equivalent.

1. INTRODUCTION

"The carbon footprint is a measure of the total emissions alone of carbon dioxide, which is directly and indirectly, caused by an activity or is accumulated over the life stages of a product." (Keuning, 1994).

The term "carbon footprint" was introduced in 1992 by William Rees, and refers to the total greenhouse gases, measured in tons of CO2, produced directly or indirectly as a result of carrying out human actions. CO2 is a greenhouse gas responsible for global warming.[1]

Carbon footprint is equivalent to the amount of greenhouse gas it produces in the form of carbon dioxide. The amount of carbon dioxide generated is usually expressed in metric tons (tCO2). Most carbon dioxide emissions generated by individuals are generated by transport and heating (and cooling) of housing. Specifically, burning gas, oil or other fossil fuels causes the release of carbon dioxide.[2]

Carbon footprint is a way to measure the impact that our activities have on the environment and in particular on climate change. It is basically the amount of greenhouse gases that we produce in our daily life by burning fossil fuels for electricity, heating, transport and others. [5]

For cars or airplanes, this occurs directly into the combustion chamber and engine emissions are known as direct emissions because they are the point of consumption. When we use electricity, emissions are indirect because they place the power plant, not in the point of consumption. The other products are responsible for production of carbon dioxide. This includes of course foods that produce directly or indirectly CO2 (transportation), clothing or footwear, electronics and appliances.(Figure 1)[3,4]

![Figure 1. How carbon emissions is produced](image1)

Carbon dioxide is the most significant greenhouse gas created by man. Besides this, there is other important greenhouse gas. Methane (CH4) for example, which is emitted mainly in agricultural activities and landfills, is 25 times stronger than CO2 per kg. Even stronger, but is issued in smaller amounts of nitrogen oxide (N2O) which is about 300 times more potent than CO2 and is released mainly by industrial and agricultural processes.[6,8]

Because some activity or process can generate several types of greenhouse gases, each in different amounts, calculation of carbon footprints could become too complex and confusing. To avoid this, was agreed that for calculation of carbon footprints, all the gas were expressed in their equivalent in CO2.[7]

When you go by car, the engine generates CO2 depending on the fuel used, driving style, car type and distance; when you warm your house with gas, electricity or coal, also generate CO2; when you use electricity, when you’re cooking, it also creates a certain amount of CO2. Even when we use electricity for heating, are chances to produce CO2. Also, when buying food or material goods we need to know that their production emitted carbon dioxide.[7,9]

Our footprint is the amount of CO2 emissions caused by our actions, in a given period of time. Usually, the individual footprints are calculated for one year. Sometimes carbon footprint is expressed in carbon instead of carbon dioxide, by applying a factor of 0.27 (1.000kg CO2 equivalent to 270 kg emissions). Individual carbon footprint is a very powerful tool for understanding the impact of each individual behavior on global warming. Many people are shocked when learns about the amount of CO2 generated by their activities.(Figure 2.)[6-8]

![Figure 2. All elements making up the carbon footprint](image2)
2. TYPES OF FOOTPRINT

Carbon footprint consists in the sum of two parts: primary footprint and secondary footprint.

Primary footprint: all direct emissions of CO2 from burning fossil fuels, which include domestic and transport energy consumption (car, plane). We have direct control over them! So, if we cut our carbon footprint, must act directly on primary footprint.[16,18]

Secondary footprint: a measure of indirect CO2 emissions from the entire lifecycle of products we use - their production and distribution. Simply put, then buy more products, and produce even more greenhouse gases.[16,18]

3. THE IMPACT OF CARBON FOOTPRINTING

Carbon footprint is calculated for each, individual, usually for one year and depends by several factors: transportation, plane flights, lifestyle and food consumption in the household.[11]

European Union plans to ban cars polluting with fuel in european cities until year 2050. Cars will be banned in major cities in Europe, according to a draconian European Union plan to reduce CO2 emissions by 60% over the next 40 years. The European Commission presented the possibility of imposing a "single European transport area", meant to produce "a profound change in models of passenger transport" by 2050. About 66% of european drivers would accept restrictions on their lives for organic whore.(Figure 3.) [12]

![Figure 3. Absolute reduction (green bar) and the percentage variation (blue spot) by Member State between 2009 and 2010.][12]

Romania is the second smallest among and the most polluting countries in the world, according to a new study, aimed at carbon dioxide emissions into the atmosphere, in the period 1990-2009.[12,13]

Our country released into the air 78.5 million tons of CO2, placing thus ranked 19th in the top 20 most polluting nations in the world, according to The Economist.[10]

Whole industrial sector, except the energy sector, with the constructions sector produce only 18% of CO2 emissions in the EU, while residential emissions amounts to 11%, according to Eurostat.(Figure 4.) [12,14]

![Figure 4. Changes occurring in % of carbon emissions between 1990-2009 in Romania][12]

The energy strategy of EU states provides that by 2020, to reduce CO2 emissions by 20% from the level recorded in 1990. Some states, such as Romania, have already reached this target, mainly due to large energy consumption closing the communist period and the significant reduction of construction.[12,15]

Romania is within the EU targets in this regard since 1991, when CO2 emissions amounted to 132-133 million tonnes, 23% below 1990 levels. [10]

In 2007, Romania had CO2 emissions less than 110 million tons, with 35.3% under 1990 levels. In 1990, the amount of CO2 emitted into the atmosphere of Romania represented 3.93% of total emissions of the 27 countries that today are part of the European Union. Today, Romania is responsible for only 2.65% of carbon dioxide pollution in the EU.[12, 16]

In 2009, Romania came from releasing into the atmosphere only 78.4 million tonnes of CO2, less than half from year 1990.

Amounts similar to those issued by Romania in 1990, were produced by the Czech Republic (about 165 million tons), Netherlands (160 million tons) and Turkey (140 miliaone tons).[18]

State least polluted is Austria, followed by Romania and Greece. At the opposite pole lies China with over 6 billion tons of CO2 into the atmosphere, the United States, with 5 billion tons, and Russia, with 1.5 billion tons. The two countries at the top of this list are responsible for 41% of CO2 emissions during 1990-2009. [12,17]

Long-term strategies, provide to reduce CO2 emissions at least 80% by 2050.
By 2050, the amount of CO2 emitted by the energy sector must be reduced to 93-99% compared to 1990, and the industry generated up to 87% (Figure 5.) [19]

The amount of CO2 related to housing should reduce it by to 91%, and issued by the transport sector to 67%. (Figure 6.)

The average carbon dioxide emissions increased by Mini with 0.14% to the level of 128.21 g / km and average Chevrolet reported an advance of 0.41% to level 148.77 g / km. All this are presented in Graphic 1.[19,20]

5. REFERENCES

16. URBAN TIMES Online Magazine, Carbon footprint breakdown, data accesării 27-04-2012,

4. TOP MARKS OF CARS USED IN ROMANIA WITH THE LOWEST CO2 EMISSIONS

Fiat, Citroen and Toyota automakers are most friendly to the environment, their production models is with an average of carbon dioxide emissions less than 125 g / km. Average CO2 emissions for all Fiat models is only 116.31 g / km, while the average for all Toyota models is 124.42 g / km, well above that recorded by Citroen, which ranks second in the top an average of 121.48 g / km [10, 19].

Compared with 2010, Fiat and Citroen have managed to reduce average emissions for all models sold, more than five percentage points, while average CO2 emissions for Toyota cars has improved by only 0.46%, according to a British clean green cars. The most significant adjustments to the average emissions of carbon dioxide was recorded by Lexus (24.23%), Chrysler (20.47%) and Jeep (17.58%).[19,20]

Quantitative of CO2 emissions

There were two exceptions: Mini and Chevrolet, whose average CO2 has not improved in 2011 compared to the previous year, on the contrary. Thus, the average carbon dioxide emissions increased by Mini with 0.14% to the level of 128.21 g / km and average Chevrolet reported an advance of 0.41% to level 148.77 g / km. All this are presented in Graphic 1.[19,20]


INTERNATIONAL RECOGNITION OF ENGINEERING EDUCATION – BEST PRACTICE

Grünwald, Norbert¹ and Krause, Regina²
1 Wismar University, Philipp-Müller-Str., Germany, norbert.gruenwald@hs-wismar.de
2 Wismar University, Philipp-Müller-Str., Germany, regina.krause@hs-wismar.de

ABSTRACT: The paper presents a case study of the implementation of the European Framework Standards for the Accreditation of Engineering Programmes in Russia. After describing the importance of the international recognition of engineering programmes a short presentation of the EUR-ACE system follows as well as the measures undertaken by the project consortium to adapt the quality standards of Russia to the European Higher Education Area (EHEA). The opportunities and benefits for engineering education in Russia are presented at the end of the paper.

Key words: engineering education, EUR-ACE, EHEA

1. BACKGROUND

Engineering is a broad church that is concerned with the art and practice of changing the world we live in. Driven by the needs of business and society, engineers strive to find solutions to complex challenges. Whilst the objective of engineering professionalism is the public good, students choose engineering for a variety of reasons and a range of motivations. Whatever these might be, all students deserve an engineering education that is world-class and that teaches them industry-relevant skills. Accreditation helps to ensure that engineering education meets these needs as well as drawing students towards a career in the engineering profession. ENAEE (European Network for Engineering Accreditation) was founded on 8 February 2006, at the end of the first EUR-ACE® project, by 14 European Associations concerned with engineering education. The implementation of the EUR-ACE® system started in 2007 with the award of the first EUR-ACE® labels. ENAEE is the European body responsible for awarding authorisation to accreditation agencies to award the EUR-ACE® label at first and second cycle to engineering programmes which they have accredited.

It demonstrates both nationally and internationally the high standard of engineering education and provides a basis for educational establishments to review their programmes and to develop excellence in delivery and content. Programmes that carry the EUR-ACE label are recognised as being of international standing and aligning with European qualifications frameworks; perhaps most importantly they are recognised as first or second cycle degrees consistent with the Bologna process. In an increasingly global market for engineering education, the opportunity of having a EUR-ACE label brings huge potential benefits for UK providers of accredited programmes. The accreditation process gives educational institutions a structured mechanism to assess, evaluate, and improve the quality of their programmes. Accreditation is a developmental process. It offers the opportunity for more of a continuing dialogue between Licensed Members and educational institutions, rather than placing all the emphasis on the periodic accreditation exercise.

In this time of globalisation a transparent and adaptable framework for accreditation is needed in order to give every country the chance to join this international network.

Adoption of the framework for the new Federal Educational Standards in February, 2007 has substantially changed the situation in Russian higher education. The principal difference of the third generation of the educational standards is the outcomes-based approach. The FES defines the framework for learning outcomes, both professional and personal, that students should demonstrate upon graduation. The new approach assumes an active involvement of the programme constituencies including employers and professional community in formulation of programme specific learning outcomes.

The amendments to the Federal Law on Education and the Law on Higher Professional Education fixed the two-tier degree system of higher education, with 4-year BS and successive 2-year MS programmes. The main changes can be summarized as follows:

- Master programmes have been separated from the Bachelor ones (Master studies were considered to last 6 years including 4 years of Bachelor studies according to previous legislation);
- Studies differentiate between research- and practical-oriented profiles and are to prepare graduates for different types of innovative activity, especially in engineering;
- HEIs are given more academic freedom in curriculum design (up to 70% of MS programme content could be designed by HEI).

Integration of the Russian Federation into the EHEA and adoption of the third generation of the educational standards stipulates that Russian universities are to design the new programmes. For this reason an existing network of European and Russian universities decided to apply for a pilot project that elaborates three subject related master programmes in engineering disciplines. The aim being to introduce them in the three most important technical universities in Russia, namely Tomsk Polytechnic University (TPU), St. Petersburg Technical University (SPbSPU) and Bauman Technical University of Moscow (BMSTU). The essential input to this initiative is...
elaboration of Guidelines for Russian HEIs on an engineering programme design aligned with EQF and EUR-ACE Standards. This is to be prepared based on the ECDEA EAST partners experience and results of implementation at TPU, BMSTU, SPbSPU. The three year project has been running since October 2010. At the end of the project these universities are expected to apply for the EUR-ACE label after implementation of new programmes.

2. THE CONSORTIUM

The consortium is always one of the most important aspects of creating a joint project. The stronger each partner is, the stronger the network is and the more likely it is to be successful. That’s why hard work has to be done in advance of the project, namely in putting together the consortium. In the case of this project we recruited the three strongest technical universities in Russia together with three European universities which are very experienced in accreditation of engineering programmes. Of these two universities are new members of EUR-ACE and one university that is a founder member:

- **TPU** – Tomsk Polytechnic University (Russia)
- **BMSTU** – Bauman Moscow State Technical University (Russia)
- **SPbSPU** – Saint-Petersburg State Polytechnical University (Russia)
- **HSW** – Hochschule Wismar (Germany)
- **KTU** – Kaunas University of Technology (Lithuania)
- **LBUS** – Lucian Blaga University of Sibiu (Romania)
- **SEFI** – Société Européenne pour la Formation d'Ingénieurs
- **ENAEE** – European Network for Accreditation of Engineering Education.

TPU, as a leading higher institution of engineering in the country and with long-standing traditions in engineering education is actively involved in cooperation with international organisations, funds and programmes. It has experience in international accreditation: several engineering programmes of TPU were accredited against EUR-ACE Standards. Last year TPU (and BMSTU) was awarded with the status of National Accreditation of Technical Universities (among 12 others) and granted the right to develop its own educational standards and programmes. Together with other Russian universities TPU will develop and implement master programmes in engineering which have to meet the requirements of new national educational standards and requirements of European quality system for engineering education (EUR-ACE Standards). TPU will share its experience in accreditation against the EUR-ACE standards with other Russian partners in the development of methodology for engineering curriculum design.

BMSTU is one of the highest ranked engineering universities in Russia. Faculty skills and experience in developing two-cycle module-based study programmes, participation in EMECW project with its attributes such as international recognition and ECTS are a strong basis to be a valid partner. An Educational and Methodological Association of Engineering Institutions of Russia as an entity of BMSTU is responsible for development of framework of engineering study programmes and disseminates its developments among technical universities of Russia. BMSTU participation in the project is of great importance for linkage with national governmental bodies and for the dissemination of project outcomes throughout Russia.

SPbSPU is one of the largest and oldest technical universities in Russia. In recent years the University has participated in more than 50 international projects. The university will contribute significantly to the elaboration of the curriculum design methodology through its highly-qualified faculty in almost all engineering disciplines.

SEFI is a network of 380 institutions of higher engineering education, educators, engineers, companies and international associations. SEFI either developed or was a partner in European projects and maintains official relations with the EU, UNESCO and the Council of Europe. Today SEFI Network is present in 42 countries. Through its involvement in ENAEE (of which SEFI is the funding organisation) and in the EUR-ACE projects, SEFI can bring useful expertise to the project. SEFI acts as a consultant for the coordinating team and serves as a relay as far as dissemination of the project work and outcomes are concerned.

ENAEE consists of 17 associations engaged in engineering education. ENAEE is running the EUR-ACE European accreditation system of engineering programmes. In this system national agencies accredit study programmes and the EUR-ACE label is added to the accreditation, provided the agency and the programme satisfy the EUR-ACE Framework Standards. The label distinguishes between BS/MS programmes in accordance with the European Qualification Framework (EQF). At present, the EUR-ACE system is being implemented by seven agencies in seven countries within the EHEA (UK, Ireland, France, Germany, Portugal, Turkey and Russia). ENAEE provides the project with its experts in evaluation of the quality of engineering programmes and is responsible for the organisation of evaluation programmes developed against the EUR-ACE Standards.

KTU’s development strategy is the internationalisation of academic life through the facilitation and enlargement of cooperation with both national and international academic, scientific, and economic structures. KTU's mission statement is to achieve and to maintain status as an integral part of the global community of universities and one of the most important research centres in Lithuania, to promote the development and to serve the needs of an information and knowledge society as well as to endeavor academic excellence. KTU provides the project with its experts in specific discipline area and in evaluation of quality of engineering programmes.

LBUS maintains its presence in the mainstream of academic events by promoting international cooperation. Consequently, LBUS has established academic links and partnership agreements with 85 universities in 35 countries including Russia, which have materialised in student exchange programmes. Together with other EU universities LBUS provides Russian partners with its expertise in specific discipline areas and in the implementation of ECTS and Bologna principles.

This network has already been at work in other projects, has conducted international conferences in engineering education and facilitated the mobility of students and teachers among the partners through exchange programmes.

3. PROJECT OBJECTIVES

In order to meet the challenges of the current globalization process in engineering education, the project’s main aims are:
• to develop a methodology for engineering curriculum design based on the alignment of EQF&EUR-ACE Standards with federal educational standards
• to train the Russian universities’ faculty to design engineering curricula according to EUR-ACE requirements with the use of ECTS;
• to develop/update and implement 3 master engineering programmes and course modules materials at TPU, BMSTU and SPbSPU according to EUR-ACE requirements with the use of ECTS and Dublin Descriptors;
• to prepare the developed programmes for accreditation with awarding of the EUR-ACE label.

4. PROJECT DESCRIPTION

At the Kick-Off meeting the Project Board (PB) was formed and the responsibilities of partners were fixed. The next meeting “Workshop on European and National Standards Alignment” was devoted to the discussion and alignment of the quality requirements of European and Russian national standards. The European partners shared their experiences and best practices in engineering education within the Bologna environment. Attention was paid to the quality standards, EQF and EUR-ACE requirements to engineering graduates’ competencies and methods to be used for their achievements. On the second day of the workshop the project consortium formed three working groups (WG) to discuss several subsequent steps for the project implementation. WG 1 discussed the approach for European and Russian Federal Educational Standards alignment. WG 2 discussed a methodology for engineering curriculum design and structure of the Guidelines. WG 3 agreed on the dates and programme of the training workshops for the faculty of the Russian HEIs. As a result of these discussions the PB approved the editorial board to edit the first draft of the Guidelines. As a very important instrument of distribution for the first project results the project web-site was launched early on in the project. Staff mobility is one of the core elements of the project that gives opportunities for personal growth, development of international cooperation between individuals and institutions, enhancement of the quality of higher education and research, and gives substance to the European dimension. At the end of the first year the Faculty training workshops for delivering the methodology on Engineering Curriculum Design were organised at each of the Russian partner universities. The workshops focused on European framework conditions for the development of master programmes (QF-EHEA, EQF, ESG, EUR-ACE, TUNING), approaches to curriculum development based on learning outcomes, modularization and credit allocation and to active methods of student-oriented learning (team work, problem-based learning). Professors and members of methodological units attended the workshops. The workshops’ attendees in general accepted the concept and methodology of curriculum design presented. The participants were quite active and interested in workshops’ topic. The workshops included lectures, discussions, case studies, and practical exercises on curricula design. Representatives from SEFI and ENAEE took part in the workshops in order to deliver firsthand information and experiences. The weak language ability of the Russian participants was a barrier in this part of the project. Another important instrument for adapting quality standards was the faculty exchange. It was intended to share experience of the European partners in areas of programme specialisation. Delegations from TPU, SPbSPU and BMSTU visited their peers at the European university for one week and got a broad overview of German, Lithuanian and Romanian quality standards in the respective areas of electrical engineering, computer engineering and mechanical engineering.

Similarly the European partners visited their peers in the Russian universities some weeks later. So everybody knew about the learning conditions and circumstances at the respective universities. Equally important was meeting colleagues who would run the new master programmes under the new conditions.

At the beginning of the second year a Workshop on Curriculum Design was held at the LBUS. The main topics for discussion were: multilevel engineering programmes, quality assurance in engineering education, assessment of programme and student learning outcomes and methodology of engineering curricula design being developed and applied within the project.

The Russian partner universities (TPU, BMSTU and SPbSPU) presented drafts of master programmes designed within the ECDEAST project. Three working groups were formed, one for each Russian university, in order to evaluate the progress of the updated curriculum and to identify barriers and hints. The working groups were led by the three representatives of ENAEE and SEFI. One outcome delivered was an oral and a detailed written report for each master programme where some recommendations on programme improvement were made. A working group was formed to prepare the midterm conference in St. Petersburg. It is always useful and not as cost intensive to combine such a project related conference with another one. The audience is much broader and the first project result can be distributed much more easily.

The project is still running. The three master programmes will be introduced in September 2012 and will meet the requirements of 3rd generation national standards and EUR-ACE Standards for engineering programmes. The development and implementation of master programmes in engineering by leading Russian engineering schools will be an important step for the Bologna process in Russia. The experience gained in the project by the faculty of Russian universities is distributed within the universities and is discussed with faculties of other technical universities within conferences and workshops on engineering education topics.

The Guidelines on engineering curriculum design based on alignment of Russian and European requirements to engineering graduates’ competences was developed, published and is available on the web-site in Russian and in English. After the programmes implementation participating Russian universities will go through peer evaluation against EUR-ACE Standards. The results will be used for the programmes improvement and allow the programmes to go through professional accreditation in the future.

To finalise the project the consortium will organise the conference in Moscow with broad participation of the Russian academic and professional community. The representatives of the Russian governmental structures (from the Ministry of Education and Science, the State Duma Committee on Education, the Federal Service for Supervision and Licensing in Higher Education) will be invited to attend. Besides presenting the project outcomes, the programme seminar will cover the issues of the Bologna process development and implementation of the EQF in the EHEA countries.
5. BENEFIT FOR ENGINEERING EDUCATION IN RUSSIA

The accreditation is intended to be widely applicable and inclusive, in order to reflect the diversity of engineering degree programmes that provide the education necessary for entry to the engineering profession. The EUR-ACE Framework affords a means for comparing educational qualifications in the EHEA, and thereby promoting the mobility of engineering graduates. Accreditation involves a periodic assessment of a programme of engineering education against accepted standards. To meet the standards of this framework means to be competitive within the international engineering education area. Russia has also faced this challenge and is going to develop its engineering master programmes to international recognized programmes that allow students to combine their knowledge with other European universities through student exchange.

6. REFERENCES

REGULAR STUDENT FEEDBACK CONCERNING EDUCATION QUALITY - GOOD PRACTICE TO FOLLOW

Valentina, Haralanova¹ and Samir, Khoshaba²
1 University of Ruse, Faculty of Transport, Department of Machine Science, Machine Elements and Engineering graphics, Ruse, Bulgaria, viharalanova@uni-ruse.bg
2 Linnaeus University, School of Engineering, Dep. of Mechanical Engineering, Växjö, Sweden, samir.khoshaba@lnu.se

ABSTRACT: This paper presents some of the experience of two European Universities concerning regular student feedback in the area of higher education quality, which is implemented at the end of every course of a particular subject. It also presents a comparison between survey questionnaires at Linnaeus University, Sweden in Machine Design courses, at the Mechanical Engineering Department, where such feedback has been applied during the last fifteen years, and the existing experience in the same field at the Department of Machine Sciences, Machine Elements, and Engineering Graphics at the University of Ruse, Bulgaria. Conclusions are made on the necessity of providing students with regular opportunity to take part in quality management in higher education.

Key words: student feedback, education quality, higher education, quality management

1. INTRODUCTION

Formal student feedback is about different strategies and methods to, systematically, invite the students to give their opinions about the teaching they are participating in. The intention is to promote a dialogue between lecturers, the institute, and students about the learning and teaching in aims to insure the quality of teaching, learning and learning environment [2].

The student feedback makes the lecturer reflect on his/her own teaching and the students to reflect on their study efforts.

The result of the formal student feedback, i.e. the result of the written course evaluation forms depends on the type of question in the questionnaire forms. Such questionnaires must cover all the aspects in education and should not only focus on one area. In some cultures, for example the cultures which promote the teacher for their teaching ability, for example to nominate the teacher of the year, the questions are focused mostly on the teachers’ skills in the teaching area as well as his/her pedagogical skills. But the education quality does not depend only on the teachers’ skills. For example, clear information in the beginning of the course regarding the course aims and goals, course schedule, types of examination, information about requirements to pass the course, ways of communication etc. are as important as the teaching itself. Teaching environment, knowledge from previous courses, studying motivation also have a huge impact on learning and, undoubtedly, on the course evaluation result.

A course evaluation is a paper or electronic questionnaire, which requires a written or selected response answer to a series of questions in order to evaluate the instruction of a given course. The term may also refer to the completed survey form or a summary of responses to questionnaires. They are means to produce useful feedback which the teacher and school can use to improve their quality of instruction. The process of (a) gathering information about the impact of learning and of teaching practice on student learning, (b) analysing and interpreting this information, and (c) responding to and acting on the results, is valuable for several reasons.

2. MACHINE DESIGN COURSE EVALUATIONS AT LINNAEUS UNIVERSITY, SWEDEN

The idea of evaluations in education reached Sweden in the early 1960s, and it became very important within the pedagogy and sciences areas very soon [4]. That means the student feedback as a form of course and program evaluation has been applied in higher education in Sweden for at least five decades. The methods and process of education evaluation has been improved during this period. Nowadays there are many different types of questionnaires for different purposes. The process and the way of evaluating applications are as important as the evaluation form itself.

There are some different course evaluation forms/questionnaires at Linnaeus University (LNU) where every instructor (teacher) is free to select the form which is most
convenient for his/her course. The instructors are also free to add, omit, or change elements in the questionnaire. There are also possibilities to accomplish the evaluation electronically or on paper. Only the paper form has been used in evaluation of the Machine Design courses since the engineering education started at LNU. This form is divided into two parts, in the first part the student will give marks (from 1 to 5) for different statements, where (1) means bad or low and (5) means excellent or high. The second part contains a number of questions which can be answered by written text. Table 1 shows some of the questions from the first part of the form. The first question “In your opinion, was the course held according to the course syllabus” is added to the form by the course examiner (who is one of the authors of this article). The reason for adding this question is to find out if the students feel that the course has followed the content of the course syllabus. The course syllabuses are legal documents, approved by the school board, regulating the course contents. The entire course syllabuses at Linnaeus University are available on the university website both in Swedish and English. It is also important to know students’ opinion regarding the course literature, the work load, and the degree of course difficulty. Another important thing is to know if the instructor has managed to stimulate the students to become interested in the subject.

Table 1. Some of the questions in the first part of the evaluation form.

<table>
<thead>
<tr>
<th>General viewpoints</th>
<th>Bad</th>
<th>Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Excellent</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>On your opinion, was the course according to the course syllabus?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total workload</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of difficulty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stimulation for the subject</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other comments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The second part of the form does contain questions like, What are the most positive things about the course?, What can be done better? Explain., How many hours per week (including scheduled time) did you use in this course, appreciate a mean value? Do you think that your previous knowledge was enough? If not – what would you need to profit from the course? Which part of the course is most/less interesting? Give your personal viewpoints about the lecturers you had on the course. (Pedagogical knowledge, Subject knowledge and supervision), Other viewpoints?

As mentioned above, the process of the course evaluation is also of big importance. The evaluations are accomplished at the end of each course but before the exams. The School of Engineering at LNU uses the quarter system for their education. That means the academic year is divided into four quarters. Two parallel courses are taught during each quarter.
with an examination week in the end. Since the students start new courses directly after the examination week, the written course evaluation is done at the end of the course, usually during the last meeting, but before the exams. This result on students’ opinion regarding the examinations is not included in their answers.

When the written evaluation is accomplished and collected, it is put together by a third party, usually a student from another class. It is very important that the third part is neither a course student nor a course teacher. When the evaluation result has been put together, it will be sent to the course examiner. The course examiner has to go through the result to analyse it and to write his/her comment. If there are more teachers involved in the course, then all the teachers have to look through and analyse the result together and to make own comments.

Figure 2. Example of the answers of question 3 “How many hours per week (including scheduled time) did you use in this course, appreciate a mean value?”

Usually if the result is good, no action have to be taken, but if there any parts of the course or the teaching which students are not satisfied with, then the examiner (together with the involved teachers) has/have to write an action plan and present it to the head of department. The first part of the evaluation form, where the mean mark of each post is calculated, is giving an indication of if the students are in general satisfied, less satisfied or not satisfied with the different statements. The second part is giving more accurate answers where the eventually negative things in a course are highlighted. Usually a mean grade of 3 or higher is acceptable for each post. Negative comments done by few students are usually discussed and the class to find out if there are any misunderstanding and or to see if more students will agree with that. But low grades and/or negative answers and comments will lead to changes in the course and/or in teaching methods after discussions with the involved class and the head of the department (or the person who is responsible for the education quality in the department or school). The students’ adviser will always be involved in such discussion when the course evaluation result is bad and actions have to be taken.

In all the situations, the course examiner has to go through the evaluation result with the actual class and discuss all the negative and positive parts of the result. There must also be an action plan for the next time the course will be given in case there are massive of negative critic. That plan must also be presented for the new students in the beginning of the course.

It is compulsory to accomplish evaluations in all of the courses and programs at Linnaeus University. The evaluation results are public documents and must be available to read for everyone. A copy of the result must be sent to the school secretary for archive and a copy to the student union as well as to the program director.

Table 3. Example on the result of the first part of the evaluation

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature</td>
<td>0%</td>
<td>23%</td>
<td>27%</td>
<td>31%</td>
<td>19%</td>
<td>3.5</td>
</tr>
<tr>
<td>Total workload</td>
<td>0%</td>
<td>4%</td>
<td>38%</td>
<td>50%</td>
<td>8%</td>
<td>3.6</td>
</tr>
<tr>
<td>Degree of difficulty</td>
<td>0%</td>
<td>4%</td>
<td>31%</td>
<td>62%</td>
<td>4%</td>
<td>3.7</td>
</tr>
<tr>
<td>Stimulation for the subject</td>
<td>0%</td>
<td>0%</td>
<td>38%</td>
<td>54%</td>
<td>8%</td>
<td>3.7</td>
</tr>
</tbody>
</table>

3. COURSE EVALUATIONS AT UNIVERSITY OF ROUSSE, BULGARIA

Until 1990 in Bulgaria there used to be a state strategy, policy and priorities in the field of secondary and higher education, creating a sense of their proper level, but the paradigm of criteria for evaluating education quality was very different compared to other countries in Europe.

Today, following the guidelines of the Bologna Declaration from 1999, that quality in European higher education area is at the core of European cooperation and Bulgarian higher education is developing under new conditions.

In 2005, in Bergen, the Bologna process was enriched with the understanding of European standards development for internal institutional quality assurance.

In the spirit of modern times, a system of quality assessment was built in Bulgarian universities. At the University of Ruse "Angel Kanchev" (RU) standards and guidelines have been adopted for quality assurance in European higher education.

Figure 3. View of Ruse University, Bulgaria
The system of quality management is open to students as they are the main users of the services offered by the university. Quality is a complex concept and in its broad sense it is an integral feature of the overall student life. The main part of the quality management system in Ruse University is to seek feedback from students through examining their views on the quality of teaching and administrative services. There has been a practice of conducting surveys at the university level, but very rarely surveys have been applied at the department and subject level. Studying and exchanging experience with leading European universities, where regular feedback from students at the end of each course has become routine, a survey is carried out with students in courses taught at the Department of Machine Science, Machine Elements and Engineering graphics. Creating the survey was considerably assisted by a colleague from Linnaeus University, Sweden - Samir Koshaba who provided us with surveys, developed by himself and also shared his experience in implementing these surveys at Linnaeus University. Based on the research experience of our colleagues Erwin Smet and Emiel Billiet from KdG University, Antwerp, Belgium, some of the questions were formulated.

In 2009 prof. Dobreva formulated a questionnaire with a brief outline in order to obtain feedback from the students at Mechanical and Manufacturing Engineering Faculty about the quality of the following subjects, which prof. Dobreva leads:
- Machine Elements – part 1
- Machine Elements – part 2
- Project in Machine Elements

This survey and its results are described and analyzed in [4].

The Department of Machine Science, Machine Elements and Engineering graphics is responsible for leading these courses:
- Projection geometry and engineering graphics, parts 1 and 2;
- Engineering Graphics, parts 1 and 2;
- Technical Documentation;
- Fundamentals of Design;
- Machine elements - part 1

They are held to students in the first, second and third year studying the field of "Mechanical Engineering". The number of students taught is as follows: 167 – year one, 170 – year two and about 150 – year three.

The objective of a compound questionnaire is to obtain current information about students’ perspective on the quality of lectures given at the department, concerning both - the content and the quality of presenting the teaching material. The survey consists of:

1. Introductory-constructive section;
2. Questionnaire.

The introductory-constructive section, contains notes when and where the survey was conducted, the teacher and the course about which students give their opinion. This section explains who and why conducts the survey and gives the necessary instructions and comments on the respondent’s work. The questionnaire consists of 10 statements (Q1-Q10). This is the main part of the survey. The authors of the survey have sought to construct unambiguous, unbiased and productive content. The statements are indirect; they give the respondent an opportunity to express varying degrees of agreement or disagreement with the position. 5 degrees of accepting the expressed statement are available (Table 4.).

Table 4. Scale of statement acceptance

| Please tick (O, V, or X) in the box that corresponds to your opinion on each statement. |
|---------------------------------|---------------------------------|
| 3. No opinion.                 | 4. Disagree.                    |
| 5. Strongly disagree.           |                                |

Questions concern the content of the presented teaching material, whether it is structured clearly and in a logical sequence, whether there are clear links from theory to practice, whether time scheduled for the lecture is used rationally. The statements are as follows:

Table 5. Questionnaire.

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1.</td>
<td>The lecture content is structured in a clear and logical manner.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2.</td>
<td>Educational content in the lectures is up-to-date.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3.</td>
<td>Relevant case studies illustrate theory in lectures.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4.</td>
<td>Time during lectures is used rationally.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q5.</td>
<td>More teaching hours to digest and absorb the material of this course are needed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q6.</td>
<td>The lecture is presented using contemporary aids (graphics, figures, tables).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q7.</td>
<td>Teacher uses clear, comprehensive academic language.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8.</td>
<td>Lecture content and its presentation are motivating and create interest in the subject.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q9.</td>
<td>Lectures are necessary and sufficient basis for the practical / laboratory exercises in this course.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q10.</td>
<td>Lectures are essential for good performance at the exam.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What is of particular interest for the proper preparation of curricula is the sufficient number of lectures provided and whether they include information, necessary for successful implementation of practical and laboratory work in a relevant discipline. Students are given the opportunity to express their opinion about the teacher, about how he/she has prepared the presentation and visualization, and his/her personal performance. The survey was conducted in a written form, but may be held in electronic form as well. Due to the large number of students the survey was conducted partly (established in the stochastic-representative way), by selecting groups of different courses and subjects, listening to lecture courses lead by the Department of Machine Science, Machine Elements and Engineering graphics. Part of the survey was conducted anonymously, while the rest of the students were given the opportunity to participate openly. After processing the survey’s results, it was clear that the openness of the inquiry does not affect the ratio of responses. The survey was conducted during the second semester. Part of the students gave a review of a lecture course, already completed during the first semester, while others assessed the new lectures, being given at the moment. As a first conclusion resulting from the questionnaire, we could point out that the majority of students understand the lectures; they claim that lectures are held in a comprehensive language and in a logical sequence with material studied previously and they see their practical value. The greatest dispersion of responses is obtained in question 5. Apparently it is difficult for students to judge the sufficiency of the hours provided for lectures, nearly 50% of the surveyed students would like an increase in the number of lecture hours and for 14% it is difficult to assess whether to support the allegation or rather vice versa.

**Figure 4.** Survey results concerning lectures, held during the spring term

(Q1- Q10 is a list of statements and 1-5 is the scale of statement acceptance)

Especially satisfying is the percentage of students - 82 %, who see the direct connection between attending lectures and their achievement in a relevant discipline. Students participating in the survey show willingness and desire and realize they can contribute to improving the learning process.

**4. CONCLUSION**

The written course evaluations are not the only way of students’ feedback in the education system at LNU. There are always questions during the courses if the students do understand the subject, if the teaching speed is alright, if there are any questions, etc. The students also do give feedback without been asked, usually they complain when things are not in a good way. In many cases there are also midcourse evaluations. This evaluation is accomplished orally through selecting two students as responsible for the accomplishment. The instructor leaves the students in the classroom alone for half an hour to discuss and give their opinion about the teaching and other aspects relating to the courses. The responsible students write down everything and give it to the instructor. The instructor in his/her turn has to give feedback to
the students and explain how to act to improve the learning quality. The results of the survey conducted at the Department of Machine Science, Machine Elements and Engineering graphics at the University of Ruse are analyzed, the benefits and the consequent need for such inquiries are evaluated. Future surveys are planned to affect not only lectures given at the department, but also practical and laboratory courses and individual forms of training - projects and coursework. We plan to include students’ opinion on being provided with literature and on the quality of administrative services in the department. We appreciate that it is good practice to conduct such inquiries as an integral part of course completion. It is particularly useful for us as a department to benefit from the extensive research experience of universities who have done this for more than five decades.

5. REFERENCES
2. Lars Holmstrand, Om utvärdering – några kritiska synpunkter. Högskole pedagogik – att vara professionell som lärare I högskolan (2009), Liber AB, Stockholm
RESEARCH EVALUATION IN ENGINEERING SCHOOLS

Claudiu Vasile, Kifor¹ Magdalena, Crângașu² Alina, Lungu³ and Baral, Lal Mohan⁴
1 Lucian Blaga University of Sibiu, claudiu.kifor@ulbsibiu.ro
2 Executive Agency for Higher Education Research Development Innovation Funding, Romania magda.crangeasu@uefiscdi.ro
3 Lucian Blaga University of Sibiu, alina.lungu@ulbsibiu.ro
4 Ahsanullah University of Science and Technology, Bangladesh and Lucian Blaga University of Sibiu, Romania, baraltex@aust.edu

ABSTRACT: The term “research evaluation” defines the endeavours of quantitative and/or qualitative analysis of the research results, performed by a research unit (e.g.: department, centre, research school). Among the decisions based on the evaluation’s results, the most important are formulation of strategies and funding. The decision-factors in higher education require a broad range of information to help build policies, to allow strategies development. This information is used for marketing purposes: helps at recruiting students and researchers, at establishing research partnerships and supports philanthropic liaisons. The research presented in the paper addressed for the first time the researcher view in the research evaluation process and can be used by policies makers if combined with stakeholders’ view (funding agencies, industry etc.) in order to have a realistic view on priorities in this field at national level.

Key words: research evaluation, engineering schools

1. INTRODUCTION

The term “research evaluation” defines the endeavours of quantitative and/or qualitative analysis of the research results, performed by a research unit (e.g.: department, centre, research school), considering the available resources of that unit. The evaluation can have two forms: ex-ante and ex-post and has a summative or formative function. The ex-ante evaluation is the evaluation done before performing the research activity and analyses the potential and the probable results. The ex-post evaluation is done after finalising the research activity and analyses the results obtained and the impact. The summative evaluation implies the analysis of the performance of a research unit compared to other similar units (assessment). The formative evaluation has the purpose of supporting the research unit to reach its own objectives. Mainly, the evaluation’s results can be used as entry data by the decision factors from the research management, the decisions being made both at project/program level, at organisation level, as well as at national system level. Among the decisions based on the evaluation’s results, the most important are formulation of strategies and funding. The formulation of strategies is often realised at institutional level, since the research organisations necessitate evaluating the strengths and the weaknesses, as well as the research environment, in order to prioritize the research domains. Also, the evaluation for formulation of strategies can be made at institutional level in order to improve the research system. The research evaluation is the main instrument for funding and for assessing the institutional or individual performances. Before initiating and developing an evaluation process it is essential to establish the purpose and the users of the results. In other words, why the evaluation is done and for whom? The purpose of the evaluation may be both to responsibly allocate the public funds, to formulate medium or long term strategies, as well as to examine the current state (including comparison with the international standards and practices). The results of the evaluation processes may allow pragmatic formulation of policies, correlating the research value with the allocated funds and with the strategies of sustained development. E.g.: “The principal goal is to survey the quality and relevance of Finnish mechanical engineering research by comparing it to international standards and practices” – Mechanical engineering research in Finland 2000-2007; “The evaluation form the basis for the future strategy of the Research Council” – Evaluation of research in engineering science in Norway; “Identifying the domains where a certain university is competitive at international level and realising a classification of universities according to specialty domains. The analysis of the performance in each domain leads to a nuanced representation of the research from a certain university, allowing the identification of peaks of excellence” – The National Exercise of Research Evaluation in Romania (RAE), 2011; “The primary purpose of the RAE 2008 was to produce quality profiles for each submission of research activity made by institutions. The four higher education funding bodies intend to use the quality profiles to determine their grant for research to the institutions which they fund with effect from 2009-2010” – Research Assessment Exercise, Great Britain. All the processes of evaluation, no matter the purpose, need to be based on scientific quality and the productivity of the research activity, on the relevance and impact, on the research environment and collaborations. Can be used methods as: peer-review (evaluation between colleagues), scientometric or mixed (peer-review evaluation combined with scientometric aspects). Different mechanisms of evaluation imply different criteria and methodologies, depending on what aspects of the scientific performance are intended to be measured. By consequence, the evaluations tend to concentrate on four main aspects: the volume of the research’ results (output), quality, impact on knowledge or on other researchers and the utility of the research, expressed by socio-economic benefits. In terms of methods used, the literature shows that the scientometric analysis and the peer-review evaluation are the most commonly approaches used for assessing the quality and the impact of research. However, these approaches need to be combined, since using only one of them presents quite a few weaknesses. For example, the scientometric analysis is not very
practical for evaluation at national level (e.g.: it is pretty difficult to achieve a unification of the institutions names in publications and so, the result may be wrong). The evaluation of the scientific research performance is becoming increasingly important, especially for the allocation of public funds for research. The political and society’s support for scientific research can be maintained through a system for evaluating the quality, the increase of performance and the improvement of the quality/price ratio, but even more through the manner in which the scientific research meets the society’s needs.

2. IDENTIFYING THE POTENTIAL USERS OF THE RESULTS OF A SCIENTIFIC RESEARCH EVALUATION PROCESS

The evaluation of research in universities is increasingly capturing the public attention, the results being often published in media and ranked in descending order. Taking into consideration the experience in ranking universities and the precedent exercises of research evaluation, it can be identified a broad range of potential users of the information regarding the research evaluation: governmental agencies, universities, private or public organisations, the civil society and media. Each group uses the information differently in order to satisfy various objectives, the experience showing that it is not possible to control the way in which people use and interpret these data. The decision-factors in higher education require a broad range of information to help build policies, to allow strategies development. This information is used for marketing purposes: helps at recruiting students and researchers, at establishing research partnerships and supports philanthropic liaisons. The governments need this information for policies for improving the international visibility, for decisions concerning the structure of higher education and the role of institutions, for ensuring that the higher education and research system functions efficiently and is in accordance with other governmental objectives. The local and regional authorities are interested in the prestige of the universities as an integrated part of an economic strategy for positioning the town or the region as an important node in the global economy. Since the regional governments contribute financially to the higher education institutions, they are interested in ensuring their investment and an efficient use of the funds. At individual level, the PhD students are frequent users of the international classifications. They use these information to choose the best institutions they want to follow, considering also the tendencies from the work market and, implicitly, for carrier opportunities. Similarly, the researchers, including here also the post-doctoral researchers, use this information to see whether a certain institution values the research and its quality and how the research value from that institution is perceived by others. The industry and other organisations use the performance indicators to identify potential partners for research projects, consultancy and technological transfer. The employers also use these data to identify potential employment resources. Media is a producer, as well as a communicator and transmitter of this sort of information. First, the public showed his interest for this information, buying it. But media also has the important role of public information, ensuring that the civil society receives a better understanding of the higher education and research system, of its contributions to the development of the society, as well of its financial requirements. The more the public is better informed on the existing problems, the more he will be willing to intensify the support for the higher education and research. To the diversity and the specific of the research results, adds the diversity of the beneficiaries of the research evaluation. Each beneficiary has its own set of motivations, correlated with the actions he intends to take. No matter the type of the beneficiary, it is unanimously accepted that the collected data must be correct and complete. From this point of view there is the tendency to adopt the evaluation indicators that are easy to verify and quantify (e.g.: scientific articles in reviewed journals), along with scientometric methodologies for obtaining composite indicators (e.g.: weighting with the impact factor of the journal and/or the number of citations of the article). This kind of approaches has been intensely promoted in the domain of fundamental sciences, being currently accepted by the scientific community. On the other hand, some data are difficult to obtain or are available in certain limits. For example, the information regarding the employment of universities graduates or the competence proved by them when exercising their profession are either unavailable, or difficult to verify and quantify. According to the study realised by the European Commission “Assessing Europe’s University – Based Research, 2010” (1), there have been identified potential users of the evaluation results, the motivation and the purpose (the utility of the evaluation). All these are adapted to the needs of the national system and to the utility of the results of an evaluation process performed in Romania (Table 1).

Table 1. Users of the results of the research evaluation, motivation and utility of evaluation.

<table>
<thead>
<tr>
<th>Users</th>
<th>Motivation of research evaluation</th>
<th>Utility of research evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The management and leadership of higher education institutions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University management</td>
<td>Policies and planning; Strategic positioning; Development strategies/management of research; The investors’ confidence, the efficiency of funds use; Quality assurance; Publicity; Recruiting students and academic staff</td>
<td>Data at institutional level/domain on the level, expertise and quality competence in research; Position relative to institutions of reference at national and international level; Level of efficiency: results versus funding; The quality of the academic staff and the PhD students; Attractiveness: recruiting students, professors, researchers from the country or abroad; Indentifying partnerships (with other universities, public-private, research organisations, non-governmental organisations).</td>
</tr>
<tr>
<td>University research groups</td>
<td>Strategic positioning; Development strategies/management of research; The sponsors’ confidence, the efficiency of funds use; Recruiting students and academic staff</td>
<td>Data at domain level on the level, expertise, quality and competence in research; The quality of the academic staff and the PhD students; Attractiveness: recruiting students, professors, researchers from the country or abroad; Indentifying partnerships (with other universities, public-private, research organisations, non-governmental organisations).</td>
</tr>
<tr>
<td><strong>Government, ministry and financing agencies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government/ministry</td>
<td>Defining the policies and informing on the decisions concerning higher education; Determining the competitiveness at national and international level; Quality, sustainability, relevance and impact of the research activity; The sponsors confidence in the efficient use of funds; Improvement of performance and quality; Development strategies and management of research; Improvement of system’s functionality</td>
<td>Data at system and institutions level on the experts, quality and competence and intensity of the research activities; Performance of higher education system at institutional level; Position of reference on national and international level; Indicators of national competitiveness; Attractiveness: recruiting students, professors, researchers from the country or abroad; The quality of the academic staff and the PhD students; Level of efficiency: results versus funding; Research infrastructure: level of use and the efficiency of use.</td>
</tr>
</tbody>
</table>
### Financing agencies
- Quality, sustainability, relevance and impact of the research activity; Determining the competitiveness at national and international level; The sponsors confidence in the efficient use of funds; Improvement of performance and quality; Support for resources allocation; Efficiency of funds use.

### Individuals
- Researchers
  - Identifying career opportunities; Identifying potential research partners; Identifying colleagues with similar domain of interest; Identifying the best research infrastructure for the domain/project of interest.

- Pupils, students
  - Informing for choosing/selecting the universities; Identifying career opportunities.

### Economic agents and partner organisations
- Private companies and entrepreneurs
  - Quality, sustainability, relevance and impact of the research activity; Identifying potential partners and expertise; Consultancy, technological transfer; Partners for knowledge and expertise transfer; Identifying candidates for employment

- Employers
  - Determining the institutional performance versus the national and international competitors; Quality, sustainability, relevance and impact of the research activity; Options for young men career; Confidence in the return value for the public money

- Civil society
  - Citizens, young men who choose a career, parents who counsel their children regarding higher education options

### Table 1
<table>
<thead>
<tr>
<th>Category</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing agencies</td>
<td>Data on the level and intensity of research activity, expertise, competence, sustainability in a discipline/domain; Reference levels at institutional level, nationally and internationally; Attractiveness: recruiting students, professors, researchers from the country or abroad; The quality of the academic staff and the PhD students; Level of efficiency: results versus funding; Research infrastructure: level of use and the efficiency of use.</td>
</tr>
<tr>
<td>Researchers</td>
<td>Data on the level and intensity of research activity, expertise, competence, sustainability; Performances of various institutions or certain individuals compared to the references in the domain; Hiring conditions; Institutional capacity (or of certain groups) for research; Potential for partnership; Institutional support for scientific research.</td>
</tr>
<tr>
<td>Pupils, students</td>
<td>Data on the level and intensity of research activity, expertise, competence, sustainability; Performances of various institutions or certain individuals compared to the references in the domain; Research capacity; the ratio number of students/number of academic staff members; Tendencies for career development after graduation; Quality of research infrastructure.</td>
</tr>
<tr>
<td>Private companies and</td>
<td>Data on the level and intensity of research activity, expertise, competence, sustainability; Performance of an institution compared to institutions from the same domain of interest; Competitive positioning of the institution and/or researchers; Tendencies in the employment of graduates and their level of competence; The quality of the educational programs in universities and the connexion between the didactic component and research.</td>
</tr>
<tr>
<td>Entrepreneurs</td>
<td>Quality, sustainability, relevance and impact of the research activity; Competing positioning of the institution and/or researchers.</td>
</tr>
<tr>
<td>Employers</td>
<td>Data on the level and intensity of research activity, expertise, competence, sustainability; Performance of an institution compared to institutions from the same domain of interest; Competitive positioning of the institution and/or researchers; Tendencies in the employment of graduates and their level of competence; The quality of the educational programs in universities and the connexion between the didactic component and research.</td>
</tr>
</tbody>
</table>

The synthetic presentation from Table 1 shows clearly that any exercise for evaluating the quality of research must be customized according to the specific, the interest and the modality in which the results declared will be used by the beneficiary. The data can be collected at the request of a beneficiary who pursues a well-defined set of objectives (for example, defining public policies, efficiently allocating resources, promoting certain research directions with priority at national level, attracting quality human resources from abroad etc.) and can be used by other beneficiaries for completely different purposes (making classifications, advertising for certain institutions/domains/disciplines, imposing some eligibility criteria for limiting the access to financial resources at the expense of promoting competition and competitiveness).

On the other hand, any exercise of evaluation transmits a message to the academic and research community regarding aspects considered relevant by the deciding-factors and/or sponsors. Consequently, the researchers, the research groups, the higher education and research institutions will orient themselves quickly (but not always with beneficial effects) to:
- maximizing the indicators which contribute mostly to a favourable positioning in the national/international classifications, at the expense of other essential components of their activity. An example of such practices become chronic is the evaluation and the promotion of didactic personnel from higher education, almost exclusively based on criteria of individual scientific performance, without the consideration of (proven) skills of trainer, communicator or coordinator.
- maximizing of funds attraction by orientation/re-orientation of research efforts to financing sources and not to resolving major challenges from the served society and which ensures in the end the public funds for financing research.
- wrong adopting, as main purpose, the increase at any price of scientometric indicators, ignoring the fact that the society awaits from scientific research solutions for increasing the level of general well-being and life quality, and not academic performances aimed at increasing personal and/or institutional prestige.
- at individual level: researchers, students, interested in obtaining an optimum correlation between individual aspirations and performances, on one hand, and the offer of educational services, on the other hand, the aim being to maximize the chances for developing a professional career that will ensure a high level of life quality.
- at institutional level: university, interested in a dynamic adaption of the educational offer, respectively correlating the production and knowledge transfer effort with the requirements of work market and society’s expectations for improved life quality.
- at system level: government/ministry, interested in an efficient management of limited human and material resources for increasing population’s level of education and for ensuring the progress in the paradigm of knowledge-based society.
- economic environment/employers, interested in attraction and efficient use of human resources with high qualifications, that can efficiently meet the continuous challenges associated with the marked dynamic of the services and products market, and also the efficient transfer of the knowledge generated in the academic and research environment and embedding this knowledge in competitive services and products.
- civil society, interested in a constant increase of life quality and in the generation, within the knowledge-based society paradigm, of opportunities and motivations adapted to all the segments of society.

It is clear from the above brief enumeration of the beneficiaries of the information generated by an evaluation process, beneficiaries with various expectations, that the design of an evaluation process must have from the very beginning clearly identified and precisely delimited the following elements:
• the beneficiary/beneficiaries, with their expectations; it is not preferable the convenience of mimicry, by adopting (frequently partially) the expectations of the beneficiaries of other evaluation exercises.
• the specific objectives of the evaluation correlated with the status of the assessed system, at the moment of the evaluation, and with the status predicted at a later time; the definition of the objectives of the evaluation process, in itself, can communicate a clear and coherent signal (or not, as the case might be) about the development vector.
• the segment of the academic environment and/or the research-development-innovation environment, subjected to the evaluation.

Despite the mirage of the omnipotence of exclusively quantitative evaluations, it is obvious that “not everything that is measurable counts and anything that counts can be measured”. Follows that, aside the necessary quantitative component, a rational evaluation process must also include a consistent qualitative component. In the case of qualitative evaluation, it is essential to clearly indicate the evaluation methodology, respectively to present the conclusions and the arguments that have generated them, to be correctly appropriated both by the evaluated as well as by the beneficiary of the evaluation.

3. CRITERIA / INDICATORS OF EVALUATION FOR THE DOMAIN OF ENGINEERING SCIENCES

The indicators (or metrics) are used for measuring different aspects or dimensions of the research-development-innovation activity. Beyond the scientific quality, the indicators must reflect the relevance, impact, resources and infrastructure associated with the scientific research endeavour. The indicators can be grouped by the measurement intention in:
• productivity of scientific research
• scientific quality and impact
• innovation, with economic and social benefits
• sustainability of research-development-innovation
• research infrastructure

The study for identifying the representative indicators of evaluation for the domain of engineering sciences in Romania was done by developing and applying a questionnaire. The stratification of the studied population is the base for establishing the research sample, but the research thematic will influence the rate of respondents’ eligibility through a set of specific criteria, associated with the professional activities from the domain of engineering sciences:
I. The professional domain within engineering sciences;
II. The portfolio of the researcher from the research school.

In the context of performing an evaluation of the scientific research in the engineering sciences domain from Romania, for the current study, it is considered representative a sample stratified according to the domains presented at point I that meets exclusively the II.1 criteria and cumulative at least two from the II.2, II.3, II.4, II.5 criteria. The research sample is, in this way, non-probabilistically stratified, established through evaluation. Meeting the criteria established at the II point is essential in the context of the integrative character of the research school. So, the selected criteria reflect:
• II.2: the experience in the management of research projects;
• II.3: the experience in evaluating personnel’s activity and the research in engineering sciences domain;
• II.4: the experience in the domain of scientific research management and evaluation, of public policies for research-development-innovation;
• II.5: the experience in the area of scientific research from the engineering sciences domain.

In order to establish the sample for the social survey, it was performed an initial analysis of the structure of the general population:

| I. Civil engineering and installations | 1113 |
| Mechanical engineering and mechatronics | 1243 |
| Air-spatial engineering | 22 |
| Transports | 269 |
| Chemical engineering | 314 |
| Materials science and engineering | 544 |
| Mining, oil and gas | 152 |
| Industrial engineering | 1228 |
| Electrical engineering | 613 |
| Energetics | 234 |
| Electronics and telecommunications | 589 |
| Systems engineering | 433 |
| Computer and information technology | 392 |
| Biotechnology, food engineering and safety | 384 |
| Environmental science and engineering | 534 |

| II. 2. Director of research projects within IDEAS Program (experience in the management of research projects) | 246 |
| 3. Member in CNATDCU commissions/panels (experience in evaluating personnel’s activity and the scientific research) | 197 |
| 4. Member in CNCSIS commissions (experience in the domain of scientific research management and evaluation, of public policies for research-development-innovation) | 23 |
| 5. Romanian evaluator from diaspora, in NEC (The National Exercise of Research Evaluation, Romania, 2011) | 23 |

*aaccording to the preliminary report of ENEC*

From a total of 8062 researchers in the domain of engineering sciences, after applying the criteria establishing the sample for the social survey, it was selected a representative population of 397 researchers. According to the practices associated, on one hand, with the studies on academic domains and, on the other hand, with the questionnaires applied by mail (email), it was estimated a response rate of approximately 25%, the coefficient reaching the real value of 24.9%. So, the volume of the studied sample was of 99 respondents, the stratification of the studied population being the aspect on which the sample’s establishment was based. The form of the questionnaire (Annex 1) was shaped in the Research report no. 3 “Model of identification and evaluation of the research schools from the universities with technical profile”, through the analysis of the evaluation methodologies of ENEC and of the Royal Academy of Engineering for engineering research. In essence, we propose 6 evaluation criteria, from which 2 present relevance on an individual level, 2 present relevance on the level of research group, and 2 appreciate characteristics on the research school level. The 6 evaluation criteria and the associated indicators are summarized in the Table 2.
In the following there are presented the results of the study:

For the centralization of data it was created a model of the data base in order to be processed with SPSS 16. The processing and evaluation of the information from the data base model was performed automatically by the program. In the first stage there were quantified the frequencies of the variables’ values. The graphic representation was done as circular diagram histograms.

I. The evaluation of the professional activity of the personnel from the research school

A. Scientific production

A1. Articles published in scientific journals indexed in Web of Knowledge

![Figure 1.](image)

For this indicator it was appreciated as being necessary the following information: the title of the article, the scientific publication, the year of publication, the influence relative score and the number of citations – without self-citations. The information number of citations with self-citations was considered by more than 80% of the respondents as a “useless, redundant indicator”. The influence relative score was appreciated as useful just by 30% of the respondents. We received the recommendation that this indicator be refined in two: articles published in scientific journals with influence relative score bigger than 0.5 and lesser that 0.5. The choice of this threshold used in all currently existing national evaluations was not substantiated.

A percent of 84.6% of the respondents have considered that the indicator “articles published in scientific journals indexed in Web of Knowledge” is important for the scientific production, being an indicator of visibility both for the researcher, as well as for the national research-development system from Romania.

A2. Articles published in scientific journals from international data bases with review process from Engineering Village

![Figure 2.](image)

Figure 2 shows that the researchers’ opinion on this indicator is divided. The indicator “articles published in scientific journals from international data bases with review process from Engineering Village” was appreciated as important by 54% of the respondents, percentage that leads to the conclusion that this data base is not representative for the evaluation of the research schools. The information necessary for the expression of this indicator were: the title of the article, the year of publishing, the scientific publication, the number of citations without self-citations. The respondents have appreciated that Engineering Village data base is more indicated to be used.

A3. Contributions to conferences with rigorous review process

![Figure 3.](image)

The graphic representation (Figure 3) shows that the respondents’ opinion on this indicator is also divided, only 12% considering it as very important. There were appreciated as important the following information: the paper’s title, the conference name, the year of publication, the number of citations without self-citations. Half of the respondents have considered that it is necessary to be known also the location of the conference and 70% have appreciated the indicator number of citations with self-citations as “useless, redundant indicator”.

From the analysis of the questionnaire has resulted the necessity of a clear definition of the term used: “conferences

<table>
<thead>
<tr>
<th>Level</th>
<th>Evaluation criteria</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research and training/specialisation for researchers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prestige (individual level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income from research (research group level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact (research group level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publications (individual level)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Evaluation criteria and indicators proposed for evaluating the research schools from the engineering sciences domain
with rigorous review process” and the elaboration of a list of such conferences for each domain of engineering.

**A4. Monographs and book chapters (including reviews)**

Only 9% of the respondents have appreciated this indicator as having a maximum importance. We received the recommendation that it should be made a distinction between the book chapter from abroad and those published in Romania.


The information necessary: the volume’s title (including chapter’s title, as case might be), the publisher house, the year of publication, the number of citations, a link to the site where the volume can be downloaded/bought from.

**A5. Software**

![Figure 5.](image)

Figure 5 shows that the indicator “Software” is not and cannot be relevant for the domain of engineering sciences, as reflected by the graphic representation of the received answers. For this indicator are necessary: name of the platform/operating platform/compatibilities, description of functionality, community/communities of users, level of availability, and year of launching. Plus, it is useful to mention the authors and their contribution to the software design.

Within the program “Partnerships in priority domains” the software production counts if the application has been launched on the international market (in countries of EU or OECD) and has recorded sales of minimum 250,000 euro (unsubstantiated condition)

**A6. Invention patents**

![Figure 6.](image)

The invention patent may be considered as the most important indicator for assessing the activity of a researcher in engineering sciences, activity focussed on development and applicative research, the utility of the patent being appreciated through its practical applicability. The information necessary for this indicator are: patent type national/international, patent’s title, the year of issuing, number of citations in subsequent patents.

However, from the graphical analysis of the answers received, only 33% of the respondents have considered the indicator of maximum importance. This situation is justified also by the analysis of the research profile of the respondents.

The respondents have recommended the extension of the criteria list for evaluation of the scientific production from the domain of engineering sciences with the following criteria/specific conditions:

- for each researcher will be selected only the significant articles – 80% positive appreciation;
- the evaluation will be weighted by considering the impact factor of the publication – 78% positive appreciation;
- the evaluation will be weighted by considering the number of citations – 65% positive appreciation;
- the evaluation will be weighted by considering the status of “author” and “co-author” - 52% negative appreciation;
- the evaluation will be weighted by considering the number of authors – 55% positive appreciation. For this specific condition we received the recommendation that the weighting should be done considering the number of Romanian authors, in this way being encouraged the international cooperation.

4. **CONCLUSION**

The research presented in the paper addressed for the first time the researcher view in the research evaluation process and can be used by policies makers if combined with other stakeholders opinion (funding agencies, industry etc.) in order to have a realistic view on priorities in this field at national level.

5. **REFERENCES**

THE I-P-C-V MODEL FOR IMPROVING THE QUALITY MANAGEMENT AND ITS APPLICATIONS

Constantin, Oprean¹ and Amelia, Bucur²
1 Lucian Blaga University of Sibiu, presedinte@ulbsibiu.ro
2 Lucian Blaga University of Sibiu, amelia.bucur@ulbsibiu.ro

ABSTRACT: The process of quality management consists of several stages defined by specific verbs. Some experts have named the stages after the following verbs[1,2,3]: to forecast and to plan, to organize, to direct, to control (Fayol), to plan, to do, to check, to act (Deming); to design, to implement, to manufacture, to deliver; to design, to supply, to control, to assess; to develop, to inspect, to control, to improve or to enhance; to establish quality policies and quality objectives, to establish strategies for quality planning, to determine strategies for quality control, to establish quality assurance policies, to establish quality assurance procedures. In this work we will show that a model of improving the quality management process could be defined starting from the following verbs: to identify needs, to program, to construct, to verify. We will also define a new quality indicator in the Oprean-Bucur model. We applied the models for a course of the Faculty of Engineering from Sibiu, Romania.

Key words: quality management, linear programming, Pert analysis

1. THE I-P-C-V MODEL FOR IMPROVING THE QUALITY MANAGEMENT: THE OPREAN-BUCUR QUALITY MODEL

In the fulfilment of our work, we used the mathematical model of the method of linear programming, PERT analysis, in which we inserted the components of the IPCV quality management model shown in Figure 1. For the model simulation, we used the WinQSB software, in which we will enter the values of the quality characteristics, on a scale from 10 to 100, specific to the steps of needs identification, programming, construction, verification of the product.

1.1. The identification of needs’ phase is realized through the following steps

Step 1. Identifying the requirements of the quality characteristics that will be marked with the variables x1, ..., x6. The meaning of variables xi are the following:

- x1 - need / requirement of a specific technical characteristic (efficiency, weight, power, temperature, tolerances, speeds etc) expressed on a Likert scale from 10 to 100;
- x2 - need / requirement of a certain economic characteristic (dutution of the guarantee, investment, cost, service, etc) expressed on a Likert scale from 10 to 100;
- x3 - need / requirement of a certain aesthetic characteristic (aspects of finishing, regarding the packaging, color, etc) expressed on a Likert scale from 10 to 100;
- x4 - need / requirement of a certain social characteristic (noise, vibrations, etc) expressed on a Likert scale from 10 to 100;
- x5 - need / requirement of a certain functional characteristic (reliability, maintainability, etc) expressed on a Likert scale from 10 to 100;
- x6 - need / requirement of an environmental characteristic (air emissions, use of non-renewable resources etc) expressed on a Likert scale from 10 to 100.

Step 2. Establishing the objective function \( F_1 = F_1(x_1, ..., x_6) \) taking into consideration the variables given in Step 1. The coefficients of the variables each represent the arithmetic mean of the values set on a Likert scale of type 1/3/5/7/9 of the importance, necessity, utility criterion in achieving the objectives from the first stage of the quality management process. The criterion were set for the stage of identifying the needs (in fig.1).

Step 3. Defining the dependency relationship of the objective function with the variables:

\[ F_1(x_1, ..., x_6) = a_1 x_1 + ... + a_6 x_6 \]  \( (1) \)

which is a summation of the variables multiplied by factors of influence \( a_1, ..., a_6 \). In our model, the objective function \( F_1 \) depends on the variables \( x_1, ..., x_6 \) in ascending order and from the range \([10, 100]\).

Step 4. We open the Linear and Integer Programming module by accessing the Start menu, clicking on the module, which will open a dialog window that has a menu bar specific to module.

Step 5. We introduce the model’s data, for the needs’ identification phase, provided in the relation (1) and the problem’s restrictions, in the Linear and Integer Programming module through the commands:

- File → New Problem, which opens a new window with the following fields: Title → Number of Variables → Number of Constraints → Objective Criterion(Maximization/Minimization) → Default Variable Type → Normal Model Form that we complete according to the figures below(fig.2, fig.3):

![Figure 2. Defining the problem in the Linear and Integer Programming module of the WinQSB software](image-url)
Figure 3. Introducing the problem in the Linear and Integer Programming module of the WinQSB software

- Click OK. A new window will be opened, in which are inserted rows completed with the variables $x_1$, ..., $x_6$ and their types: $x_i \in [0,M]$, introduced in the previous step, as well as blank rows, ready for introducing the aim and constraints $C_i$ function.

Step 6. We now use the menu Edit, which contains options that allow us to change the type of the objective function, the names for restrictions, the introduction or deletion of variables, the addition or deletion of restrictions. We will complete the window mentioned at point 5 with the mathematical expression of the aim function and the mathematical expressions of the constraints. The new window obtained will have the image from figure 3.

Step 7. From the menu Solve and Analyse, we select and click on the command Solve the Problem or Solve and Display Steps or Graphic Method for solving the problem and displaying the result(fig.4, fig.5):

Figure 4. Introducing the problem in the Linear and Integer Programming module of the WinQSB software

Figure 5. The graphic of the solution in the Linear and Integer Programming module of the WinQSB software

We find that the maximum of the objective function, respectively of the optimum quality, displayed by the Linear and Integer Programming module is read from the fourth column of the table, from the picture above and represents the value of 2980.00(fig.4). After obtaining the maximum of the objective function we will create a hierarchy of needs / requirements by the criterion of their contribution in the objective function and a plan of quality characteristics needed to be achieved in implementing the product, service or process, containing also the measures for increasing the performance for each individual feature and a prioritization of the appliance of those measures.

1.2. The stage of programming the activities

In this stage, we set the ways of action, their sequence, the time limits for their completion and their related costs. The analysis of the total cost of the rescheduling stage can be made through a PERT analysis and can also be simulated with software applications such as WinQSB. In this respect, a table will summarize all activities, redesigned in order to achieve the product and the precedence relations between activities, such as Table 1. Precedence refers to the activities that must be completed before the activity conducted, so that it can begin. The time each activity will consume is subjectively estimated, so that a scheduling of the total time can be made to complete the realization of the product. In case of simulation, all these elements are analyzed and assembled into a network model automatically created by the WinQSB software.

Table 1. Timed successive activities and afferent costs

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Duration</th>
<th>Resource</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A - B</td>
<td>165 days</td>
<td>$3000$</td>
<td>A - B</td>
</tr>
<tr>
<td>2</td>
<td>A - C</td>
<td>165 days</td>
<td>$3000$</td>
<td>A - C</td>
</tr>
<tr>
<td>3</td>
<td>A - D</td>
<td>165 days</td>
<td>$3000$</td>
<td>A - D</td>
</tr>
<tr>
<td>4</td>
<td>A - E</td>
<td>165 days</td>
<td>$3000$</td>
<td>A - E</td>
</tr>
<tr>
<td>5</td>
<td>A - F</td>
<td>165 days</td>
<td>$3000$</td>
<td>A - F</td>
</tr>
<tr>
<td>6</td>
<td>A - G</td>
<td>165 days</td>
<td>$3000$</td>
<td>A - G</td>
</tr>
</tbody>
</table>

a) Step 1. From the keyboard are inserted in the PERT / CPM module of the WinQSB software: the activities to be performed, their predecessors, the time of 165 days and its costs, obtaining the image in Figure 6:

Figure 6. The activities, the costs, the time

b) Step 2. By using the commands Format → Switch to Graphic Model, the PERT diagram is obtained, represented in Figure 7. It is known that, for the PERT technique, there are two ways of work: the arrow network activities and network with nodes activities. Diagrams showing by the WinQSB are the second type, with activities in nodes, as shown in Figure 7. Circular representations include activities, coded with A, B, C, D, E, F, G. At the top of the nodes are specified time periods set in days for them and at the bottom, the corresponding costs. The sequence of the activities is inferred from the orientation of the arrows of the PERT diagram, displayed by WinQSB software.

c) Step 3. By performing the command Solve Critical Path, it is obtained the critical path, its cost, the total time and cost of product development activity, as well as the start and end times of each activity, as shown in Figure 8:

Figure 8. The PERT matrix

Figure 9. The critical path marked in red

From figures 8 and 9 results that there are nine critical paths, containing the activities A-B-C-D-F-G, A-C-D-F-G, A-F, A-G, A-D-F-G, A-F-G, A-B-F-G, A-B-D-F-G, A-C-F-G, with a total duration of 155 days, the activities being framed within a limited time provided in the third column of Figure 8. In
columns 4,5,6,7 and 8 are shown the times of onset and completion of each activity, as well as the differences between the earliest time of completion and the earliest time of onset of each activity. Critical path cost was calculated automatically by the program, to the amount of 4650$ and the total cost of implementing the product, process or service to the amount of 4950$.

1.3. The Construction Stage

In this stage is made the proper implementation of the product or proper conduct of the process, analyzed in terms of quality. The actions specified in the second step are performed, respecting their succession, their performance requirements, the time limits imposed.

1.4. The Verification Stage

In this stage is made the needs/requirements verification.

Step 1. Specifying the variables denoted by y1 , ..., y6.
- y1 represents the verification on a Likert scale of type 10 - ... -1000 the meeting of a need/requirement of a certain technical feature(yield, mass, power, temperature, tolerances, speeds, etc.);
- y2 - the verification on a Likert scale of type 10 - ... -1000 the meeting of a need/requirement of a certain technical feature(guarantee duration, investments, cost, service etc.);
- y3 - the verification on a Likert scale of type 10 - ... -1000 the meeting of a need/requirement of a certain technical feature (finishing aspects, packaging, color etc.);
- y4 - the verification on a Likert scale of type 10 - ... -1000 the meeting of a need/requirement of a certain social feature (noise, vibrations, etc.);
- y5 - the verification on a Likert scale of type 10 - ... -1000 the meeting of a need/requirement of a certain functional feature (reliability, maintainability etc.);
- y6 - the verification on a Likert scale of type 10 - ... -1000 the meeting of a need/requirement of a certain technical feature (air emissions, use of non-renewable resources etc).

Step 2. The establishment of the objective function F2 = F2 (x1, ..., x6), taking into consideration the variables mentioned in step 1. The variables’ coefficients each represent the arithmetic mean of the values set on a Likert scale of type 1/3/5/7/9 of the criterions of importance, necessity, utility in achieving the objectives from the first stage of the quality management process. The criterions were provided for the verification phase in Figure 1.

Step 3. Defining the dependency relationship of the objective function in relation to the variables:
\[ F2(y1,\ldots,y6) = a1 y1 + \ldots + a6 y6 \] (2)
which represents a summation of the variables multiplied by factors of influence a1, a2, ..., a6. In our application, the objective function F2 depends on the variables y1,…,y6, in ascending order and within the range [10, 100].

Step 4. We open the Linear and Integer Programming module by accessing the Start menu, clicking on the module, which will open a dialogue window that has a menu bar with menus specific to the module.

Step 5. We introduce the problem data, for the identification of needs phase, provided in relation(2) and in the restrictions of the problem, in the Linear and Integer Programming module by the following commands:
- File → New Problem, which opens a new window with the following fields: Title→ Number of Variables → Number of Constraints → Objective Criterion (Maximization) → Default Variable Type → Normal Model

Minimization) → Default Variable Type → Normal Model

Form that we complete according to the image below(fig.10, fig.11):

Figure 10. Defining the problem in the Linear and Integer Programming module of the WinQSB software

Figure 11. Introducing the problem in the Linear and Integer Programming module of the WinQSB

- Click OK. A new window will open, in which are inserted rows filled with the variables y1,...,y6 and their types: yi ≥0, ≤M, introduced in the previous step, as well as blank rows, ready for introducing the aim function and the Ci constraints.

Step 6. We use the menu Edit, which contains options that permit the changing of the type of the objective function, of the names for restrictions, the introduction or deletion of some variables, the addition or deletion of restrictions. We will complete the window mentioned in point 5 with the mathematical expression of the aim function and the mathematical expressions of the constraints. The new obtained window will have the image from Figure11.

Step 7. From the Analyse and Solve menu, we select and click the command Solve the Problem or Solve and Display Steps or Graphic Method for solving the problem and displaying the result (fig.12, fig.13):

Figure 12. Introducing the problem in the Linear and Integer Programming module of the WinQSB software

Figure 13. The graphic of the solution in the Linear and Integer Programming module of the WinQSB

We find that the maximum of the objective function, respectively of obtaining the optimum quality, displayed by the module Linear and Integer Programming is read from the fourth column of the table, in the image above and represents the value of 940.00, which is, in this case, a satisfactory value, if we interpret it on the Likert scale 10 - ... -1000. After obtaining the maximum of the objective function, we will make a hierarchy of the quality characteristics, based on the criterion of their contribution in the objective function and a plan of measures to improve quality, containing performance measures for each individual feature and a prioritization of the
implementation of the measures. Conclusions: We define the mathematical model of the report function:

\[ F(x_1, \ldots, x_6, y_1, \ldots, y_6) = \frac{F_1(x_1, \ldots, x_6)}{F_2(y_1, \ldots, y_6)} \]  

(3) that has as counter, respectively denominator, the values of the objective functions from the stages one and four (identification of needs, verification). Its value is a quality indicator. The fulfillment of objectives related to the making of the product, is achieved if the value of the report function from formula (3) is lower than 1. The lower the value than 1, the more certain we are that the customers will appreciate the quality of the product, as being the desired one, as being the one that meets to their needs. We will appreciate the level of quality according to the values of the indicator in formula (3), as follows:

<table>
<thead>
<tr>
<th>Table 2. Quality levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F_1 )</td>
</tr>
<tr>
<td>High-quality</td>
</tr>
<tr>
<td>Values greater than 1.9</td>
</tr>
</tbody>
</table>

We call the mathematical model from formula (3) the Opran-Bucur model of quality. In the specific case studied, \( F(x_1, \ldots, x_6) = 2980/940 = 3.17 \), product analyzed has a low quality. Ultimately, the fulfillments of the quality management objectives will be conditioned by the features of each organization, the specific manner of exerting the competences of the managers and other factors involved in the functioning of the organization, suppliers, customers, in each stage of the quality management process.

2. **THE I-P-C-V MODEL AND THE OPRAN-BUCUR MODEL OF QUALITY APPLIED IN THE COURSE “SPECIAL MATHEMATICS” OF THE FACULTY OF ENGINEERING, „LUCIAN BLAGA” UNIVERSITY OF SIBIU**

In the development of the application, we used the mathematical method of linear programming, the PERT analysis, in which we inserted the components of the I-P-C-V model of improving the quality management, shown in Figure 14. For the simulation of the model, we used the WinQSB software, in which we introduced the values of the quality characteristics on a scale from 10 to 100, specific to the stages of identification of needs, programming, construction, verification of the course “Special Mathematics” from the curriculum Electromechanical study programme, of the Faculty of Engineering of the “Lucian Blaga” University of Sibiu.

![Figure 14. The I-P-C-V model applied to the course of “Special mathematics”](image)

2.1. The stage of identifying needs

Step 1. Identifying the requirements of the quality characteristics that will constitute variables marked with \( x_1, \ldots, x_6 \). The meaning of the variables \( x_i \) are the following:

- \( x_1 \) represents the need for printed training materials expressed on a Likert scale from 10 to 100;
- \( x_2 \) - the need for electronic training materials, expressed on a Likert scale from 10 to 100;
- \( x_3 \) - the need to include in the analytical syllabus the necessary mathematical apparatus necessary to the teaching of other specialized disciplines, expressed on a Likert scale from 10 to 100;
- \( x_4 \) - the need of as many connections as possible to the practical aspects of the electrical and mechanical fields, expressed on a Likert scale from 10 to 100;
- \( x_5 \) - the need to make connections between the course’s topic and the mathematical knowledge from the secondary education, expressed on a Likert scale from 10 to 100;
- \( x_6 \) - the need to know how to simulate mathematical models in more softwares, expressed on a Likert scale from 10 to 100.

The customers, in this case, are students and the course, a service offered by the “Lucian Blaga” University of Sibiu.

Step 2. The establishment of the objective function \( F_1 = F_1(x_1, \ldots, x_6) \), taking into consideration the variables provided in Step 1. The variables’ coefficients each represent the arithmetic mean of the values set on a Likert scale of type 1/3/5/7/9, of the criterions of importance, necessity, utility, in fulfilling the objectives from the first stage of quality management process. The criterions were set for the stage of identifying the needs in Figure 14.

Step 3. Defining the dependency relationship of the objective function in relation to the variables:

\[ F_1(x_1, \ldots, x_6) = a_1x_1 + \ldots + a_6 x_6 \]  

(4) which represents a summation of the variables multiplied by factors of influence \( a_1, \ldots, a_6 \). In our application, the objective function \( F_1 \) depends on the variables \( x_1, \ldots, x_6 \), in ascending order and within the range [10, 100].

Step 4. We open the Linear and Integer Programming module by accessing the Start menu, clicking on the module, which will open a dialogue window that has a menu bar with menus specific to the module.

Step 5. We introduce the problem data, for the identification of needs phase, provided in relation(4) and in the restrictions of the problem, in the Linear and Integer Programming module by the following commands:

- File → New Problem, which opens a new window with the following fields: Title → Number of Variables → Number of Constraints → Objective Criterion (Maximization/Minimization) → Default Variable Type → Normal Model Form that we complete according to the image below(fig.15, fig.16):

![Figure 15. Defining the problem in the Linear and Integer Programming module of the WinQSB software](image)

- Click OK. A new window will open, in which are inserted rows filled with the variables \( x_1, \ldots, x_6 \) and their types: \( x_i>=0, <=M \), introduced in the previous step, as well as blank
rows, ready for introducing the aim function and the Ci constraints.

Step 6. We use the menu Edit, which contains options that permit the changing of the type of the objective function, of the names for restrictions, the introduction or deletion of some variables, the addition or deletion of restrictions. We will complete the window mentioned in point 5 with the mathematical expression of the aim function and the mathematical expressions of the constraints. The new obtained window will have the image from Figure 14. The new obtained window will have the image from Figure 16.

Step 7. From the Analyse and Solve menu, we select and click the command Solve the Problem or Solve and Display Steps or Graphic Method for solving the problem and displaying the result:

Step 1. From the keyboard, are inserted in the PERT / CPM module of the WinQSB software: the activities to be performed, their precedents, the time of 20 weeks, obtaining the image from Figure 19.

Figure 19. Representing the activities to be performed

Step 2. By using the commands Format → Switch to Graphic Model, the PERT diagram is obtained.

Step 3. By using the command Solve Critical Path, we obtain: the critical path, the time of accomplishment of all activities, as well as times of beginning and completion of each activity, as in Figure 20.

Figure 20. The PERT matrix, representing the critical path

From Figure 20 results that there are nine critical paths, containing the activities A-B-C-D-F-G, A-C-D-F-G, A-F, A-G, A-D-F-G, A-F-G, A-B-F-G, A-B-D-F-G, A-C-F-G with a total duration of 19 weeks, the activities being contained within a limited time provided in the third column of Figure 20. In the columns 4, 5, 6, 7 and 8 are shown the moments of beginning and completion of each individual activity, as well as the differences between the earliest time of completion and at the earliest time of beginning of each individual activity.

2.3. The construction stage

In this stage is made the proper presentation of the course analyzed in terms of quality. The actions provided in the second stage are performed, keeping their succession, their performance conditions, the time limits imposed.

2.4. The verification stage

In this stage is made the verification of the fulfilment of needs/requirements.

Step 1. Specifying the variables denoted by y1, ..., y8.

- y1 represents verifying the need satisfaction of printed courses, expressed on a Likert scale from 10 to 100 (as an average of the need of each student);
- y2 - verifying the need satisfaction of courses in electronic format, expressed on a Likert scale from 10 to 100;
- y3 - verifying the need satisfaction of including in the curriculum mathematical models necessary in the teaching of other specialized disciplines, expressed on a Likert scale from 10 to 100;
- y4 - verifying the need satisfaction of making connections with the practical aspects of the electrical and mechanical fields, expressed on a Likert scale from 10 to 100;
- y5 - verifying the need satisfaction of making connections between the course’s topics and the knowledge of mathematics in the secondary education, expressed on a Likert scale from 10 to 100;
- y6 - verifying the need satisfaction of knowing how to simulate mathematical models in many softwares, expressed on a Likert scale from 10 to 100;
- y7 - the degree of the partial evaluation results, expressed on a Likert scale from 1 to 10;
- y8 - the results of the final evaluations, expressed on a Likert scale from 1 to 10.
Step 2. Establishing the objective function \( F_2 = F_2(y_1, \ldots, y_8) \), taking into consideration the variables provided in Step 1. The variables’ coefficients each individually represent the arithmetic mean of the values set on a Likert scale of type 1/3/5/7/9, of the criterions of importance, necessity, utility in achieving the objectives from the first stage of the quality management. The criterions were set for the stage of identifying needs in Figure 14.

Step 3. Defining the dependency relation of the objective function in relation to the variables:

\[
F_2(y_1, \ldots, y_8) = a_1 y_1 + \ldots + a_8 y_8
\]

which represents a summation of the variables multiplied by factors of influence \( a_1, \ldots, a_8 \). In our application, the objective function \( F_2 \) depends on the variables \( y_1, \ldots, y_8 \) in ascending order and ranging between [10, 100].

Step 4. We open the Linear and Integer Programming module by accessing the Start menu, clicking on the module, which will open a dialog window that has a menu bar specific to the module.

Step 5. We introduce the problem’s data, for the stage of identifying needs, provided in relation (5) and the restrictions of the problem, in the module Linear and Integer Programming, through the following commands:

File → New Problem, which opens a new window with the following fields: Problem Title → Number of Variables → Number of Constraints → Objective Criterion (Maximization/Minimization) → Default Variable Type → Normal Model Form that we complete according to the images below (fig.21, fig.22):

![Figure 21. Defining the problem in the Linear and Integer Programming module of the WinQSB software](image)

![Figure 22. Introducing the problem in the Linear and Integer Programming module of the WinQSB](image)

- Click OK. A new window will be opened, in which are inserted rows filled with the variables \( y_1, \ldots, y_8 \) and their types: \( y_i \geq 0 \leq M \), introduced in the previous step and blank rows, ready for introducing the aim function and the \( C_i \) constraints.

Step 6. We use the menu Edit, which contains options that allows us to change the type of the objective function, the names of the restrictions, the introduction or deletion of variables, the addition or deletion of restrictions. The new obtained window will have the image from Figure 22.

Step 7. From the menu Analyse and Solve, we select and click on Solve the Problem or Solve and Display Steps or Graphic Method for solving the problem and displaying the result (fig.23, fig.24):

![Figure 23. Introducing the problem in the Linear and Integer Programming module of the WinQSB](image)

![Figure 24. The graphic of the solution in the Linear and Integer Programming module of the WinQSB](image)

We find that the maximum of the objective function, respectively of the optimum quality, displayed by the module Linear and Integer Programming is read from the fourth column of the table, from the picture above and represents the value of 4500.00.

3. CONCLUSIONS

After obtaining the maximum of the objective function, we will create a hierarchy of quality characteristics based on the criterion of their contribution in the objective function and a plan of measures for improving the quality, containing measures for increasing the performance of each individual feature and a prioritization of the application of the measures.

<table>
<thead>
<tr>
<th>Table 5. Prioritization action plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this case, the value of the indicator from formula (3) is 4500/4500=1, which indicates a high quality of the course. Ultimately, the fulfillment of the management objectives of the “Special Mathematics” course will be conditioned by its logistic assurance, by the students’ prior knowledge and by the students’ interest in the course.</td>
</tr>
</tbody>
</table>

4. REFERENCES

2. Oprean, C., Kifor, C.V., 2008, Quality management, Editura Callidus, Wismar, Germany
AN OUTCOMES-BASED EDUCATION (OBE) APPROACH & TYPOLOGY-BASED QUALITY ASSURANCE (QA) SYSTEM: A PROPOSED FRAMEWORK AND TRANSITION STRATEGY FOR PHILIPPINE HIGHER EDUCATION INSTITUTION’S (HEI) SHIFT TOWARDS INTERNATIONAL STANDARDS

Ronald, Pastrana¹ and Alicia, Manabat²
1 La Consolacion College Manila, Philippines, ronaldmpastrana@yahoo.com
2 La Consolacion College Manila, Philippines, aymanabat@yahoo.com

ABSTRACT: This study is part of a bigger study supporting the Philippine Government’s Medium-Term Plan to institute major reforms in its educational system. The main research question of this study is how can Philippine Higher Education Institutions (HEIs) shift towards an Outcomes-Based Education (OBE) approach and typology-based Quality Assurance (QA) System that would meet international standards? Specifically, the study aimed to: 1) craft a Ten-year transition strategy (AY 2012-2022) for Philippine HEIs to become compliant to international accords; 2) design a framework for an Outcomes-based Education (OBE) approach and typology-based Quality Assurance (QA) system for HEIs; and 3) on the bases of the results, design a Model academic Course Syllabus in the field of business, particularly the BS Accountancy Program that applies OBE approach and typology-based QA using an actual case of an existing HEI - La Consolacion College Manila (LCCM), Philippines. The researchers’ main motivation in undertaking this study was the specific significant contribution to LCCM-a 100-year old HEI that is in need of a transition strategy during Academic Year 2012-2022 and the benefits to national interest. The Philippines has consistently lagged behind in the World Economic Forum (WEF) Global Competitiveness Index, placing 65th worldwide and 3rd least competitive among its Southeast Asian neighbours. The conceptual framework primarily used three of the world’s most popular quality management system models – Deming’s PDCA Cycle used in ISO 9001:2008 QMS, Baldrige Framework – Education Criteria for Performance Excellence (MBNQA,2010) and Kaplan’s Balanced Scorecard (BSC) Methodology (Kaplan and Norton,2000). The methodology used was a descriptive-case analysis research design primarily using secondary data analysis technique to analyse existing publications, memorandum orders, and studies from government and private agencies. Primary data was sourced from internal records of LCCM—the sample case study. The study showed that Outcomes-based framework presupposes quality and goals anchored on the Vision-Mission-Goals and Objectives (VMGO) of HEIs. Thus, HEIs define their VMGO in response to local contexts and their assessment of institutional strengths and weaknesses, the quality goals and outcomes of HEIs necessarily differ. It can be concluded that Philippine HEIs are not differentiated along the mission and functions vis-a-vis the national goals, with specific focus (target clientele, resource requirement and competencies of graduates). Typology-based QA for HEI must therefore be classified into three types: a) Professional Institutes b) Colleges and c) Universities. The study recommends immediate implementation of the 12-year Basic education (K-12) to comply with international accords (Washington and Bologna) in view of the economic impact of the gap during the transition phase. Strategies were crafted and designed for LCCM which may be applicable to HEIs in the Philippines during the 10-year transition stage (AY2012-2022). It is recommended that HEIs should adopt OBE approach and typology-based QA to produce world class graduates with competencies in accord with international standards. Private accrediting and certifying agencies must subsequently revise criteria to conform to these new methodology and typology, and to suit to the needs of HEIs aligned with the national goals and cascaded down to its VMGO. A Proposed BS Accountancy (BSA) Course Syllabus was developed in this study that may serve as a Model for all HEIs. It is further recommended that government regulatory units such as CHED and PRC, local accrediting agencies such as PAAASCU/PACU-COA, and international certifying agencies such as SGS for ISO and MBNQA for Baldrige, must use standards on the basis of this new typology. Finally, the study recommends an 8-step Action Plan for HEIs, starting with the K-12 implementation in Basic Education to cascading the HEI’s VMGOs into Program Course objectives following the OBE approach and revised HEI typology.

Key words: Outcomes-based Education (OBE), typology-based Quality Assurance (QA), VMGO (Vision-Mission, Goals and Objectives), international standards and competencies, global competitiveness

1. INTRODUCTION

 Philippine Higher Education Institutions (HEIs) lag behind in the top 500 annual university rankings worldwide (Times Higher Education (THE) and Quacquarelli (QS) Symonds, 2011), ranked 65th out of 144 countries in the World Economic Forum (WEF) Global Competitive Report 2012; and even in the ASEAN, ranked the third least competitive country behind Singapore, Malaysia and Thailand. (WEF Report, 2012). The impact could be seen in the Philippine’s still “underdeveloped economy” status, surpassed by the traditional strong economies in Asia such as Japan and the emerging economies of China and India. Previous studies pinpoint this slow economic performance to quality indicators such as mismatch of graduates against industry needs, inadequate skills and global competencies of the workforce and unemployability of graduates in the global environment. Both private and government-funded studies (World Bank and Asian Development Bank (ADB) opined the following reasons:
a) a 10-year Basic Educational System, short of the 12-year pre-college international standards prescribed by the Bologna and Washington Accords; b) an expert/teacher-based learning approach and input-based quality assurance (QA) system of its educational system.

The Philippine Government, through the Commission on Higher Education (CHED) and the Department of Education (DepEd) plans to overhaul the educational system and embark on a long-term plan called “K-12” (Kindergarten to Grade 12) and shift towards an Outcomes-based Education (OBE) and typology-based QA for Higher Education. (TFQA, CHED, 2012).

The Accounting profession in the Philippines has undergone a major transformation in the past decade. These changes were influenced by the opening of the Philippine market to global economies as part of its commitment to the Asia Pacific Economic Council (APEC) and World Trade Organization (WTO). The Filipino professional accountant is faced with the challenges of globalization.

2. REVIEW OF RELATED LITERATURE AND THEORETICAL FRAMEWORK

One of the defining themes of contemporary organizational theory is the emphasis on information and measurement for assessing, tracking and promoting organizational excellence. “Information and Analysis” is one of the seven categories in Malcolm Baldrige criteria for performance excellence and “management by fact” which has been a core value in the Baldrige framework (De Carlo & Sterrett, 1989, 1995; BMNQA, 1988-1998) and most other writings on organizational quality for more than a decade (Cortada & Woods, 1995; Deming, 1993; Hiam, 1992; Juran, 1995; Lynch & Cross, 1991, Ruben, 1995). (Ruben, 1999).

The basic references for HEI QA in the Philippines are the minimum requirements prescribed by CHED on five areas used for evaluating start-up programs (Figure 1) and the eight criteria prescribed by the accrediting agencies-Philippine Association of Accrediting Schools, Colleges and Universities (PAASCU) and Philippine Association of Colleges and Universities-Commission of Accreditation (PACU-COA), in granting accreditation status on HEIs such as Center of Excellence, Deregulated and Autonomous status, (Figure 2).

According to an ADB study, the main weakness of this QA system is its input-based framework (ADB Report 2000). Further, this QA is Program-based; contrasted with institution-based accreditation in foreign universities.

Thus, HEIs resorted to international standards such as the ISO 9001:2008 Quality Management System (QMS) which evaluates the entire organization’s QMS. The basic conceptual framework of this study adapted the Deming/Shewhart PDCA-Cycle, which is shown below.

As a process-based Model, the PDCA cycle can easily be adapted by HEIs, with parents-students as Input clientele and industry as Output stakeholders.

However, to be able to translate to an OBE and Typology-based QA, HEIs must adopt the MBNQA (Baldrige) Model primarily because of its Results/Outcomes- based approach, as shown below.

The main strength of the results-based framework is the quantification of all criteria towards a more objective assessment of an institution’s quality performance and excellence.

However, a deeper analysis of the Baldrige Framework revealed a difficulty in quantifying educational metrics (learning outcomes).

Thus, the Model is further simplified by the Balanced Scorecard (BSC) Method of Kaplan and Norton (Kaplan, 1995). This Methodology dovetails with PAASCU/PACU-COA Accrediting Agencies’ eight standards- criteria, and can be
used by HEIs in Operational Planning. The modified BSC for an HEI is shown below:

![Figure 5: Kaplan & Norton’s BSC adapted to HEI Setting](image)

3. METHODOLOGY

The methodology used a descriptive-case analysis research design primarily using secondary data analysis approach to analyse existing publications and studies from government and private agencies. Primary data were sourced from internal records of LCCM—the sole sample HEI in this case study.

4. FINDINGS: RESULTS, DATA ANALYSIS AND DISCUSSION

4.1. With regard to objective 1: transition strategy to an OBE approach and typology-based QA system

80% of HEIs in the Philippines are privately-owned; and unlike in the US and Europe wherein there are committed Government budget and private grants and endowments, they are solely dependent on tuition fee-based revenues. HEIs will experience a gap in freshmen intake in seven years (starting Academic Year (AY) 2016/17 due to the implementation of the K-12 Program effective AY 2012/13. College and University faculty will be displaced, including Non-Teaching Personnel (NTP), facilities will be under-utilized as a result of this Gap. This will only stabilize in AY 2021 as shown in Table 1.

<table>
<thead>
<tr>
<th>Year Level</th>
<th>College Transition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
</tr>
</tbody>
</table>

This Gap will bring enormous impact on the financial condition of all HEIs. Thus, the following strategies have been identified to cushion the impact:

- **Strategy 1:** Redesign Senior High School (Grades 11 & 12) Curriculum as a Bridge Program for Collegiate/University Courses.
- **Strategy 2:** Establish Junior College as Grades 11& 12 for Vocational Technology (VocTech) plus programs.
- **Strategy 3:** Ladder-type of VocTech Plus leading to Formal College Degrees
- **Strategy 4:** Ladder-type AB/BS (Bachelor’s) Degree Programs (College/University)
- **Strategy 5:** Re-Tool the General Education Component (GEC) Faculty and Non-Teaching Personnel (NTP),
- **Strategy 6:** Invest in Laboratories and Facilities supporting VocTech and Dual Learning System
- **Strategy 7:** Vertically Integrate along Core Competencies (Academic Programs) such as Voc-Tech certificate-Associate-Bachelor’s, Masteral and Doctoral Programs.
- **Strategy 8:** Establish industry partners for specific industry manpower requirements
- **Strategy 9:** Explore non-tuition-fee based revenues to support Faculty/Staff development and facilities upgrade

4.2. With regard to objective no. 2: OBE and typology-based QA framework for Philippine HEIs

The quality approach (e.g. Deming, 1993; Juran, 1995 Ruben, 1995) emphasizing external stakeholder focus, process effectiveness and efficiency among others, provided impetus for the use of a more comprehensive array of performance indicators. One approach that addresses this need in a systematic way is Kaplan’s BSC Methodology. This should translate a business unit’s mission and strategy into tangible objectives and measures. (Kaplan, 1995).

The VMGO of an HEI can be cascaded down the line: core and enabling functions such as Instruction, Faculty, Laboratory, Student Services, Library, and Administration. These HEIs tasks are translated as Key Result Areas (KRAs); and further cascaded into Key Performance Indicators (KPIs) and quantifiable targets (results/outcomes).

Study shows that Typology-Based QA for HEI should be classified into three types: a) Professional Institutes b) Colleges and c) Universities. Institutes develop technical knowledge and skills that lead to professional practice (e.g. engineering, management); while Colleges provide experiences to develop adults on thinking, problem-solving, decision-making, communication, technical and social skills to participate in various types of employment. Universities provide highly specialized educational experiences to train experts in various technical and disciplinal areas and develop new knowledge through research. (CHED, Technical Panel (TP) Report, 2012)

The outcomes-based framework presupposes quality and goals anchored on the VMGO of HEIs. Thus, HEIs define their VMGO in response to local contexts and their assessment of institutional strengths and weaknesses, the quality goals and outcomes of HEIs necessarily differ.

In the Philippines, however, HEIs are not differentiated along the mission and functions vis-à-vis the national goals.

Thus, accrediting and certifying agencies such as CHED, PAAASCU/PACU-COA and Societe Generale Surveillance (SGS) for ISO must use standards on the basis of this new typology. There must be no “one size-fits-all” policy on QA standards.
The proposed OBE and Typology-Based QA Framework for Philippine HEIs is shown in Table 1 below.

### Table 2. Proposed OBE/Typology-based QA Criteria

<table>
<thead>
<tr>
<th>Typology/Class</th>
<th>Criteria</th>
<th>Results: Outcomes &amp; Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Institutes</td>
<td>Focus</td>
<td>At least 70% enrolment in degree programs in the professional areas e.g. engineering, IT, Management, Law, Medicine</td>
</tr>
<tr>
<td></td>
<td>Program</td>
<td>At least 60% of academic programs in professional areas e.g. engineering, IT, Management, Law, Medicine, Education</td>
</tr>
<tr>
<td></td>
<td>Faculty</td>
<td>At least 50% of FT with relevant license and/or professional experience</td>
</tr>
<tr>
<td></td>
<td>Students-graduates</td>
<td>Technical knowledge and skills of the profession</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Colleges</th>
<th>Focus</th>
<th>Deepen the degree of theoretical and methodical knowledge in various fields of society. Develop competencies in adults to engage in various social discourses and development activities.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Program</td>
<td>At least 70% of undergraduate programs in humanities and philosophy and sciences-humanities, arts, social sciences and natural sciences.</td>
</tr>
<tr>
<td></td>
<td>Faculty</td>
<td>At least 50% of Full time and permanent faculty with relevant graduate degrees.</td>
</tr>
<tr>
<td></td>
<td>Students-graduates</td>
<td>Post-secondary (K-12) graduates. Bridge for Senior High/Junior Colleges and Community Colleges (associate degree, certificate, technical training (TESDA))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Universities</th>
<th>Focus</th>
<th>Highly specialized, trained experts in various technical and disciplinal areas.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Program</td>
<td>20% of active degree programs (at least 6 in graduate degree-MA/MS/Ph.D level. 1 active Ph.D Program in 3 disciplines All graduate and 50% undergraduate degree with thesis</td>
</tr>
<tr>
<td></td>
<td>Faculty</td>
<td>Full time researcher- with MA; 30% full time and/or 20% of all full time ; active in Research; 5% faculty with research patents; referred journals and publications.</td>
</tr>
<tr>
<td></td>
<td>Students-graduates</td>
<td>Graduate students and trained experts in the professional practice and/or discovery of new knowledge</td>
</tr>
</tbody>
</table>

### 4.3. With regard to objective no.3: proposed model of an OBE-approach and topology based bsa curriculum

Accountancy is a discipline under business and management. A review of the government bureaucracy shows that professional practice is supervised by the Philippine Regulatory Commission (PRC) a government body that administers licensure examinations. LCCM offers a BS Accountancy (BSA) Program—a formal 4-year education in preparation for the Licensure Examination.

An examination of the internal documents showed the following initiatives:

   a) These standards were observed in setting plans (KPI), teaching methodologies, systems and procedures, evaluation of performance, and feedback.  
   b) These standards made ‘continuous improvement’ a norm in the QMS.

2. Outcomes-Based Education (OBE) - This approach was adopted by devising a new curriculum; and annually reviewing and revising its corresponding syllabi to make sure that the OBE approach, i.e., identifying the desired outcome in each topic and the assessment tools used to measure the success of the approach.

It was also noted in the examination of primary internal records that among the changes in teaching methodologies were:

- shift from teacher–centered approach to learner-centered approach;
- use of case studies to simulate actual work situations;
- critical thinking;
- use of technology and e-learning;
- Problem-solving skills;
- Group learning;
- Research, analysis of current trends;
- and practical application through an internship program in a real external auditing firm.

On the bases of the Findings in this study, a Model OBE and Typology-based Accounting Curriculum/Syllabus is proposed and shown in the succeeding section.

### COURSE SYLLABUS in Financial Accounting 3

#### I. COURSE DESCRIPTION/SCOPE

This course deals with the preparation of a properly classified balance sheet, income statement, statement of changes in equity, and statement of cash flows including the required disclosures and notes to the financial statements.

#### II. COURSE EXPECTED LEARNING OUTCOMES

At the end of the course, the students are expected to possess the following competencies:

**Cognitive**

1. Identify the principles underlying the preparation and presentation of financial statements.
2. Describe accounting for fundamental errors and accounting changes.
3. Differentiate accounting for companies engaged in specialized industries with those engaged in ordinary trade or business; accrual from cash basis.

**Psychomotor**

1. Prepare financial statements under the single-entry system and solve problems in realistic situations.
2. Convert cash basis financial statements into accrual basis financial statements.
3. Solve problems on accounting for fundamental errors and accounting changes; specialized industries.

**Affective**

Integrate truthfulness in the preparation of financial statements.

#### III. COURSE OUTLINE: 1 sem/18 weeks/54 hours
Table 3. Course outline

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of Financial Accounting 1 and 2 and overview of the course</td>
<td>Relate the course to Financial Accounting 1 and 2</td>
</tr>
<tr>
<td>Review of the accounting process:</td>
<td>Understand the nature of the accounting process and perform the steps in the cycle.</td>
</tr>
<tr>
<td>- Nature</td>
<td>Evaluate the importance of making adjustments at the end of the accounting period prior to preparation of financial statements.</td>
</tr>
<tr>
<td>- Phases</td>
<td>Journalize adjusting, closing, and reversing entries and understand the need to prepare them.</td>
</tr>
<tr>
<td>- Recording phase</td>
<td>Identify and understand the nature of general-purpose financial statements.</td>
</tr>
<tr>
<td>- Summarizing phase</td>
<td>Identify and describe the basic financial statements.</td>
</tr>
<tr>
<td>- Adjusting, closing and reversing entries</td>
<td>Apply the principles relating to the presentation of general purpose financial statements.</td>
</tr>
<tr>
<td>Presentation of general purpose of financial statements:</td>
<td>Identify and evaluate critically the overall considerations in the preparation of general-purpose financial statements.</td>
</tr>
<tr>
<td>- Nature of general-purpose financial statements.</td>
<td>Describe the structure of financial statements.</td>
</tr>
<tr>
<td>- Overall considerations in the preparation of financial statements.</td>
<td>Identify and describe the minimum requirements for the content of financial statements.</td>
</tr>
<tr>
<td>- Structure of financial statements.</td>
<td>Apply accounting standards relating to preparation of income statement and statement of changes in owner’s equity.</td>
</tr>
<tr>
<td>- Minimum requirements for the content of financial statements</td>
<td>Understand, differentiate, and evaluate the two approaches to income measurement.</td>
</tr>
<tr>
<td>- Balance Sheet</td>
<td>Differentiate single-entry system from the double-entry system.</td>
</tr>
<tr>
<td>- Income Statement</td>
<td>Analyze transactions affecting both the balance sheet and income statement accounts and determine their effect on the statement of cash flows.</td>
</tr>
<tr>
<td>- Statement of Changes in Owner’s Equity</td>
<td>Convert cash basis net income to accrual basis net income.</td>
</tr>
<tr>
<td>- Statement of Cash Flows</td>
<td>Differentiate segment reporting.</td>
</tr>
<tr>
<td>- Accounting Policies and explanatory notes</td>
<td>Understand the concept of comprehensive income and how it is measured.</td>
</tr>
<tr>
<td>Overall considerations in the preparation of financial statements.</td>
<td>Identify, describe, differentiate, and evaluate the three concepts of capital and capital maintenance.</td>
</tr>
<tr>
<td>Structure of financial statements.</td>
<td>Define the elements of income statement and apply the standards relating to the recognition and measurement.</td>
</tr>
<tr>
<td>Minimum requirements for the content of financial statements</td>
<td>Identify, define and describe the content in accounting estimate and changes in accounting policies.</td>
</tr>
<tr>
<td>- Balance Sheet</td>
<td>Analyze cases related to correction of errors.</td>
</tr>
<tr>
<td>- Income Statement</td>
<td>Evaluate published income.</td>
</tr>
<tr>
<td>- Statement of Changes in Owner’s Equity</td>
<td>Net Income</td>
</tr>
<tr>
<td>- Statement of Cash Flows</td>
<td>Change in Accounting Estimate</td>
</tr>
<tr>
<td>- Accounting Policies and explanatory notes</td>
<td>Definition and Nature</td>
</tr>
<tr>
<td>- Accounting treatment</td>
<td>Accounting Treatment</td>
</tr>
<tr>
<td>- Disclosure requirements</td>
<td>Change in Accounting Policies</td>
</tr>
<tr>
<td>- Prior period errors</td>
<td>Definition and Nature</td>
</tr>
<tr>
<td>- Accounting treatment</td>
<td>Accounting treatment</td>
</tr>
<tr>
<td>- Disclosure requirements</td>
<td>Prior period errors</td>
</tr>
<tr>
<td>Discontinued operations</td>
<td>Financial Statement and disclosures</td>
</tr>
<tr>
<td>Financial Statement and disclosures</td>
<td>Describe the nature of discontinued operations.</td>
</tr>
<tr>
<td>Balance Sheet</td>
<td>Identify and analyse appropriate financial statements of accounts related to it.</td>
</tr>
<tr>
<td>Elements of the Balance Sheet</td>
<td>Prepare an income statement and statement of changes in owner’s equity in accordance with international standards.</td>
</tr>
<tr>
<td>- Assets and Liabilities</td>
<td>Forms of Balance Sheet presentation</td>
</tr>
<tr>
<td>- Current</td>
<td>Describe, differentiate and evaluate the forms of Balance Sheet presentation.</td>
</tr>
<tr>
<td>- Non-Current</td>
<td>Assess the necessity of the balance sheet and its weaknesses.</td>
</tr>
<tr>
<td>- Owner’s Equity</td>
<td>Prepare a Balance Sheet in accordance with international standards.</td>
</tr>
<tr>
<td>- Contributed Capital</td>
<td>Statement of Cash Flows</td>
</tr>
<tr>
<td>- Retained Earnings</td>
<td>Describe the nature and purposes of the statement of cash flows.</td>
</tr>
<tr>
<td>- Capital maintenance adjustments</td>
<td>Analyse transactions affecting both the balance sheet and income statement accounts and determine their effect on the statement of cash flows.</td>
</tr>
<tr>
<td>Forms of Balance Sheet presentation</td>
<td>Conversion from cash to accrual basis.</td>
</tr>
<tr>
<td></td>
<td>Accounting Treatment</td>
</tr>
<tr>
<td></td>
<td>Financial statement and its weaknesses.</td>
</tr>
<tr>
<td></td>
<td>Accounting treatment.</td>
</tr>
<tr>
<td></td>
<td>Deficiency single-entry system from the double-entry system.</td>
</tr>
<tr>
<td></td>
<td>Analyze case problems related to real-life situations.</td>
</tr>
<tr>
<td></td>
<td>Prepare financial statements from incomplete records.</td>
</tr>
<tr>
<td></td>
<td>Compute net income by analysis of changes in capital.</td>
</tr>
<tr>
<td>Reconciliation of accounts</td>
<td>Segment reporting</td>
</tr>
<tr>
<td>- Statement from incomplete records (single-entry system)</td>
<td>Define and describe the nature of segment reporting.</td>
</tr>
<tr>
<td>- Conversion from cash to accrual basis</td>
<td>Assess the need to present segment reports.</td>
</tr>
<tr>
<td>Accounting treatment</td>
<td>Analyse cases related to segment reporting.</td>
</tr>
<tr>
<td>Disclosure requirements</td>
<td>Identify and differentiate the two types of segments.</td>
</tr>
<tr>
<td></td>
<td>Apply accounting standards relating to identification of reportable segments.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. CONCLUSIONS AND RECOMMENDATIONS: THE NEXT STEPS

1. Study shows the economic impact of the current state of Philippine education to global competitiveness. However, the study also shows that a shift to the 12-year Basic education (K-12) in order to comply with international accords (Washington and Bologna) would create a big Gap and negative financial impact on HEIs. Thus, strategies were crafted and designed for HEIs in the Philippines during the 10-year transition stage (AY 2012-2022).

2. The study concludes that HEIs must adapt OBE approach and typology-based QA to produce graduates with competencies in accord with international standards. Regulatory and government units such as PRC and CHED, private accrediting agencies (PAASCU & PACU-COA) and certifying agencies (SGS) for ISO 9001:2008 QMS must subsequently revise criteria and audit standards to conform with these new OBE methodology and typology. HEIs must now be classified as Professional Institutes, Colleges and Universities with specific quality and excellence indicators (outcomes and competencies) which are suited to the needs of HEIs to align VMGOs with national goals.

3. A Proposed Outcomes-Based BS Accountancy Course Syllabus developed in this study may serve as a Model for all HEIs, in any field (Engineering, Information Technology, Business & Management, Arts and Sciences).

Eight specific steps (Action Plan) shown below may serve as a guideline for HEIs in the transformation process:

1. Step 1- Implement K-12 for Basic Education
2. Step 2- Implement the Transition strategies for HEIs
3. Step 3- Apply OBE approach and new typology for HEIs QA through government legislation (revision of R.A 7722 (Private Education Law)

4. Step 4- Government Regulatory Agencies (PRC and CHED) must revise Licensure Syllabus and Policies, Standards and Guidelines (PSG) respectively.

5. Step 5- Private accrediting agencies (PAASCU, PACU-COA, SGS) should revise their standards and criteria according to the new OBE approach and typology standards.

6. Step 6- HEIs must adapt the new QA System and revise Strategic and Operational Planning & Control System, integrating the OBE and revised typology in the metrics.

7. Step 7- Re-craft Institutional VMGOs along the new typology criteria

8. Step 8- Revise Program Curriculum and Course Syllabi following the OBE approach

6. REFERENCES

8. Times Higher Education (THE) and Quacquarelli (QS) Symonds University Ranking Report (2011)
THE RESEARCH SCHOOL IN THE FIELD OF ENGINEERING SCIENCES

Magda, Susan Resiga¹ Ștefania, Kifor² and Amelia Bucur³
1 Executive Agency for Higher Education Research Development Innovation Funding, Romania magda.crangasu@uefiscdi.ro
2 Lucian Blaga University of Sibiu, kifors@yahoo.com
3 Lucian Blaga University of Sibiu, amelia.bucur@ulbsibiu.ro

ABSTRACT: The paper proposes the detailing of the concept of “Research School”, which encourage the maximization of the performance, both in the doctoral studies and also in the scientific research. The multi-criteria programming is used for the classification of the Romanian Research Schools in the field of engineering sciences. The application, realized through the method of multi-criteria programming in the field of evaluation and ranking of the research schools, will highlight that an optimum decision may be made through modelling and simulation in this field, with the information provided by Microsoft Excel, regarding the selection of a research school as being the closest to performance or excellence, and also regarding the ranking of the research schools.

Key words: research school, engineering, national assessment exercise, multi-criteria programming

1. INTRODUCTION

According to the current legislative framework of Romanian national education law [2], the higher education is organized in the higher educational institutions that generically named universities.

Any institution of higher education can contain the following organizational units: colleges, departments, institutes, centers or laboratories, design units, consultancy centers or other entities for production and transfer of knowledge and technology (Art. 131). The college is the functional unit that elaborates and distributes the study program.

A college may contain one or more departments, doctoral schools, post-graduate schools and university extensions that are responsible with organizing the study program on types and cycles of university studies.

The department is the functional academic unit that ensures the production, transmission and valorisation of knowledge in one or more fields of expertise. A department may organize centers or research laboratories that operate as income generating units within the university.

The program of doctoral university studies are organized in doctoral schools. Doctoral schools may be organized by a university or a university consortium. The partnerships that are legally made between a university/a university consortium and units of research-development, these entities have been generically named IODUS (Institution Organizing Doctoral University Studies).

Doctoral schools within the IODUS are worked on disciplinary or interdisciplinary themes. To these specifications from the National Education Law[2] were added secondary normative, approved by Government’s decision, „the code of doctoral university studies”, which presents methodological regulations of organizing and conduct of doctoral university studies according to [2].

It has to be specified that the doctoral studies are currently considered to be the third cycle of university studies (after the cycles of bachelor and master) that lead to the achievement of an 8th level qualification degree within The European Framework of Qualifications and The National Framework of Qualifications.

Basically, doctoral studies promote learning through research as advanced form of study that implies the acquiring and producing of knowledge through direct participation in a process of scientific research.

According to the code of doctoral university studies, a doctoral school is defined as an organizational and administrative structure within an organizational institution of doctoral university studies (IODUS). This may be formed through one of the followings:
- an institution of higher education;
- a university consortium;
- through a partnership legally established between a higher educational institution and units of research and development;

The existing (or in under development) legislative framework offers enough flexibility for organizing the activities of doctoral training or the scientific research within a university.

For the above mentioned each case, the organizing options obviously depend upon the university’s profile and it benefits achieved from the freedom offered by the university autonomy.

In this context, the current research proposes to define and detail a concept of “Research School”, which encourage the maximization of the performance both in the doctoral program and also in the scientific research, recognizing the mutual condition within the two essential components of the university activities for achieving the level of excellence.
2. FRAMEWORK OF THE RESEARCH SCHOOL

In Figure 1 we schematically present a possible organization and unification of the departments, doctoral schools and research centers from a university. An organization of this type is, in our opinion, beneficial to the universities with a technical profile, in the first place or for departments with engineering profile from the mixed universities.

The argumentation for this suggestion is going to be presented in the following lines, being preceded by the identification of current problems in the taking place of the activities of doctoral training and scientific research with a technic profile.

![Diagram of a research school from a university](image-url)

Figure 1. Schematic diagram of a research school from a university

The most important point is that the “research school” has the difficulties associated to the doctoral training including doctoral program in the third cycle of university training (after the cycles of bachelor and master), that there is a limited period of time like 3-4 years for the thesis preparation.

Similar surveys have been done within the project „Doctoral Studies in Romania – Organization of Doctoral Schools”[11] in order to identify the best options of organizing the PhD schools.

For the PhD students, in the field of applied sciences and engineering sciences, the experimental component and/or the practical applications of the doctoral research is essential.

Moreover, validating the originality and value of the obtained results must be achieved through scientific journals and/or through attending international conferences. In these conditions, perhaps the most efficient method of ensuring the quality of the PhD training, reflected among others also by the quality of the PhD thesis, is to immerse the PhD student into a research environment that can ensure:

(i) Access to the research infrastructure (specialized laboratories, modern equipment for experimental investigation, hardware and software infrastructure for numerical simulation, access to specialized bibliography, including the main specialized journals from the field of the PhD student’s thesis etc.)

(ii) Conducting the activities within a research group by including experienced researchers who have the ability to acquire the necessary knowledge quickly for the doctoral research program.

For the above requirements, it is necessary to respond the “research school” presented in Figure 1, which reunites in a single entity with doctoral school and research centre that the specific department is constructed on a field or group of fields in the engineering sciences.

Another reason for the need of a research school may be examined by analysing the attributes of the research center, particularly for the engineering research centers have a unique aspect [4], [5].

The fact is that they include (or should include) an important component like; partnership with the industry and transfer the results to the industrial environment. The concept of Engineering Research Centers promoted by the National Science Foundation, and supported by government since the 80s as one of the major innovations in the research policies. It also proved to be a favourable environment for the university-industry collaboration. Besides the infrastructure and proper financing, engineering research is mostly focused on projects and needs to qualify the human resource at the highest level.

Practical training for the human resource is an important component in engineering education (including the bachelor and master degree) for ensuring the quality and safety of the products and technologies. So, the concept “learning through research” for the PhD studies would be realized by put into practice the PhD students into the research team of the projects offered within a research center. Besides the above mentioned two conditions, it should be ensured the following needs:

To connect the doctoral research projects with long-term research programmes or medium-short term research projects.

To provide the necessary human resource to the research center (PhD students) for fulfilling the necessary members of the research teams. The PhD students are usually financed through the PhD scholarships which are separate from the budget of the research projects.

3. THE ADVANTAGES OF SCIENTIFIC RESEARCH AND THE DOCTORAL TRAINING IN RESEARCH SCHOOLS

The main advantages of establishing research schools are the unification of the human resources with well-organized infrastructure into a structure which will be able to carry on the followings:

a) To arrange a high level PhD training for young scientist by the reputed trainer, who has good scientific research career with high level PhD thesis.

b) To organize the training for research projects within the research teams by including both senior and junior researchers.

c) To make collaboration with university and industry for transferring knowledge and using the results for the practical applications. It can also be appealed the employment opportunities for the researchers instructed through doctoral or postdoctoral program.

The above attributes define the coordination of development of the research school, starting from existent structures and infrastructures. The core of a research school is obviously constituted by the PhD supervisors. The research school includes more research groups, whose suggestion is freely accepted. The aim is to increase the performance in the research activity and train the young researchers, having a target to achieve the research excellence on international level.
There are some limitations for the “research school”, which are associated with either to the doctoral school individually or the research center individually. These limitations may be identified as follows:

1. Not well structured administration for conducting doctoral training:
   - it can promote exclusively the relationship PhD student – PhD supervisor, without the significant interaction of the PhD student with other researchers or doctoral students, with the exception of public presentations of research reports or PhD thesis;
   - The PhD supervisor may not be able to sustain the logistics for the research project of the PhD student, or may not be able to ensure access to the infrastructure necessary for the research;
   - The topics of the PhD thesis tend to adapt to the resources available to the PhD supervisor, without considering the scientific approach to some interdisciplinary researches that inherently required an effort of collaboration.

2. The research center as self-financed organization through research projects basis:
   - It may limit drastically its development or it may temporarily have an unsustainable development. In case of human resource, it is based solely on teachers and full-time senior researchers.
   - The portfolio of projects/contracts of research tends to self-limit in a field in which it was previously successful and in which the researching risk is minimized, in favour of the safety of the financing;
   - It is manifested the aging of the research group and the decrease of motivation and appetite for difficult and challenging topics.

In the research field of engineering sciences of development and innovation, it is essential to have a clear definition and argumentation of the research directions assuming the mission of the Research School, which is also the solid argumentation according to the requirements of the economic environment and the society’s expectations.

The focus is often exclusively on recognizing the academic environment, having the result of alienation from the true beneficiaries of the research-development-innovation.

4. FINANCING THE RESEARCH SCHOOLS

The European Science Foundation (ESF) has recently proposed a guide for integrating the national policies and practices of evaluating projects for the various financing lines [7]. The typical financing tools considered in the ESF study are mentioned in Table 1.

<table>
<thead>
<tr>
<th>Financing tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual research projects</td>
<td>Financing dedicated to the proposals sent by a researcher of a research group that forms the research team. Such proposals include a set of objectives, work plan and budget.</td>
</tr>
<tr>
<td>Collaborative research projects</td>
<td>Financing for proposals generated by groups of applicants aiming to improve collaboration at national or international level within a specific project of research.</td>
</tr>
</tbody>
</table>

The ensemble of these financing lines may be combined into a financing instrument like “block grant” for a longer period of time (5-10 years) to sustain the component of sustainability of the research school’s strategy. Clearly, the other financing tools (for example individual or collaborative research projects) may be accessed by researchers or groups of researchers within the research school.

The structure of a financing tool for the research school may be inspired from the program of excellence centers [7]. As it is also highlighted by ESF, to be important to recognize and encourage the various models of excellence centers instead of promoting a model considered “Ideal” at a certain time.

5. APPLYING THE MULTICRITERIAL PROGRAMMING IN THE HIERARCHY OF THE “ROMANIAN RESEARCH SCHOOLS IN THE FIELD OF ENGINEERING SCIENCES”

In this section will be approached, through the method of multicriterial optimization, the hierarchy of the Romanian research schools from the field of engineering sciences.

Multicriterial analysis helps us to have a unitary view on all the research schools from Romania from the field of engineering sciences and not a separate analysis, distinct for each of them. The criteria and actual states to which we will relate the research school will be chosen as being:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Articles published in scientific journals indexed in Web of Science</td>
</tr>
<tr>
<td>02</td>
<td>Articles published in scientific journals from international databases with review process from Engineering Village</td>
</tr>
<tr>
<td>03</td>
<td>Contributions to conferences with rigorous review process</td>
</tr>
<tr>
<td>04</td>
<td>Conferences with rigorous review process</td>
</tr>
<tr>
<td>05</td>
<td>Software</td>
</tr>
<tr>
<td>06</td>
<td>Invention certificate</td>
</tr>
</tbody>
</table>

A decisonal matrix of the following type will be used:
The setting of the values is made by the evaluator of the research schools, with scale. In this sense, we constructed the matrix from table 4.

\[
\begin{align*}
\text{Criterion} & \quad \text{S} & \quad \text{S} & \quad \text{S} \\
\text{C} & \quad \text{C} & \quad \text{C} & \quad \text{C} \\
\text{C} & \quad \text{C} & \quad \text{C} & \quad \text{C} \\
\text{C} & \quad \text{C} & \quad \text{C} & \quad \text{C} \\
\text{C} & \quad \text{C} & \quad \text{C} & \quad \text{C} \\
\end{align*}
\]

Here, \( V_i \) - variant of \( i \), where \( i=1,2,3,\ldots,m \). \( S_h \) - situation/state \( h \), where \( h=1,2,3,\ldots,s \). \( C_j \) - criteria of \( j \) where \( j=1,2,3,\ldots,n \). \( k_j \) - coefficient of importance (weight) given to the criteria \( j \), where \( j=1,2,3,\ldots,n \). \( a_{ijh} \) - the consequence (performance) of the \( i \) variant, for the \( j \) criteria, in case the situation (in the conditions of the state of fact) \( h \) exists.

We may have:

1. The criteria by which the research schools can be evaluated:
   - \( C_1 \) - Articles published in scientific journals indexed in Web of Science;
   - \( C_2 \) - Articles published in scientific journals from international databases with review process from Engineering Village;
   - \( C_3 \) - Contributions to conferences with a rigorous review process.

2. It was assumed that the coefficients of importance of the criteria were: \( k_1 = 0.6, k_2 = 0.2, k_3 = 0.2 \).

3. The research schools were noted with \( V_1 = \text{Sc1}, V_2 = \text{Sc2},\ldots, V_5 = \text{Sc5} \).

4. The situations to which we relate the problem to be solved (states of fact):
   - \( S_1 \) - the Conference Indicator with rigorous review process is made in the optimum way;
   - \( S_2 \) = the Software Indicator is made in the optimum way;
   - \( S_3 \) = the Patents Indicator is made in the optimum way.

The problem of multi-criteria optimization was solved in the event that the states \( S_1, S_2, S_3 \) defined above, have the occurrence probabilities: \( p(S_1) = 0.4 \), \( p(S_2) = 0.5 \), \( p(S_3) = 0.1 \).

Modelling the problem:

Step 1. The elements \( a_{ijh} \) from table 4 are calculated as a product between the level of the values given to the criteria \( C_j \) on a Likert scale from 1 to 5, namely \( N_i(C_j) \) with the importance coefficients \( k_j \) and the probabilities of occurrence of the states \( p(S_h) \). This product is calculated using the following formula:

\[
a_{ijh} = N_i(C_j)k_jp(S_h)\]

Where,

\[
i = 1,2,3,4,5; \quad j = 1,2,3; \quad h = 1,2,3.
\]

In formula (1), all elements are known except for \( N_i(C_j) \), respectively the value level of the decision criteria on a Likert scale. In this sense, we constructed the matrix from table 4, with the values of these levels, which we wrote in the matrix. The setting of the values is made by the evaluator of the research schools, according to his experiences.

The calculation of the values \( a_{ijh} \) is automatically realized by introducing the problem's data in Microsoft Excel and using the program's features.

Step 2. The method of mathematical expectancy will be applied, conditioned by the restriction that all criteria have to be measured on the same Likert scale. In order to do this, at first all the consequences will be transformed into utilities. Utility is a subjective measure, based on the experience and institution of the evaluator of the research schools, of the decision-maker, who expresses his degree of satisfaction when choosing one or another research school.

The mathematical model used for the calculation of the utilities is as follows:

\[
U_{ijh} = \frac{(a_{ijh} - a^p_{ijh})}{(a'_{ijh} - a^p_{ijh})} \quad \text{(2)}
\]

where,

\[
U_{ijh} - \text{the utility of the consequences of variant } i, \text{ for the criteria } j \text{ in the state } h(a_{ijh});
\]

\[
a^p_{ijh} - \text{the most favorable consequence for criteria } j \text{ in state } h;
\]

\[
a^p_{ijh} - \text{the most unfavorable consequence for the same criteria } j \text{ in state } h.
\]

Step 3. For each decisional variant \( i \) and within each state \( h \), it has been calculated the synthesis utility (by multiplication with the coefficient of importance given to each criterion) by using formula (3):

\[
u_{Sih} = \sum k_j U_{ijh} \quad \text{(3)}
\]

where,

\[
u_{Sih} - \text{the synthesis utility for each decisional variant } i \text{ and state } h.
\]
\[
\sum_k \prod_j u_{ijk} \quad - \text{a summing of all the products between utilities and the importance coefficients of the criteria, on each line of the matrix}
\]

**Table 7.** The matrix with the synthesis utilities in the conditions of state S₁

<table>
<thead>
<tr>
<th>Criteria of decision</th>
<th>C₁</th>
<th>C₂</th>
<th>C₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients of importance (k)</td>
<td>0.5</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>V₁</td>
<td>0.50</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>V₂</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>V₃</td>
<td>0.00</td>
<td>0.50</td>
<td>0.00</td>
</tr>
<tr>
<td>V₄</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>V₅</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

The same procedure has been used in order to find the synthesis utilities in the case of states S₂ and S₃ and obtained matrices are presented in the table below:

**Table 8.** The matrix with synthesis utilities in the conditions of states S₂

<table>
<thead>
<tr>
<th>Criteria of decision</th>
<th>C₁</th>
<th>C₂</th>
<th>C₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients of importance (k)</td>
<td>0.5</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>V₁</td>
<td>0.50</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>V₂</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>V₃</td>
<td>0.00</td>
<td>0.50</td>
<td>0.00</td>
</tr>
<tr>
<td>V₄</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>V₅</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Table 9.** The matrix with synthesis utilities in the conditions of states S₃

<table>
<thead>
<tr>
<th>Criteria of decision</th>
<th>C₁</th>
<th>C₂</th>
<th>C₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients of importance (k)</td>
<td>0.5</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>V₁</td>
<td>0.50</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>V₂</td>
<td>0.00</td>
<td>0.33</td>
<td>1.00</td>
</tr>
<tr>
<td>V₃</td>
<td>0.00</td>
<td>0.67</td>
<td>0.00</td>
</tr>
<tr>
<td>V₄</td>
<td>0.00</td>
<td>0.00</td>
<td>0.50</td>
</tr>
<tr>
<td>V₅</td>
<td>1.00</td>
<td>0.33</td>
<td>1.00</td>
</tr>
</tbody>
</table>

A synthesis of the results from tables 8 and 9 is shown in table 10:

**Table 10.** The matrix of the synthesis utilities for the multi-criteria problem to be solved

<table>
<thead>
<tr>
<th>States</th>
<th>S₁</th>
<th>S₂</th>
<th>S₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>V₁</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>V₂</td>
<td>0.20</td>
<td>0.20</td>
<td>0.27</td>
</tr>
<tr>
<td>V₃</td>
<td>0.10</td>
<td>0.10</td>
<td>0.15</td>
</tr>
<tr>
<td>V₄</td>
<td>0.50</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>V₅</td>
<td>0.80</td>
<td>0.80</td>
<td>0.87</td>
</tr>
</tbody>
</table>

**Step 4.** Based on the synthesis utilities from table 10, a new matrix has been realized that contains the variable of decision on the rows of the matrix, and the states S₁, S₂, S₃ on the columns. Thus formed, the problem may be treated as any other problem of single criteria decision. In the conditions of knowing the probabilities of manifestation of the states S₁, S₂, S₃, the decisional variant with the highest mathematical expectancy have been chosen, according to the formula below:

\[
V_{opt} = \sum u_{sh} \cdot p_h \quad \text{…………………………………(4)}
\]

Where,
- \(u_{sh}\) – synthesis utility for each decisional variant i and state h
- \(p_h = p(S_h)\) is the possibility of manifestation of state h.

**Table 11.** Matrix regarding the synthesis utilities associated to the decision variables for each state and their hierarchy

<table>
<thead>
<tr>
<th>States</th>
<th>S₁</th>
<th>S₂</th>
<th>S₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>V₁</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>V₂</td>
<td>0.20</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>V₃</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>V₄</td>
<td>0.50</td>
<td>0.40</td>
<td>0.44</td>
</tr>
<tr>
<td>V₅</td>
<td>0.80</td>
<td>0.80</td>
<td>0.81</td>
</tr>
</tbody>
</table>

In the last column, the values of the mathematical expectancy have been registered for each decision variant which has been obtained by applying formula (4).

Moreover, the last column classifies and ranks, in report to the value’s criteria, the variants candidate for making the decision in report to the criteria and influence coefficients in the case of the problem to solve, as follows:

1) \(V₅ = Sc₅ \to 0.81\); 2) \(V₁ = Sc₁ \to 0.50\); 3) \(V₄ = Sc⁴ \to 0.44\); 4) \(V₃ = Sc₂ \to 0.21\); 5) \(V₃ = Sc₃ \to 0.10\).

From the study of the values written in the matrix, the maximum value obtained through the method of mathematical expectancy is 0.8₁ and it refers to choice as optimum of the decisional variant \(V₅ = Sc₅\).

**Figure 2.** Simulation in Microsoft Excel

### 6. CONCLUSIONS

a) The application, realized through the method of multi-criteria programming in the field of evaluation and ranking of the research schools, has highlighted that an optimum decision can be made through modeling and simulation in this field with the information provided by Microsoft Excel, regarding the selection of a research school as being the closest to performance or excellence, and also regarding the ranking of the research schools. The software offered the optimum solution for the decisional variant \(V₅\) and for research school Sc₅.

b) Even though the National Education Law[2] mentions the necessity of efficiently using the resources existent in the system, not all the methodologies of institutional / individual evaluation follow these requirements, much less encourage scientific collaborations. However, scientific collaborations are the foundation of establishing the research schools at national level.
REFERENCES


2. Legea Educatiei Nationale. Monitorul Oficial al Romaniei, Partea I, Nr. 18/10.01.2011


IMPLEMENTING ALTERNATIVE METHODS FOR QUALITY EVALUATION THAT AIM THE DEVELOPMENT OF A SUSTAINABLE BUSINESS

Irina, Șogorăscu1 Amelia, Bucur1 Constantin, Opren1 Mihai Victor, Zerbes1 and Alina, Rus1
1 “Lucian Blaga” University of Sibiu, amelia.bucur@ulbsibiu.ro

ABSTRACT: Global macro economical context, forced the researchers and organization from food industry, to focus more on identifying and developing of new alternative methods that might lead to a good performance in crisis conditions. These new methods aim a cost optimization, reduction of the environmental impact and the increase of customer satisfaction, while all the organizations pursue the sustainability of their own business.

The method presented in this paper, confirms the efforts of the researchers and organizations in food industry. In this study, food quality was defined throughout attributive and quantitative dimensions in order to establish a correlation between them. Sensory method it is proposed as an alternative in the educational system with the purpose of training the future specialists for sustainable development of the society.

Key words: food’s quality; modelling; simulation; sustainability.

1. INTRODUCTION

In the global context of material resources and energy crisis, food crisis, lies in the focus of all concerns. Correlated with the current demographic growth, the dimension of the issue is acquiring significant negatives meanings.

The general policy for agriculture durability and ensuring food security results from sustainable development and aims to produce the right food quantity, without affecting the environment.

The complexity of the food composition and the diversity of the quality features, which are identified in order to define quality, require the usage of some adequate analysis methods, in accordance with the technical progress and quality standards.

Sensory method is the oldest quality evaluation method. With a 60% share in the food quality evaluation, the sensory method, recorded significant progresses in the last three decades.

A series of researches have been the object for some national and international projects, by approaching new trends in applied sensory. COST FA 1001[1] and UMAMI [2] are highlighted here.

The purpose of the current research is the sensory analysis objectification and the usage on a large scale in the evaluation of the food quality.

In this sense the project team defined the quality of the food in terms of two dimensions:

- **Attributive dimension** – expressed by a quality indicator: colour, texture, consistency, taste, scent, etc;
- **Quantitative dimension** – determinate by dimensional value of an object: form, weight, substance content (fats, salt, water, sugar), acidity, etc.

These two types of features are directly related, trough the fact that the quantitative dimension determinates the attributive dimension of the food, a certainty proved in the laboratory using instrumental analysis methods.

Therefore, if determining the quantitative characteristics the attributive characteristics can be approximated. For example: a 3% value of the sodium chloride in the content of a pate indicates an intense salty taste, and a value of 0.5% of the sodium chloride in the same content, indicates a less salty taste.

The problematic of this research, was to determine the approximation of a product quantitative dimension, by knowing the attributive dimension.

Some standardized and validated methods have been used to determine the quantitative characteristics:


To determinate the attributive dimension, some analytical methods have been used for sensory examination. Among this quality assessing methods used in this research are mentioned:


For the statistical data processing SPSS 16 program was used.

As a case study was chosen a meat product, tightly closed sterilized canned container: chicken liver pate.

2. CASE STUDY

The volume of the analyzed survey was of 69 types of „Pate Bucegi pasăre”, randomly selected. Thus, it was realized the base model. The processing and evaluation of the information from the database model is automatically made by the SPSS 16 program, consisting of the following steps:

- **Step I:** Centralizing the acquired data – the raw data, acquired through actual measurements had been centralized in a special file of the program SPSS 16;
- **Step II:** Analysis of correlations – in order to determine how close is the connection between the quantitative values and attributive values (water-texture, fat-texture, collagen protein-texture, salt-taste, protein-taste, sodium nitrite-colour), it was calculated in SPSS 16 the value of...
the Pearson coefficient of correlation, in order to determine the type of correlation between the two discrete characteristics. This coefficient of always contained in the range [0,1], a value closer to zero indicates a weaker correlation between the analyzed variables, and a value closer to one indicates a stronger correlation between them. The analysis and interpretations of the correlations are presented below:

Table 1. The coefficient of correlation between the variables water-texture

<table>
<thead>
<tr>
<th></th>
<th>water</th>
<th>texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>Pearson coefficient of correlation</td>
<td>1,000</td>
</tr>
<tr>
<td>texture</td>
<td>Pearson coefficient of correlation</td>
<td>-0,855</td>
</tr>
</tbody>
</table>

The correlation displayed in the table is bivariated, one of the variables being dependent and the other one independent (factorial). The Pearson coefficient of correlation is equal to -0,855, which means that there is a negative (indirect) correlation of high intensity between the two variables.

Table 2. The coefficient of correlation between the variables fat-texture

<table>
<thead>
<tr>
<th></th>
<th>fat</th>
<th>texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>fat</td>
<td>Pearson coefficient of correlation</td>
<td>1,000</td>
</tr>
<tr>
<td>texture</td>
<td>Pearson coefficient of correlation</td>
<td>0,690</td>
</tr>
</tbody>
</table>

The correlation displayed in the table is bivariated, one of the variables being dependent and the other one independent (factorial). The Pearson coefficient of correlation is equal to 0,690, which means that there is a positive correlation (direct) of medium (moderate) intensity between the two variables.

Table 3. The coefficient of correlation between the variables collagen protein-texture

<table>
<thead>
<tr>
<th></th>
<th>collagen protein</th>
<th>texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>collagen protein</td>
<td>Pearson coefficient of correlation</td>
<td>1,000</td>
</tr>
<tr>
<td>texture</td>
<td>Pearson coefficient of correlation</td>
<td>0,896</td>
</tr>
</tbody>
</table>

The correlation displayed in the table is bivariated, one of the variables being dependent and the other one independent (factorial). The Pearson coefficient of correlation is equal to 0,896, which means that there is a positive correlation (direct) of high intensity between the two variables.

Table 4. The coefficient of correlation between the variables salt-taste

<table>
<thead>
<tr>
<th></th>
<th>taste</th>
<th>salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>taste</td>
<td>Pearson coefficient of correlation</td>
<td>1,000</td>
</tr>
<tr>
<td>salt</td>
<td>Pearson coefficient of correlation</td>
<td>-0,015</td>
</tr>
</tbody>
</table>

The correlation displayed in the table is bivariated, one of the variables being dependent and the other one independent (factorial). The Pearson coefficient of correlation is equal to -0,015, which means that there is a negative correlation (indirect) of very low intensity between the two variables.

Table 5. The coefficient of correlation between the variables protein-taste

<table>
<thead>
<tr>
<th></th>
<th>taste</th>
<th>protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>taste</td>
<td>Pearson coefficient of correlation</td>
<td>1,000</td>
</tr>
<tr>
<td>protein</td>
<td>Pearson coefficient of correlation</td>
<td>0,212</td>
</tr>
</tbody>
</table>

The correlation displayed in the table is bivariated, one of the variables being dependent and the other one independent (factorial). The Pearson coefficient of correlation is equal to 0,212, which means that there is a positive correlation (direct) of low intensity between the two variables.

Table 6. The coefficient of correlation between the variables sodium nitrite-colour

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Sodium nitrite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Pearson coefficient of correlation</td>
<td>1,000</td>
</tr>
<tr>
<td>Sodium nitrite</td>
<td>Pearson coefficient of correlation</td>
<td>0,690</td>
</tr>
</tbody>
</table>

The correlation displayed in the table is bivariated, one of the variables being dependent and the other one independent (factorial). The Pearson coefficient of correlation is equal to 0,690, which means that there is a positive correlation (direct) of high intensity between the two variables.

- Step III: Analysis of regressions – in order to determine which is the most appropriate model of regression, there have been taken into consideration the following three conditions: the report of correlation has to tend to 1, the value of the ANOVA analysis of the significance of test F to be lower than 0,05, the values of the significance of test “t” for the parameters that accompany the independent variable in the model of regression to be lower than 0,05. Thus the program was asked to display the coefficient afferent to the independent variable from the regression equation and to build the graphic of approximation of the model, obtaining the results from fig.3, 4, 5, 6, 7:

Figure 1. Models of regression – graphic representation
The continuous line represented in the graphic of the regression function \( y = a + bx \), (in the case of the application \( y = 76,603 - 1,897 x \)). This function allows the estimation of values for one of the variables, if the value for the other variable is known. Thus, if the value of the variable: texture is known, it is possible to estimate the value of the second variable: water and the reverse.

![Figure 2. Models of regression – graphic representations](image)

The continuous line represented in the graphic of the regression function \( y = a + bx \), (in the case of the application \( y = -1,259 + 0,295 x \)). This function allows the estimation of values for one of the variables, if the value for the other variable is known. Thus, if the value of the variable: texture is known, it is possible to estimate the value of the second variable: collagen protein and the reverse.

![Figure 3. Models of regression – graphics representations](image)

The continuous line represented in the graphic of the regression function \( y = a + bx \), (in the case of the application \( y = 1,308 - 0,012 x \)). This function allows the estimation of values for one of the variables, if the value for the other variable is known. Thus, if the value of the variable: taste is known, it is possible to estimate the value of the second variable: salt and the reverse.

![Figure 4. Models of regression – graphic representations](image)

The continuous line represented in the graphic of the regression function \( y = a + bx \), (in the case of the application \( y = 1,256 + 0,118 x \)). This function allows the estimation of values for one of the variables, if the value for the other variable is known. Thus, if the value of the variable: taste is known, it is possible to estimate the value of the second variable: salt and the reverse.

![Figure 5. Models of regression – graphic representations](image)

The continuous line represented in the graphic of the regression function \( y = a + bx \), (in the case of the application \( y = -6,00 + 10,00 x \)). This function allows the estimation of values for one of the variables, if the value for the other variable is known. Thus, if the value of the variable: colour is known, it is possible to estimate the value of the second variable: sodium nitrite and the reverse.

- Step IV: Analysis of the results – the conclusions of the statistical analysis refer generally to the degree of fitting of the analyzed in a certain STAS, in certain norms, limits and also, to the determination of forecasts or of measure of improving the analyzed values.
3. CONCLUSIONS

The conclusion of the statistical analysis demonstrates a correlation between determinate variables and approximated variables, confirming the degree of the sensory method objectivity.

The research results have many applications in industry with a positive impact in all 4 systems of sustainable development:

- Human: ensuring highly specialized personnel in the food industry;
- Economical: objectification of the sensory analysis method can partially replace the quantitative determination currently used in food industry, involving also a cost reduction related to laboratory equipment and reagents;
- Ambiental: the analysis method does not affect the environment.
- Technological: can be used for new products development, improvement of the existent products, changes in the technological process, cost reduction and/or selecting of new supplies sources, quality control and customer preferences testing.

The purpose of this study is to facilitate thorough knowledge of the theoretical concepts and experimental methodology from food industry and from other connect scientifically areas such as: quality, psychology, mathematical modelling, statistics, nutrition and physiology.

4. REFERENCES

1. COST FA 1001 Application of the innovative fundamental relations: food product - structure - property for food products design, beneficial for health, confort and leisure. Project coordinator Prof. Laura Piazza - Department of Food Science and Microbiology University of Milan. Romanian partners: Dunarea de Jos University from Galati, Bio resources Institute Bucharest.
2. UMAMI The 5th basic taste and new resources for balancing the taste and the flavour. Application of artificial intelligence for automated recognition of the compounds. Beneficiary: Dunarea de Jos University from Galati.
QUALITY INDICATORS FOR SHAPING THE COMMUNICATION PROCESS IN THE UNIVERSITY TYPE OF PUBLIC ORGANIZATION

Mihail Aurel, Titu¹ and Daniela Maria, Flucsä²
1 Lucian Blaga University of Sibiu, titu.mihail@gmail.com
2 Lucian Blaga University of Sibiu, daniela_flucs@yahoo.com

ABSTRACT: In the context of competition in higher education environment the university type of public institution ensures high quality, accessible, challenging university and research programs, expertise services based on a strong motivation, commitment and professional attitude from the teaching body and students. National documents promoted by ARACIS show that “The internal dimension of academic quality is built based on the legislation in force and according to the specific of each university, its tradition and cultural heritage. It is fully under the responsibility of each university. In this approach, quality assurance becomes a process adapted to the existing institutional specific and it is instituted as a mechanism through which academic results or performances are constantly improved”. Communication quality management is integrant part of the institutional quality management system and to this extent the formulation of general criteria, quality indicators and standards is considered so that emphasis is placed not only on the organization’s conformation to a set of predefined or predetermined quantitative and qualitative conditions but also on the deliberate, voluntary and proactive commitment of the institution for accomplishing certain performances that can be proved by effective results. Within the presented paper, in considering the importance of communication for all process participants, we have identified and defined a series of qualitative indicators which, through content and structure, hold a certain weight in communication quality management implementation in the organization. In formulating the communication strategies, in designing the informational system of a public institution in general and of the university type of public institution these groups and subgroups of indicators, which represent the quintessence of the apprehensions, believes related to sending the information formulated by the stakeholders and actors of the communicational field from all structures of an academic institution, are suggested.

Key words: communication, quality indicators, public organization, quality management

1. INTRODUCTION

Permanent changes in education with an unprecedented speed determine the academic institution to adapt development strategies and policies in the sense of extending the traditional knowledge supplier mission and correlating it with the demands of the social and economic environment [12].

The university – as public institution – promotes and supports in the local, regional, national and international community the development of a culture of action based on innovative and systematic knowledge; a culture of proactive and participative attitude; a culture of personal development, of integration in diversity and globalization [8].

Academic quality assurance is one of the major concerns of the Bologna Process, process in which all university type of public institutions in Romania are involved.

Its accomplishment is dependent on the correspondences established between the meanings of academic quality and the changes that take place in higher education.

Since these characteristics and changes are able to influence significantly academic quality assurance, the correspondences between the dynamic of the system or higher education institutions and quality approach are essential [10].

As we have shown communication quality management is integrant part of the institutional quality management system.

Thus, the diagnosis of the human resource’s perception on the institutional communication system is necessary.

Also, in the same tune, within the institutional evaluation process including indicators in the evaluation tools, a diagnostic analysis regarding customers’ and partners’ point of view, of the communication relations between the institution and them is required in order to have a concrete image regarding the coherency, consistency and efficiency of the communication mechanisms functioning manner.

The evaluation of these aspects determines the best managerial decisions regarding communication quality improvement to be taken [1].

2. QUALITY INDICATORS. GENERAL PRESENTATION.

In order to perform a quality type of research, abiding by existing evaluation procedures available in the university type of public institution and the harmonization to general indicators weight, we have suggested a set of indicators which are presented below.

According to practices, the indicators were structured in groups and subgroups. The set of indicators is structured in 7 groups in the following manner:

1. Harmonization between the institutional mission and the personal development objectives of the human resource;
2. Internal communication. Quality of information and evaluation of the informational system;
3. Communication with the student community in the evaluation of the teaching staff;
4. Communication management. Communication with the human resource;
5. Integration of the student community in the educational system;
6. Student communication with academic structures;
7. Communication of student associations with academic structures.

The groups were further divided in subgroups aimed at identified global or particular aspects and are applicable in evaluating the communication with the human resource, with the student community in general and with the student associations in particular, three main elements which illustrate the quality of the communication management from within the institution.

![Figure 1. Structure of communication quality evaluation indicators set](image_url)

3. Evaluation indicators of information quality of which the human resource benefits from

These indicators enclose two groups and determine in a clear formulation the characteristics necessary for the agreement between the human resource’s requests and the obvious realities of the institutional communication process.

We have defined the indicators in two specific groups:

**GROUP 1. HARMONIZATION BETWEEN INSTITUTIONAL MISSION AND OBJECTIVES AND PERSONAL DEVELOPMENT OBJECTIVES OF THE HUMAN RESOURCE**

This group cumulates quality indicators at the level of the entire human resource of the university type of public institution, the community of teaching and administrative staff. Next we will present the names of the two semi-groups included, and by defining the indicators we will highlight two significant elements in the management of an institution, in the following manner:

**Subgroup I A – Level of human resource integration in the organization**

**Indicator 1. Human resource integration in the organization.**

The indicator defines the level of human resource integration and identification with the organization’s values.

**Subgroup I B – Capitalization of human resource within the institution**

**Indicator 2. Degree of institutional interest for human resource development.**

The indicator reflects the managerial approach to the strategies of human resource development, capitalization and continuous improvement.
GROUP 2. INTERNAL COMMUNICATION. INFORMATION QUALITY AND EVALUATION OF THE INFORMATIONAL SYSTEM points out a description of information capitalization, by means of its subgroups and included indicators, in the following manner:

Subgroup II A. – Manner of sending information in accordance with its utility in time

Indicator 3. Access to information related to sending – receiving factors.

This indicator illustrates the extent to which the time factor may increase or decrease the value of information sent through the system.

Subgroup II B. – Quality of information according to its source

Indicator 4. Information quality level in accordance with source qualification.

This indicators reflects the qualification of information sources, their authorization in using and sending information.

4. INDICATORS REGARDING ACADEMIC EVALUATION OF THE STUDENT ENVIRONMENT

This set of indicators presented in group 3, the first group which refers to the student community reflects the appreciation degree of the academia on the manner in which students perceive the university environment but also the quantification of extra-didactic university interests in developing the organizational culture, of the students’ feeling of belonging to the system.

GROUP 3. COMMUNICATION WITH THE STUDENT COMMUNITY IN THE EVALUATION OF THE TEACHING STAFF includes three sub-groups of quality indicators that reflect the teaching staff assessment in relation to the knowledge students have about the organization, significant indicators in the assessment of information quality available to the student community.

Let us proceed to a detailed presentation of the group with defining included indicators:

Subgroup III.A. – Teaching staff assessment of the level of student integration

Indicator 5. Student training in view of their integration in the system. This indicator defines the quality of teaching staff preoccupation, in charge of promoting the educational system that will further assimilate students.

Subgroup III.B. – Teaching staff assessment of student access to information

Indicator 6. Degree of student information.

Similar to the previous indicator, this one defines the quality of teaching staff preoccupation, in charge of making interesting information available to students, including a notification of hazardous information

Subgroup III.C. – Quality of the teaching staff – student partnership

Indicator 7. Student access to professional development mechanisms.

This indicator reflects the degree in which teaching staff supports communication with students outside and within the educational process in view of ensuring a partnership meant to provide students the opportunity for professional development by means of training programs, internships or scientific events mutually designed.

Indicator 8. Preoccupation for student involvement in projects.

This indicator illustrates the teaching staff preoccupation for enlarging the knowledge horizon of their students.

5. INDICATORS REGARDING THE VALUE OF THE INFORMATION SENT IN THE INTERNAL ENVIRONMENT AND ITS PERCEPTION IN ASSESSING HUMAN RESOURCE

The value of the information sent through the institution’s communication system is reflected in its accuracy degree, its efficiency being appreciated by the human resource according to its accessibility, to the degree in which information sources are blocked, to the availability reported to the issuing time and reception time.

GROUP 4. COMMUNICATION MANAGEMENT. COMMUNICATION WITH THE HUMAN RESOURCE includes the quality and indicators subgroups able to facilitate a quality evaluation of the entire informational system in relation to the existence of communication barriers, qualification of information sources, blocking the communication process by information that is not true to reality.

The structure of this group of indicators is given below:

Subgroup IV.A. - Designing the communication system

Indicator 9. Efficiency of the communication system.

It defines the degree of human resource knowledge of the internal communication system and assessment of the communication methods design.

Indicator 10. Quality of information sending process.

This indicator reflects information quality in relation to the qualification of sources and connections established among organizational structures in view of efficient information sending with a significant weight in the evaluation of the entire system.

Subgroup IV.B. – Level of perceiving communication barriers

Indicator 11. Information quality.

This indicator evaluates the value of the information sent through the internal communication system related to the
managerial interest for system improvement and eliminating all disturbing factors that might prevent its proper functioning.

**Subgroup IV.C. - Human resource management**

**Indicator 12. Quality of the management – human resource relationship.**

This indicator may be defined as a reflection of managerial structure receptiveness towards the solutions brought about by employees in view of improving communication quality, communication system.

The presentation of values obtained from evaluations performed during research will highlight, just like all documents on quality assurance in higher education, the significance of student assessment of institutional management quality, in the present case in the communication management within the organization.

The set of indicators includes three groups (with the associated subgroups and quality indicators with a significant rate in the evaluation of the communication process) which quantify in percentage within the whole process the quality of communication with the student community.

### 6. INDICATORS REGARDING COMMUNICATION QUALITY IN ASSESSING THE STUDENT ENVIRONMENT

This chapter contains three groups of indicators designed to reflect the student’s degree of belonging to the educational environment, the quality of the management with the entire student community and in particular, with the student associations.

**GROUP 5. INTEGRATION OF STUDENT COMMUNITY IN THE EDUCATIONAL SYSTEM** includes the subgroups and indicators reflecting the sense of involvement, motivation and the degree of belonging to the institution’s values and mission.

Subgroup V.A. – Degree of student initiation to institutional mission, vision, objectives and values in the process of student evaluation.

**Indicator 13. Quality of student information about the educational system.**

This indicator reflects the extent to which university students are familiar with the operation of institutional structure and strategies.

**Indicator 14. Quality of student information holding.**

This indicator reflects the degree of student information, the extent to which they have access to information sources.

**GROUP 6. STUDENT COMMUNICATION WITH ACADEMIC STRUCTURES** cumulates the subgroups and indicators that are defining for the evaluation of student relationship management, the extent to which their projects, problems and objectives are relevant for the public academic institution. Subgroup V.I.A. - Management of student communication process

**Indicator 15. Quality of student communication with managerial structures.**

This indicator reflects the extent to which institutional administration evinces responsiveness towards student objectives.

**Indicator 16. Quality of communication with students ensured by factors in charge.**

The indicator has significant weight in assessing the activity and efficiency of the factors in charge of student relationship management (mentors, tutors, institutional structures).

Subgroup V.I.B. - Quality of student problem management

**Indicator 17. Degree of student problems hearing.**

The indicator reports to what an extent the student community receives answers to their requests from university or faculty administration.

**Indicator 18. Quality of student counselling and mentoring.**

The indicator expresses the degree of communication between students and tutors, between students and mentors providing assistance in view of institutional operation mechanisms knowledge, identifying optimal solutions for professional development.

**GROUP 7. COMMUNICATION OF STUDENT ASSOCIATION STRUCTURES WITH ACADEMIC STRUCTURES.** The indicators included in this group reflect the manner of accomplishing a partnership with the student community that requires not only an understanding of the problems confronting young people, but also initiating a permanent dialogue aimed at identifying and analyzing situations in which they require support.

Subgroup V.IIA. – Quality of relationship management with student association structures

**Indicator 19. Quality of the extent of the relationship between student association structures and academic structures.**

This indicator reflects the interest and proclivity for encouraging and supporting student association activities.

**Indicator 20. Quality of communication between student associations and academic structures in charge of student service management.**

This indicator quantifies the degree in which through specific academic structures support and counselling is ensured, the relationship between student organizations and external environment, public institutions, university partners is facilitated.

In the context of defining, designing and establishing the weight of each indicator its content was also mentioned.
7. CONCLUSIONS

The indicators groups have been defined as a result of an internal documentary research after which 48% of the respondents have estimated that the internal communication ways are efficiently designed, 31% of the respondents have estimated the internal communication ways as being only satisfactory (Fig. 2) and regarding questioning about the staff in the organization’s administrative structures knowledge of the communication system, 41.4% of the employees who took part in the study have a satisfactory level of knowledge of the communication system, 27.6% good, and 24% very good.

Introducing in the quality procedures and the institutional evaluation procedures the suggested indicators represents a highly important stage in ensuring communication quality management in the organization.

Making these indicators by the university type of public institution guarantees a better functioning of the relations between the human resource and the institution’s management, between the student community and university, certifying the realization of the quality management principle customer focus.

Designing the set of indicators has as purpose ensuring a coherent communication frame for the continuous improvement of the communication system in the institution, for permanently ensuring quality and qualification of information sources, of time efficiency in sending information.

Reorganizing communication management in the university type of public institution based on this set of indicators is considered as a refinement process by introducing at the level of all structures performance indicators.

8. REFERENCES

9. Țîțu A.M, Flucșă Daniela Aspects regarding principles content and actions imposed to creating a procedure prior to adopting a communication quality management plan in a organization, 5th International Conference on Manufacturing Science and Education MSE - Creative thinking in engineering and academic education, Sibiu, Romania, (2011).


ABSTRACT: European initiatives on quality education started in higher education and vocational education and training.

Objectives: Identification of the main EU initiatives in quality assurance; Analyzing the stage of applying the European Parliament and Council Recommendation on the European constitution European Framework of Reference for Quality Assurance in Education and Training; There were studied the official EU documents and other papers in the subject matter. Intermediate results show: It is necessary to ensure inter-comparability of educational systems, using indicators and through the establishment and adherence to common principles of quality assurance in education. Implications of the European approach is to develop national quality assurance systems.

Key words: quality management, education, quality assurance

1. INTRODUCTION

Documents and the latest European initiatives put an increasing emphasis on the need to address unified, effective and sustained implementation of European instruments of education and training. This concerns but not exhaustive the following:

- European Framework of Reference for Quality Assurance in Education and Training (EQARF / EQAVET)
- European Qualifications Framework for Lifelong Learning (EQF)
- European Credit System for VET (ECVET)
- EUROPASS
- Key competences for lifelong learning
- Recognition of learning contracts
- Guidance and counseling for lifelong learning.

2. THE EUROPEAN FRAMEWORK OF REFERENCE FOR QUALITY ASSURANCE IN EDUCATION AND TRAINING (EQARF / EQAVET)

The European Quality Assurance Reference Framework for Vocational Education and Training is a reference tool designed to assist Member States in improving the quality of education and training (VET). Implementation EQARF contribute to increased transparency and consistency in education and training policies developed among Member States, thereby promoting mutual trust, labor mobility and lifelong learning. On June 18, 2009 was adopted Parliament and European Council Recommendation on the establishment of a European Quality Assurance Reference EQARF / EQAVET.

In 2003, at the European Commission's initiative, is created the Technical Working Group for Quality Assurance Training (TWG), which is developing the Common European Framework for Quality Assurance in Training (CQAF). CQAF includes quality criteria formulated in the form of questions for each of the quality cycle stages, and a set of benchmarks.


In 2005, it is established at the initiative of the European Commission, European Network for Quality Assurance Training (ENQAVET), later (in 2010) EQAVET. Currently, in the ENQA-VET are represented 25 EU countries, including Romania.

The main objectives of the ENQA-VET / EQAVET are:

- The development further cooperation at European level and the development of exchanges of good practices in quality assurance training, within and between Member States, between training and higher education; between training providers and key stakeholders
- ENQA VET prepares a proposal for the Common European Framework of Reference for Quality Assurance Training (EQARF) from CQAF and taking into account the suggestions for improvement of Member States. EQARF keep fundamentals introduced CQAF (quality cycle model, the emphasis on self-training providers, quality criteria and benchmarks), while stressing the need to focus on improving the quality of training.

The document recommends that member states use EQAVET developing training systems, support lifelong learning, promoting a culture of quality and innovation at all levels. It also urges Member States to establish within 24 months of the approval of Recommendation a national approach to European Framework of Reference for Quality Assurance in training following a transparent process of consultation with key stakeholders. Defining this approach will enable them to provide national qualification programs according to European requirements and create prerequisites for European recognition of national certificates of professional competence. [2].

Implementation of Recommendation entails several successive steps:
• Knowledge of the recommendations by key stakeholders
• Adaptation and operational quality criteria and indicative descriptors in the working tools at system and provider level
• Create and use a database to measure quality indicators

At European level, current efforts are directed to clarify all aspects of interpretation in the context of each Member State's indicative descriptors and indicators, to identify the state where located, at system and provider, implementing quality assurance.

There are three fundamental elements of content, useful for development of quality systems: (1) General recommendations on the educational policies - which form the document, (2) lists indicative descriptors - at system and VET provider level - contained in the Appendix I of Recommendation, (3) list of indicators - included in Appendix II of the Recommendation.

In the body of the document it is recommended to use EQARF Member States to develop training systems, support lifelong learning, promoting a culture of quality improvement and innovation at all levels. The document supports the implementation of European tools for VET, such as the European Qualifications Framework (EQF), the European Credit System for VET (ECVET) and the common European principles for identification and validation of non formal and informal learning.

Framework provides common principles, quality criteria, indicative descriptors and indicators that may help in assessing and improving existing systems and providing VET.

The insurance contains a cycle and improve the quality of four key steps: (1) planning, (2) implementation, (3) evaluation and (4) review of the education and training course supported by common quality criteria, indicative descriptors and indicators of quality.

Application of National Reference Framework includes several common elements:

- The framework will be applied both in the VET system, as well as the providers of VET, including at the award of qualifications.
- Measuring instruments will be used to prove the effectiveness and fairness of the system, based on indicators. These tools will allow a decision based on evidence, on developing or improving the quality, level and system provider.
- Monitoring processes will be applied, which combine internal and external mechanisms of evaluation, supported by measurement and qualitative analysis to identify the strengths of systems, processes and procedures, and areas for improvement: [3].

Figure 1. Quality cycle proposed by CQAF / EQAVET

Monitoring processes will be applied, which combine internal and external mechanisms of evaluation, supported by measurement and qualitative analysis to identify the strengths of systems, processes and procedures, and areas for improvement: [3].

In the policy on quality assurance in VET, Recommendation invites Member States:

- Use and further develop the European reference for quality assurance, quality criteria, indicative descriptors and reference indicators as set out and described in the annexes, to improve and develop their VET systems, support lifelong learning strategies lifelong learning and implementing the European Qualifications Framework and the European Quality Charter for mobility and to promote a culture of quality improvement and innovation at all levels. More emphasis should shift from VET to higher education.
- To design, to June 18, 2011, an approach aimed at improving quality assurance systems at national level, as appropriate, and use the most effective framework involving the social partners, regional and local authorities and other relevant stakeholders in the accordance with law and practice.
- To actively participate in the European reference network for quality assurance as a basis for further development of common principles, reference criteria and indicators, guidelines and tools for quality improvement in VET appropriate national, regional and local.
- To establish if it is not yet a national reference point for quality assurance for VET, which is linked to structures and specific national requirements and that, in the accordance with national practice, bringing together existing relevant bodies and to involve social partners and all stakeholders concerned at national and regional initiatives to ensure continuation.
- To undertake a review of the implementation process every four years - this review should be incorporated into every second national business plan in the context of future strategic framework for European cooperation in education and training - based on reference criteria to be defined within the network European Framework of Reference for quality assurance and in cooperation with the Commission and Member States.

3. STATUS OF IMPLEMENTATION OF THE RECOMMENDATION OF THE EUROPEAN PARLIAMENT AND EUROPEAN COUNCIL ON EQARF / EQAVET

Binding character of the Recommendation, and its application based on the principle of subsidiarity, the possibility of implementing various initiatives EQARF by Member States, in compliance with common principles, quality criteria, indicative descriptors and indicators that may help in assessing and improving existing systems and provision of VET. It is
important to note that most Member States have started initiatives to implement in the technical and vocational education system.

Such initiatives have targeted multiple issues are summarized below without considering that they cover the whole experience and good practice at European level.

Making decisions / recommendations at the national quality assurance and / or encourage the development of a quality culture at the institutional level (top-down approach or bottom-up or combination of both approaches)

Thus Finland has adopted since 2000, updated in 2008, a Recommendation on Quality Management which provides long-term development of quality management in all types of education and initial and ongoing training, including VET schools. VET schools for students with disabilities special system of apprenticeship. How the recommendation can be implemented is up to users.

Hungary has a national system based on CQAF available for each VET provider and set a deadline (December 2008) to all VET institutions to use a quality assurance model based on CQAF and request that each institution to develop their own Quality Management Program.

In Italy EQARF recommendation is considered an integral part of school reform. Additionally, new legislation initiated by the Ministry to define the reform of vocational schools and technical recommendation include references to EQARF and at the need to develop indicators for self-evaluation and external evaluation.

This is an example of the approach "from above". Italy encourages a consistent strategy "bottom up" quality assurance, including the development of an institutional culture that supports quality.

In July 2006, Slovenia has introduced new law on vocational education, including provisions for quality assurance at both the provider and nationally. Each training provider must ensure the quality of their offer in the principles of total quality management, taking into account the Common Quality Assurance in VET (CQAF / EQARF). The legislation also established the national quality indicators, which are determined by the National Council for TVET Experts.

Austria develops a culture of quality assurance with internal management objectives achieved through the consensus and negotiation. The system aims to create a culture of quality assurance covering all schools and colleges TVET system and institutional levels, including regional level - regional councils for education and national and federal level (the Ministry of Education, Arts and Culture). Addressing refers to teaching and learning in the each school administrative. Each institution, at every level, develop quality matrix (Q-matrix), including sub-objectives and measurable targets; matrix is used for planning and implementing medium-term development objectives.

Portugal is developing a quality culture in the institutions by supporting centers of excellence.

New Opportunities Centres [Centros Novas Oportunidades (NOC)] NOC include public and private VET providers, training centers, municipalities, companies and other associations. CNO role is to attract school graduates by offering them better opportunities for lifelong learning and access to occupations that require higher qualifications. Network (there are now 459 NOC) has a central role in the national structure.

There is a Quality Charter for New Opportunities Centres (Centros dos Qualidade Charter Novas Oportunidades) which defines the structure and rules that must comply each center. NOC success is measured by benchmarks of quality that allows:

a) self-regulation or regulation by reference to a common set of standards;

b) develop a quality assurance system to be used for external or internal evaluation;

c) strengthening the monitoring system because of shared responsibility for outcomes and quality standards.

Additionally, there are 12 centers of excellence working — in Management Training Centers [Center for Gestão Formação Profissional Participada] — which are partnerships between government, employers associations and unions.

These partnerships have a long tradition and allowed to establish a predominantly sectoral network of training centers complementary public VET network. These centers have administrative and financial autonomy and covers the main economic activities. Also have the responsibility of validation of their skills and certification courses.

Romania facilitates the creation of a culture of quality assurance in VET institutions by supporting networks of VET schools.

In 2005 a law was passed that defines the main concepts of quality assurance on the quality of education and requires a methodology for internal and external quality assurance. There are two established national agency responsible, ARACIS for higher education and ARACIP for pre-university education. These institutions dealing with licensing and accreditation of educational institutions or university undergraduate level. It created a structure at school level - committee for evaluation and quality assurance. Quality Assurance in Education Law establishes areas and criteria for quality systems that will exist:

A. Institutional capacity defined by the following criteria: the institutional, administrative and managerial material base, human resources

B. Educational Effectiveness materialized by criteria such as: the contents of curricula, learning outcomes, scientific research, financial activity

C. Quality management resulted in criteria such as: procedures for ensuring quality learning outcomes assessment procedures, etc.

By the PHARE projects TVET in 2003-2006 drove the quality assurance 122 units of VET and were created: self-assessment manual and manual inspection which was approved by order of the Minister.

It was founded National Group for Quality Assurance in training established in 2006 following the recommendation ENQAVET and works as a quality assurance benchmark nationwide.

At the level of education and training provider, there are two main types of quality assurance processes:

- Internal processes: planning, internal monitoring, self-evaluation, review

- External processes: monitoring external validation of self-reports, improvement plans are approved providers of education and training, licensing and accreditation of
4. EUROPEAN QUALIFICATIONS FRAMEWORK FOR LIFELONG LEARNING (EQF)


EQF is a reference tool to help EU Member States: [4].

- Development of national qualifications frameworks (NQF) using EQF
- Description of national qualifications is done using the concept of learning outcomes (Learning Outcomes)
- Correlation of NQF levels with the 8 EQF levels
- Qualification certificates, diplomas and Europass documents should contain a reference to the appropriate EQF.

In terms of content EQF is a tool for classifying and describing qualifications in terms of a set of criteria for specified levels of learning and training. Descriptors are defined using a number of 8 levels of qualification according to the following dimensions: knowledge, skills and competencies. There are set common principles for quality assurance in education and training. There are no replaced national qualifications frameworks and can not define new qualifications.

Benefits of implementing EQF:

- Utility for citizens, employers, participants in vocational education and training to increase transparency, mobility and confidence in the qualifications
- National qualifications frameworks are rebuilt in conjunction with the EQF NQF based on a common procedure.

Romania has started using national qualification framework using EQF.

5. EUROPEAN CREDIT SYSTEM FOR VOCATIONAL EDUCATION AND TRAINING (ECVET)

Reference document is at the European Parliament and Council recommendation from 18 June 2009 establishing a European Credit System for vocational education and training.

It represents a technical transfer, recognition, accumulation of learning outcomes in order to achieve a qualification. It is facilitated the transfer, recognition and accumulation of learning outcomes. The results provide transparency lifelong learning, mobility is assured qualifications is provided nationally consistent approach across different sectors. It is facilitated the development of flexible and individualized paths in the context of EQF, insured recognition of learning outcomes acquired in non formal and informal.

In terms of content we can talk about the description of qualifications through the units of learning outcomes. Are created ECVET points to qualifications and units assigned, required a validation process (assessment, transfer, recognition and accumulation of learning outcomes) through partnerships.

Benefits of implementing ECVET:

- Is facilitated transnational mobility and recognition of learning outcomes in the VET
- Are created necessary conditions and measures applied gradually VET qualifications at all levels of the EQF
- Are national and European Partnerships
- Common principles are applied for quality assurance in VET areas mainly assessment, validation, recognition of learning outcomes.

6. CONCLUSIONS - ACKNOWLEDGEMENT

European level It is necessary to ensure inter-comparability of educational systems by using INID establishment and enforcement of common and common principles of quality assurance in education. There are different levels in the assimilation tools / European policies: EQAVET, EQF, ECVET, Europass. In the various European countries have been developed national quality assurance systems in education and training.

7. REFERENCES

2. The Bologna Declaration of 19th of June 1999
DEVELOPING A DECISION SUPPORT SYSTEM FOR PROJECT MANAGEMENT IN UNIVERSITIES

Radu Vasile, Pascu; Radu Adrian Ciora; Lucian Lobonț and Carmen Mihaela Simion
Lucian Blaga University of Sibiu, radu.pascu@ulbsibiu.ro, radu.ciora@ulbsibiu.ro, lucian.lobont@ulbsibiu.ro, carmen.simion@ulbsibiu.ro

ABSTRACT: Decision making is a complex and continuous process of correlation and harmonization of the project objectives with the organizational goals and all kinds of the resources available for projects carried out in universities (regardless of their source of funding). At an academic institution that can run simultaneously a large number of projects, using a Decision Support System (DSS) contributes to increase both transparency of decision and reaction rate of the decision makers. This paper presents a very useful DSS: POMADESUS – PrOject MAnagement DEcision SUport System. This DSS can be used to increase the efficiency of the Projects Implementation Unit from the University. POMADESUS is also a useful tool for all personnel involved in the implementation and the management of the projects.

Keywords: Project Management, Knowledge Management, Decision Support System, Dreamweaver, SQLyog.

1. INTRODUCTION

The decision support systems (DSS) form a distinct class of information systems. In very general terms, a decision support system (DSS) is a system that supports technological and managerial decision making by assisting in the organization of knowledge about ill-structured, semi structured, or unstructured issues. DSS are defined as an interactive computer-based systems that help people use computer communication, data, knowledge, and models to solve problems and make decisions [1]. In the process of decision-making in the projects that are carried out in universities, decision makers combine different types of data (e.g., internal data and external data) and knowledge (both tacit knowledge and explicit knowledge) available in various forms in the organizations.

The general architecture for a DSS [1], [2], [3] is shown in Figure 1.

A proper integration of DSS and KMS will support the required interaction and will present new opportunities for enhancing the quality of support provided by each system in managing the projects in universities. In this paper is presented a DSS realized in Lucian Blaga University of Sibiu: POMADESUS (PrOject MAnagement DEcision SUport System). POMADESUS can be used both to have an evidence of the finished and on-going projects in University and to develop a knowledge database as a tool for the project teams and for the management.

2. POMADESUS COMPONENTS

POMADESUS, like other DSS [7], consists in software modules for databases management, for dialog management and for models and knowledge management. We can say that POMADESUS is a knowledge based DSS. Decision support and knowledge management must be two interrelated and interacting processes in managing projects carried out in universities. POMADESUS is a framework that attempts to integrate DSS and KMS. This integration is expected to result in several benefits that cannot be realized with any of the two systems. The POMADESUS databases structures is shown in Figure 2.

2.1. The main database

The main database consists in a series of predefined tables for group of processes, action type, knowledge area, classes of problems, root causes, responsible, experts. (Figure 3).
2.2. The knowledge database

This database contains all the 42 project management processes grouped by knowledge areas. The processes are detailed according to PMBOK®: the process name, the code and the belonging group, the process description, the inputs and outputs of the process and the tools and techniques used to transform the inputs in the expected and compliant outputs. An extract from this table is shown in Figure 4. A complex and comprehensive graphical description for all the project management processes was included in this database to facilitate holistic approach of the projects. (Figure 5)

![Figure 3. The tables from main database](image)

<table>
<thead>
<tr>
<th>Grup procese</th>
<th>Impact</th>
<th>Tip acţiune</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inițiere</td>
<td>Cost</td>
<td>Preventiv</td>
</tr>
<tr>
<td>Planificare</td>
<td>Durată</td>
<td>Corectivă</td>
</tr>
<tr>
<td>Implementare</td>
<td>Scop</td>
<td></td>
</tr>
<tr>
<td>Monitorizare</td>
<td>Calitate</td>
<td></td>
</tr>
<tr>
<td>Încheiere</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 4. The processes table (extract)](image)
The main window used to update the knowledge database is shown in Figure 6.

2.4. Databases management

POMADESUS was developed using Adobe Dreamweaver for WEB based user interface creation and SQLyog to manage the databases. Using these tools is motivated by the following:

- Dreamweaver can use third-party "Extensions" to extend core functionality of the application, which any web developer can write (largely in HTML and JavaScript). Dreamweaver is supported by a large community of extension developers who make extensions available (both commercial and free) for most web development tasks from simple rollover effects to full-featured shopping carts [5].
- SQLyog MySQL GUI is the most powerful MySQL manager and admin tool, combining the features of MySQL Administrator, phpMyAdmin and other MySQL Front Ends and MySQL GUI tools. [6]

The databases management can be accessed from the main menu of the application (Figure 7).

Figure 5. Graphical description for project management processes

Figure 6. The knowledge database update

2.3. The Models Database

In the models database are included the solutions for the problems encountered during the various projects. The solutions are structured as follows:

- the problem identifier;
- the identified solution (s);
- the solution(s) author (s);
- the solution(s) implementer;
- the type of the action (preventive or corrective)
- the impact of the action (on the project cost, on the project quality, on the project duration, or on the project scope)
3. CONCLUSIONS

The application is in testing phase now. The identified benefits of using the proposed solution are:

- Improves personal efficiency.
- Speeds up the process of decision making.
- Increases organizational control.
- Encourages exploration and discovery on the part of the decision maker.
- Speeds up problem solving.
- Facilitates interpersonal communication.
- Promotes learning or training.
- Reveals new approaches to thinking about the problem space.
- Helps automate managerial processes.

POMADEUS is not meant to replace the final decision maker, who takes a solution and approves its submission to execution. Its role is limited to supporting decision making activities. There is no question of a fully automated system. DSS control remains entirely in the hands of the user.

Decision problems arising in the management of projects developed at a university considered to be resolved by POMADEUS are not so trivial, that could be solved only on the basis of simple reasoning and judgment and cannot be properly structured to could be solved with other classes of systems.

POMADEUS can turn the teamwork in a competitive advantage for the University. Using this application, project managers at the University have the opportunity to intervene directly in decision making, assessing and understanding the consequences of their actions, and improving knowledge and practices of the institution.

In this way, application users will be able to acquire appropriate solutions through their own approach rather than imposed by the system. This will contribute significantly to expanding acceptance and understanding of collaborative work. Collaborative work is so taken as part of the project’s team based on the implicit assumption that team work is directed towards a common goal shared by all members.

4. REFERENCES

PREMISES FOR ESTABLISHING AN INTEGRATED MANAGEMENT SYSTEM IN HIGHER EDUCATION INSTITUTIONS. CASE STUDY: “LUCIAN BLAGA” UNIVERSITY OF SIBIU

Lucian, Lobont¹ and Radu Vasile, Pascu²
1 Lucian Blaga University of Sibiu, lucian.lobont@ulbsibiu.ro
2 Lucian Blaga University of Sibiu, radu.pascu@ulbsibiu.ro

ABSTRACT: In the context of increased requirements of an ongoing developing market, nowadays organizations are implementing management systems able to respond the specific requirements concerning quality assurance, environment, health and security. By integrating the existent distinct management systems, it becomes possible to minimize overlapping, align the objectives and reduce costs. The concept of integrated management system tends to be adopted not only by production organizations, but also by higher education institutions. This paper analyses the premises for establishing such a system at “Lucian Blaga” University of Sibiu. There are analyzed the benefits an integrated management system would present, the steps necessary for creating such a system, as well as the possible obstacles when implementing it. Our research shows that an integrated management system will constitute a unitary frame for ensuring that both external and internal norms that regulate the activity of a university are complied and the objectives of the institution are efficiently pursued.

Key words: integrated management system, higher education institutions, quality

1. INTRODUCTION

In the context of increased requirements of an ongoing developing market, nowadays organizations are implementing management systems able to respond the specific requirements concerning quality assurance, environment, health and security. The development of the management system is associated with the appearance of distinct branches and a segmentation of activities within the organization, corresponding to each type of management system.

The problems appear when the organization is expanding and the activities related to the existing management systems are overlapping. Since the actions and decisions are made separately within the distinct structures of the organization, there is a great risk that they might not be optimal for the entire organization.

Employees may face a proliferation of information and contradictory instructions which may affect their activity. Bureaucracy may increase. The phenomenon of lack of responsibility and ownership may manifest.

A solution would be to create an integrated management system (IMS). Using separate management systems within one organisation is clearly expensive in terms of time and finances, and inefficient. By integrating the management systems, it becomes possible to minimize overlapping, align the objectives and reduce costs.

Such a system is doable since the legislation and regulations concerning quality assurance, environment, health and safety share many common elements. Integration can improve organization’s activity and reduce risks, identify areas less efficient, facilitate a restructuring of bureaucratic procedures, of audit procedures and remediate dysfunctions between departments.

2. DEFINITION. GENERAL MODELS

The integration of management systems was defined as: “the connection of the processes, procedures and practices of the working of applied at the organization in the aim of its politics implementation which can be more effective in achieving aims resulting from the politics than the approach through separate systems”[1].

IMS is a ”set of interconnected processes that share a pool of human, information, material, infrastructure, and financial resources in order to achieve a composite of goals related to the satisfaction of a variety of stakeholders” [2].

The purpose of an IMS is “to integrate the systematic and coordinated implementation of the requirements laid down in various international standards and industry standards in a SINGLE uniform management system”[3].

Beckerhagen et al. (2003) defines IMS as: “a process of putting together different function-specific management systems into a single and more effective integrated management system” [4].

As shown above, the literature provides various definitions for the integrated management system, an analysis of those outlining certain specific elements of this system: (1) the IMS provides a unitary frame that integrates and coordinates the existing management systems of an organization, (2) the integration concerns processes, procedures and practices from an organization and (3) its aim is to increase the efficiency of the organisation.

There is no agreement in the literature regarding the constituents of an IMS. The typical variants most studied are different combination, of two or three elements, between the quality management system, the environmental management system and the occupational health and safety management system (Figure 1).
A more comprehensive variant is approached by Asif et al. (2008), their IMS comprising, beside the three quality systems mentioned above, another element: the corporate social responsibilities [5].

The IMS from nowadays organizations take into consideration minimum two standards from the quality standards issued by the International Organization of Standardization, specifically ISO 9001 and ISO 14001.

The extended IMSs comprise also elements concerning occupational health and safety and other systems. Some studies [4], [6] researched the degrees of integration of different management systems within organizations. They identified three degrees of integration, as follows:

- harmonization – the documentation within the organization was partially integrated;
- cooperation – the documentation, internal audits and resources were partially integrated;
- amalgamation – a complete integration of documentation, resources and procedures is achieved.

3. ADVANTAGES AND DISADVANTAGES OF IMS

The benefits of implementing an IMS have been highlighted repeatedly in the literature. Asif et al. (2008), performing an exploratory research on drivers for IMS implementation, have identified a certain taxonomy of the benefits IMS present [5]. Table 1 shows these benefits and the general domains according to which they have been categorized.

Table 1. Benefits of IMS (adapted after [5])

<table>
<thead>
<tr>
<th>Resources allocation and utilization</th>
<th>better allocation of resources; saving of human resources; better utilization of resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural change</td>
<td>teamwork promotion; greater acceptance by employees;</td>
</tr>
<tr>
<td>Other benefits</td>
<td>strategic planning; holistic view; enhanced interdepartmental communication; better definition of responsibilities; means for sustainable development</td>
</tr>
</tbody>
</table>

Among the problems organizations face when implementing an IMS are: lack of strategic planning, few experts and consultants, resistance, even hostility from employees, continually changing regulations and guidelines, need of fast reporting system [7].

Zeng et al. (2007) studied the factors that affect the implementation of an IMS. They divided the factors in two categories: (1) internal which include: human resources, organizational structure, company culture, and understanding and perception, and (2) external, including here technical guidance, certification bodies, stakeholders and customers, and institutional environment. They proposed a multi-level synergy model (strategic synergy, organizational structural-resource - cultural synergy, and documentation synergy) for an effective implementation of IMS [8].

The analysis of IMS in the industrial environment reveals multiple advantages. Obviously, these could be of benefit to the higher education institutions too, if IMSs would be implemented in a particularized manner that takes into considerations the specifics of a higher education institution.

4. INTEGRATED MANAGEMENT SYSTEMS IN HIGHER EDUCATION

In the recent years there has been an evident transition in higher education from traditional universities to entrepreneurial universities [9], [10].

Unlike the traditional universities, the entrepreneurial ones have a threefold activity: teaching, research and business services. In order to function efficiently and achieve their objectives, especially in the field of research and business services, universities need to adapt their management system and increase their focus.

They focussed more on processes and start implementing quality systems based on international standards, specifically ISO 9001 and ISO 14001.

The first step in implementing management systems in higher education institutions is represented by the management systems for education quality assurance.

Aside from the specific requirements imposed by national (The Romanian Agency for Quality Assurance in Higher Education, The Quality Assurance Agency for Higher Education – Great Britain; The Norwegian Agency for Quality Education in Higher Education etc.) and international (The European Association for Quality Assurance in Higher Education, The International Network for Quality Assurance Agencies in Higher Education, Central and Eastern European Network of Quality Assurance Agencies etc.) organisations of certification, many academic institutions have taken a step forward completing the instruments for quality assurance with the implementation and certification of quality management systems based on ISO 9001 [11], [12].
The standard ISO 9001 provides general rules for implementing a quality management system, it has universal applicability. In 2009 became applicable the norms from SR ISO IWA 2:2009 “Quality Management Systems – Guidelines for application of ISO 9001:2000 in education” that provide directions for the educational organizations concerning the implementation and improvement of an effective quality management system.

The objective of SR ISO IWA 2:2009 is to ensure the global effectiveness of the quality management system from the educational organization, as well as the continuous improvement of the educational services provided by these organizations. Thus, this international workgroup agreement is recommended as a reference guide for the educational organizations where their highest level management wants to exceed the ISO 9001 standards, the final aim being continuous improvement and long-term success. SR ISO IWA 2:2009 comprises a self-evaluation questionnaire for educational organization and also examples of processes, assessments, records and educational instruments.

In Romania the regulations for education quality assurance are established by The Romanian Agency for Quality Assurance in Higher Education (RAQAHE). This is an autonomous public institution of national interest that has as main mission performing of an external evaluation of the quality of education offered by higher education institutions and other organizations that provide study programmes.

We performed an empirical analysis on the academic environment to see if Romanian universities have implemented quality assurance systems, what type of systems are these and whether or not they are integrated.

An excerpt of the results of our analysis is presented in Table 2. As the data from the table show, there are certain Romanian universities that, aside from the systems developed to meet the requirements of RAQAHE, have also implemented quality assurance management systems according to ISO 9001 standards and some even have implemented ISO 14001, ISO 22000 and OHSAS 18001.

Table 2. Quality management systems in Romanian universities

<table>
<thead>
<tr>
<th>UNIVERSITY</th>
<th>ISO 9001</th>
<th>ISO 14001</th>
<th>ISO 22000</th>
<th>OHSAS 18001</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;1 Decembrie 1918&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Bacau</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academy of Economic Studies</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Bucuresti</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academy of Military Technique</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Art and Design</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Tuliu Hatieganu&quot; University of Medicine and Farmacy</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Agriculture Sciences and Veterinary Medicine</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Bogdan Voda&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maritime University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Danubius&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Ion Ionescu de la Brad&quot; University of Agriculture Sciences and Veterinary Medicine</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Gr.T. Popa&quot; University of Medicine and Farmacy</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Oil - Gas&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Eftimie Murgu&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Constantin Brancusi&quot; University</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>University of Agriculture Sciences and Veterinary Medicine of Banat</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A concise formulation of the information presented so far would be that higher education institutions must meet certain quality assurance requirements/standards either imposed by different national and international organizations, or self-imposed.

As far as Romanian universities are concerned, a supplementary regulation element comes from the law of internal/managerial control - OMFP no. 946/2005, document that aims at systematizing the activities from Romanian public institutions, including universities.

As can be noticed, there are three main systems: the RAQAHE regulations, the norms of Ministry of Public Finances concerning internal/managerial control and the internal regulations of each university, which essentially establish regulations for the same domain (fig. 2).

They all target quality assurance in academic institutions through procedures and processes that will lead to an efficient and effective pursue of institutions’ objectives.

In Romania the regulations for education quality assurance are established by The Romanian Agency for Quality Assurance in Higher Education (RAQAHE). This is an autonomous public institution of national interest that has as main mission performing of an external evaluation of the quality of education offered by higher education institutions and other organizations that provide study programmes.

We performed an empirical analysis on the academic environment to see if Romanian universities have implemented quality assurance systems, what type of systems are these and whether or not they are integrated.

An excerpt of the results of our analysis is presented in Table 2. As the data from the table show, there are certain Romanian universities that, aside from the systems developed to meet the requirements of RAQAHE, have also implemented quality assurance management systems according to ISO 9001 standards and some even have implemented ISO 14001, ISO 22000 and OHSAS 18001.

Table 2. Quality management systems in Romanian universities

<table>
<thead>
<tr>
<th>UNIVERSITY</th>
<th>ISO 9001</th>
<th>ISO 14001</th>
<th>ISO 22000</th>
<th>OHSAS 18001</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;1 Decembrie 1918&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Bacau</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academy of Economic Studies</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Bucuresti</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academy of Military Technique</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Art and Design</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Tuliu Hatieganu&quot; University of Medicine and Farmacy</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Agriculture Sciences and Veterinary Medicine</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Bogdan Voda&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maritime University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Danubius&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Ion Ionescu de la Brad&quot; University of Agriculture Sciences and Veterinary Medicine</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Gr.T. Popa&quot; University of Medicine and Farmacy</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Oil - Gas&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Eftimie Murgu&quot; University</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Constantin Brancusi&quot; University</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>University of Agriculture Sciences and Veterinary Medicine of Banat</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. INTEGRATED MANAGEMENT SYSTEM AT “LUCIAN BLAGA” UNIVERSITY OF SIBIU

At “Lucian Blaga” University of Sibiu we intend to establish an integrated management system that meets the legal requirements regarding quality assurance.

The further development of the system will mean incorporating other requirements in the domains of environmental management and health and safety management. In order to create the integrated management system we need to unify the existent regulations specific for quality assurance for the main processes: management processes, base activity processes (education and research) and support processes.

These regulations were formulated in order to meet the requirements of RAQAHE, of Ministry of Public Finances (regarding the internal/managerial control system) and of the internal system of quality assurance (which follows the generic mechanisms created by ISO 9001 standard). An appropriate manner to realize this objective is the procesual approach. The IMS model in our university is based on the following processes:

• managerial processes – coordinate all the other processes within the university;
• educational processes;
• research processes;
• tertiary processes (from the interaction between university and external environment – economic organisations, public administration, NGO etc.);
• support processes – sustain and ensure normal functioning of all the processes.

Following there are presented the steps we consider necessary to take to create the IMS.

1. identifying the processes necessary for IMS (activities management processes, resources assurance processes, services providing processes, measurement, analysis, control and improvement processes);
2. determining the succession and the interaction of the identified processes;
3. establishing the necessary criteria and methods to ensure that both the performance, and their control are efficient;
4. ensuring the availability of necessary resources and information to perform, monitor and control these processes;
5. monitoring, measuring and analysing these processes;
6. implementing the actions necessary to achieve planned results and continuous improvement of the processes.

The IMS we intend to establish at “Lucian Blaga” University of Sibiu is organized so as to exercise (through internal audits) an exigent and permanent control of all the activities with impact on quality. It focuses more on prevention (prevention actions), rather than on solving nonconformities after they appear (corrective actions). Once implemented, the integrated system will be continuously improved so as ensure that the policy and the objectives established by the management are efficiently pursued.

6. CONCLUSIONS

The integrated management systems implemented in production organizations present certain benefits worth to be considered: reduction of bureaucracy, efficient answer to the customer’s demands, cost reductions, time saving, operational improvements, better allocation of resources etc. It is no doubt that such benefits would be appreciated in higher education institutions too. However, it is important to emphasize that, when implementing an IMS in higher education institutions, it is mandatory to take into consideration the specifics of such institutions and the particular context of each institution. The procesual approach can be an appropriate method to implement IMS in universities. The steps to follow were presented in this paper. The next move for our institution will be to effectively implement the IMS and to assess its efficiency and efficacy.

7. REFERENCES

MULTIMEDIA IN ENGINEERING AND BUSINESS EDUCATION
MULTIMEDIA TUTORIALS, USED IN ENGINEERING EDUCATION

Sorin, Borza\textsuperscript{1} Ionela Magdalena, Rotaru\textsuperscript{2} and Iunia, Borza\textsuperscript{3}  
1 University "Lucian Blaga" of Sibiu, sorin.borza@ulbsibiu.ro  
2 University "Lucian Blaga" of Sibiu, ionela.rotaru@ulbsibiu.ro  
3 University "Lucian Blaga" of Sibiu, iunia.borza@gmail.com

ABSTRACT: The purpose of this paper is to highlight the benefits that they generate using multimedia tutorials in the process of education and especially higher education. One of the major objectives of the paper is to make a pertinent analysis that has a multimedia tutorial both classical and educational process at the distance. Another area in which the paper refers is the one related to research conducted in training on the web or WBC. The paper is the result of a long period that was studied the impact that it presents these types of tutors both in the educational process of education and living at a distance. The paper will present a concrete impact on groups of students use multimedia tutorials on learning process and the implications they will have in the future. This paper is based on research undertaken by the author for many years on the educational process and its results show both in writing and graphic methods, the advantages of this technology on how to teach the students and the impact of the multimedia tutorial to the teacher.

Key words: multimedia tutorials, engineering education, educational process

1. INTRODUCTION

Today's society is characterized by extraordinary dynamics, information systems have revolutionized society and the pressure of change from all fields is increasingly pregnant upon individuals. More free access to information and to continuous education are the main solutions for the adaptation of individuals to social pressure. In today's complex society systems influence each other and it often happens that a discovery in a field be useful in other areas. The emergence of IT technologies is an obvious aid to education, design and research, leading to modern and efficient solutions.

In the past, the teacher was the core of classical education; conversely, today's educational actions are focused on the students, everyone's role changes and educational methods have become fundamentally different. Starting from the idea that "a man is only old once he has given up learning", experts in education seek to provide modern learning methodologies, which can be applied irrespective of time and location.

Design and research activities employ an increasing amount of information and communication technology, which is a huge step forward. However, the importance of involving the most valuable specialists in any field has not diminished. The customers have an increasingly active role in the design and research processes now, and whereas they used to take on a much less involved stance in the pass, nowadays the entire action is directed towards them. International virtual learning environments are emerging, and the European Community allocated substantial funds for the educational process in the information society. Most EU member countries have implemented distance learning. Such programs "Socrates" and "Leonardo" is intended for financial support of distance learning projects. Much of the educational process for projects, financed by the European Commission is based on multimedia and telematics methods and techniques. Internationally have established various bodies that oversee the implementation of new technologies in distance learning in universities and also pursue its impact on globalization and widening. In terms of research in new technologies for education and training we mention some directions of research: virtual learning environments and virtual classrooms, Internet use in schools (static electronic classrooms, electronic classrooms mobile) based open and distance learning the 'Hyperwave', 'structured hypermedia systems "based on hyperlinks, designed to create hierarchical windows and searches to support multilingual documents, user identification and access control, integrating existing information systems on the Internet, and to generate consistent and documents etc. virtual interviews to assess knowledge (tele-conferencing, email, etc.) designed to help postgraduate education and training for new jobs, tutorials intelligent systems, intelligent agents, distance learning models etc. universities and also look at the impact of globalization and expanding was.

2. TUTORIALS

The notion of a tutorial emerged together with the development of IT technologies.

The tutorial is a tool often used nowadays in various fields in order to present a specific software product or business activities-products of a given company, etc. In making a tutorial there are several concepts to be taken into account, such as:

- Entrain Multimedia presentations in business and education;
- Enlight concept of dynamic templates for online communication;
- Enlife web concept training and E-learning

The user has the option of creating material-support improving message and audience impact. Tutorials are used in different situations:

- as an auxiliary tool for university courses or other teaching activities;
- for supporting communication in scientific sessions, symposia, workshops, etc.;
• for communication between employees at the level of economic organizations;
• for communication between economic organizations, in the vendor-client relationship;
• for the dissemination of information via public computers (electronic information systems, electronic kiosks, infokiosks);
• for development of tutorial-based applications, in closed systems, mixed or open (in the Internet environment).

The presentations are integrated with the Office software systems, being aligned with the principles of interaction and with the available instruments. They are geared towards solving the problems of communication and ensuring the possibility of personalization by including elements of interactivity with the receiver user. The development of several versions for each application leads to the diversification of methods, which range from a simple slideshow to rich multimedia applications.

The tutorial aims to introduce participants to the educational process in a given subject, with the final goal of assimilating a minimum level of knowledge. But there are some fundamental differences from other educational processes[5]:

- Educational methodology is rich in media content (static content, motion screenshots, animation or video instructions), which is necessary in order to exemplify the necessary steps in solving the problem.
- There is a focus on a particular topic, without details about adjacent concepts.
- A tutorial cannot replace a course, so theoretical aspects are usually overlooked in favor of practical ones. Theory is only mentioned when it becomes absolutely necessary to explain an applied situation.
- In general, if software is permanently installed, the tutorial makes reference to the way of using multimedia software;
- A minimum of IT resources and documentation (for the hardware, the software and the prerequisite knowledge), time and motivation are the only things necessary to acquire a tutorial.

2.1. The Steps involved in making a Tutorial

Usually the tutorial starts with an introductory section that informs the student about the objectives and the nature of the lesson (Borza et al., 2007). The information is then presented in a determined form. Questions that are addressed to the student receive an answer. The program considers the student's response and provides a reaction in order to strengthen the understanding and to increase student performance.

The constituent parts of the Tutorial are:

- Introduction;
- Monitoring of the student on browsing the lesson;
- Motivating the student;
- Presentation of the information;
- Questions and answers;
- Answer analysis;
- Additional guidance depending on the accuracy of the responses;
- Sequencing/Segmentation of the lesson;
- Completion of the tutorial.

Usually there are several steps to be followed when creating a tutorial:

1. establishment of the subject that will be treated in the tutorial;
2. determining the target audience who should attend the tutorial. The difficulty level, as well as the estimated time of browsing must be determined. These two affect the degree of motivation for learning. It is preferable to have a short tutorial that covers a more limited topic, instead a richer one that demands a lot more effort.

3. choice of the type of technology to be used. The elaboration of a tutorial that explains a software application requires complex IT elements.
4. compiling, structuring and placing information in the tutorial;
5. tutorial test, and correction of any conceptual and/or implementation mistakes that may arise

2.2. Multimedia

The multimedia information representation means of computer audio, graphics, video and animation with traditional media Multimedia is everything you can hear or see: texts, books, pictures, music, sounds, CDs, videos, DVDs, Records, Films, and more. Multimedia comes in many different formats. On the Internet you will find many of these elements embedded in web pages, and today's web browsers have support for a number of multimedia formats. The support for sounds, animations and videos is handled in different ways by different browsers. Some elements can be handled inline, some requires a plug-in and some requires an Active control. Multimedia elements (like sounds or videos) are stored in media files. The most common way to discover the media type is to look at the file extension. When a browser sees the file extensions .htm or .html, it will assume that the file is an HTML page. The .xml extension indicates an XML file and the .css extension indicates a style sheet.

For computer science multimedia is represented by several important areas:

- processing and encoding multimedia: multimedia content analysis, content-based multimedia retrieval, security, multimedia, audio processing, image and video compression, etc;
- support system and network processing multimedia network protocols, Internet, operating systems, servers and clients, quality of service (QoS - "Quality of Service") database;
- media tools, "end-systems' and applications: hypermedia systems, user interfaces, systems" authoring ";
- interaction and multi-modal integration: Web devices spread ("web-everywhere"), including multimedia educational computer based collaborative learning ("Computer Supported Collaborative Learning"), design and applications of virtual environments.

Picture formats are recognized by extensions like .gif and .jpg. Multimedia elements also have their own file formats with different extensions.

2.3. Sampling and quantisation

Analog-digital conversion: sampling and dithering.
Select discrete sampling points in which to measure the phenomenon analog (signal) time (sound) or points (x, y) plane (image).
Sampling rate or resolution (number of samples taken in unit time or space).
Dithering: each sample represented over a fixed number of bits (bit depth) => precision measurement signal
Example: sampling an image, rectangular grid sampling (sampling units).
The most popular audio format, appeared in 1994 remains the most popular with users of PCs and laptops, but also the most popular audio equipment manufacturers (media players, car stereos - all with MP3 support).

Expect all your future software systems to support it. Sounds stored in the MP3 format have the extension .mp3, or .mpga (for MPG Audio). The most popular audio format, appeared in 1994 remains the most popular with users of PCs and laptops, but also the most popular audio equipment manufacturers (media players, car stereos - all with MP3 support).

Peak is that over 15 years of existence, MP3 encoding algorithm had not who knows what improvements instead appeared more advanced format that delivers superior audio quality mp3’s. These are called "lossless Audio Formats" (audio compression formats without losing quality), and best known of these is the FLAC.

FLAC’s are encoded with an algorithm that, although the original file compression means, manages to keep the quality intact. In practice, removing a track from the CD and convert WAV to FLAC came with about 30% lower (but you can reach the percent good to 50% - depends on the track). WMA is a format developed by Microsoft and promoted through Windows Media Player player. Compression and quality is similar to that found in MP3 (37.64 MB Track WAV -> WMA file 5.13 MB), but with extension pieces. Wma differs in two respects:

- Lossless compression supports, such as FLAC;
- can be accompanied by the copyright protection (DRM);

Microsoft’s audio format is closest in popularity of MP3, but still somewhere behind the astronomical distance. AAC format is the common denominator of a great multitude of audio file extensions: .3 g2, .3 gp,. Aac,. M4a,. M4B and. Mp4. AAC’s occupies less space and the quality is as good. However, this format is not embraced by many people. Among the major companies that are paying attention to Apple (which issued him a support iTunes DRM) and Sony. Although AAC is over MP3, awareness of the latter makes AAC format only remain interesting for fans and those who pull the teeth of each KB of hard disk.

The AIFF (Audio Interchange File Format) was developed by Apple. AIFF files are not cross-platform and the format is not supported by all web browsers. Sounds stored in the AIFF format have the extension .aif or .aiff. This sound format was originally was used on Apple computers and Silicon Graphics (SGI). Waveform files are stored in a monaural format of 8 bytes (single-channel or single channel), which is compressible and can create very large files.

2.4. Multimedia Sound Formats

The WAVE (waveform) format is developed by IBM and Microsoft. It is supported by all computers running Windows, and by all the most popular web browsers. Sounds stored in the WAVE format have the extension .wav.

MP3 files are actually MPEG files. But the MPEG format was originally developed for video by the Moving Pictures Experts Group. We can say that MP3 files are the sound part of the MPEG video format. MP3 is one of the most popular sound formats for music recording. The MP3 encoding system combines good compression (small files) with high quality.

The AVI format is the common format on the Internet, but not always possible to play on non-Windows computers. Videos stored in the AVI format have the extension .avi.

Microsoft develops the Windows Media format. Windows Media is a common format on the Internet, but Windows Media movies cannot be played on non-Windows computer without an extra (free) component installed. Some later Windows Media movies cannot play at all on non-Windows computers because no player is available. Videos stored in the Windows Media format have the extension .wmv.

The MPEG (Moving Pictures Expert Group) format is the most popular format on the Internet. It is cross-platform, and supported by all the most popular web browsers. Videos stored in the MPEG format have the extension .mpg or .mpeg.

Apple develops the QuickTime format. QuickTime is a common format on the Internet, but QuickTime movies cannot be played on a Windows computer without an extra (free) component installed. Videos stored in the QuickTime format have the extension .mov.

To achieve multimedia tutorials one can use both Internet and INTRANET technologies based on what was mentioned above.
This depends the type of software used. For image processing, one can use software like: Photoshop, Corel Draw, or open source products, like GIMP. To achieve animation we can use the FLASH product or software that captures the screen image like Camtasia. We will write some words about Camtasia in the “Video Tutorials” section of this paper.

2.6. Streaming Applications

The increase of the accessibility of video equipment has allowed the development of online educational resources. Making interactive distance has now become possible by following a multimedia technology developed recently, namely streaming technology.

Streaming data is transmitted in the form of streams, which refers to the ability of an application to play synchronized media data streams in a continuous manner, while those streams are transmitted to the client through a data network. Streamed data is divided into packets whose size is suitable for transmission from one server to the client. Thusly, a user can view a package, while at the same time receiving and uncompressing the following parts. The great advantage here is that they don't have to wait for the end of the transmission in order to view the material.

Applications that can be built using streaming services are viewed in figure 3 and divided into:
- on demand applications - news, music, movies, multimedia tutorials;
- live information - radio and TV programs directly.

On-demand streaming is based on files stored on a server for a longer period. Files are available to customers as they submit their requests to the server. Live streaming videos are transmissions that occur as the performances or events depicted take place. Streaming technology has caused a profound change in education, business, media and entertainment, as it combines the richness of television content with the interactivity of the Internet.

2.7. Integration Tutorial in Web Pages

An important step tutorials published in Web applications is to choose how to integrate themselves. We deal with three cases [7]. Link (link) to multimedia content, a simple, but effective, indicating an audio or video store with all its HTML pages and other files.

When accessing such a link between the user chooses to save the file and run it later or opening in your browser using so-called plug-ins Windows Media Player, Apple QuickTime Player, etc. Encapsulation (object, applet, embed) is considered a “technology” because it involves integrating advanced material directly into the HTML page.

Browsers will have to use plug-ins (helper programs) to run content, which can be a disadvantage because visitors can be different and different can be plug-ins used by them to run [7]. Eliminate this drawback is possible by using HTML 5 technology. It will be seen in the future if its facilities will have a beneficial impact on the "Internet users". Plug-ins can be launched using the elements (tags) <object>, <embed> and <applet>. Hosting (hosted) means that audiovisual material to own a dedicated server hosted by another Web application (youtube.com, vimeo.com, trilulili.ro), the media will be displayed in its own web page or make a link to external location.

The advantage of such solutions is that these sites can host and run high-quality media materials and good resolution for connoisseurs in the field to remember 720p and 1080p. The link to them a simple user can display / play back video of a quality.

3. VIDEO TUTORIAL IN ENGINEERING EDUCATIONAL PROCESS

Video tutorials are not a new concept. The concept has emerged in the late 1960s, when Bandura, first commented on the issue of self-modelling[2]. Since then, video modelling has been described as “instructional videos” or “video tutorials”. Most video tutorials are produced as part of a strategy to promote guidance in developing new skills and abilities - for example, to improve teacher training[3] or to prepare medical students for their internship experience. Also, video tutorials have been used to assess their effectiveness in improving the learning efficacy of students[4]. Video tutorials are one of the most important factors in the improvement of the educational process. As we also mentioned in the conclusions of this work, the video tutorial has a strong impact on students. It can exist in two modes. The first one is as a separate entity with no text. In this case several independent tutorials treat a particular topic. The second mode is having it embedded in a website, or as part of a topic that is presented in the context of web page or slideshow. In both cases the video tutorial is recorded using specialized software.

By offering audio-visual demonstrations, the teacher can use a video tutorial to develop a particular skill or strategy. Thus, video tutorials can be used as a medium to encourage students to learn independently outside the regular classroom schedule. The materials presented in the audio explanations and the visual demonstrations become achievable goals that the learner can reach by understanding and applying a similar process to produce their own project. The video tutorial resources may used to engage learners to explore their technical skills. Exposure to software operation in the target language might empower students to become familiar with the target technical lexical items thus enabling them to discuss their difficulties with their teacher or peer. Hence, the teachers' role becomes one of facilitator or guide when a student needs further assistance, and their oral interaction has the potential to change from language learning to purposeful communication exchange whereby problem-solving is the focus.

3.1. Making video tutorials using the Camtasia software

Camtasia is one of the applications that can be used to make a video tutorial. TechSmith produces it. Video tutorials created with Camtasia assists in creating demonstration videos by recording computer screen activities. For example, one could video record the screen as they type. Even though Camtasia is fairly user friendly, some video editing skills are necessary.

After recording the screen activity, Camtasia stores the recording on its editing environment. During the editing stage it is possible to add narration, music, photos or other movie elements. Finally the finished video tutorial can be saved -
either on a CD or DVD, or, it can be uploaded on a website for online access.

3.2. Multimedia Tutorial for Learning the G Language Used in Engineering Education

To write programs using LabVIEW G graphical language, language of the 5th generation. If the text-based programming languages (eg Fortran, Pascal or C-language-generation 3-a), to achieve a program instruction line must be written in LabVIEW using a graphical programming language (called G), which assembles components. LabVIEW contains several libraries of predefined functions for acquisition, processing, displaying, saving and sending dates. The programs made in LabVIEW are called virtual instruments (Virtual Instruments - VI).

In LabVIEW “to assemble visual” structure VI, instead of writing lines of code text, a strict syntax. In the implementation of programs in LabVIEW are concepts of modularity and hierarchy tree. When designing and implementing an VI, must take into account the modular nature of it: it can be used both as the main program and subroutine in leg VI.

Modular programming advantages are obvious:

- module component (IV under them) are designed, implemented and tested independently;
- reduce program size by reusing code. A module (in IV) is made once and then used as constituents of modules (IV-s)
- Application maintenance is easier. One application can use several modules (IV) emerges a hierarchy tree of IV, the fourth main single parent in the tree

To ease the study of the programming language G, an on-line tutorial has been designed, which uses multimedia elements to provide examples for the main notions involved. The tutorial contains 17 lessons (fig.4), which are titled as follows: About Labview, Windows, Build VI, Data Type, SubVI, Debug, While Loop, For Loop, Array, Clusters, Case Structure, Sequence structure, String, Files, Build an Application. Each lesson contains text and pictures, in which the content is illustrated. The tutorial begins with an introduction that provides some initial background. “LabVIEW is a tool by National Instruments Company. It is an integrated development environment (with graphic interface), based on the G language. It is different from other development environments in that programming in LabVIEW is based on the concept of connecting icons[6].

3.3. Multimedia tutorial used in the educational process in environmental engineering

Multimedia tutorial was conducted using software called GIS Geomedia Professional. It is used in various environmental engineering activities such as spatial analysis of risk factors: air pollution, carbon monoxide emissions, sound, spatial analysis of land, influence on air pollution, the environment etc.

The tutorial was made in two distinct parts:
- one to make the classes necessary to elaborate a map graphics
- spatial analysis of the map made

Particular emphasis was placed on making classes conducted queries on attributes.

The tutorial contains movies with Camtasia software that is explained by the teacher for taking entities in Geomedia Professional. In figure 6 is presented the home page of the tutorial.

4. CONCLUSIONS

Although multimedia tutorial may seem outdated concept, it is timely for several viewpoints.

4.1. Multimedia tutorial impact on students

Research conducted by the author of several generations of students have emphasized that there are positive aspects and negative in its impact on students. If tutorial gives the student as object of study in the laboratory hours to see a boring subjects in the context in which they react as one unit mass of people. How can capture tutorial is made more or less attention to the student. The main factors influencing the multimedia tutorial are shown in Figure 7.

Generally educational techniques based multimedia tutorials to improve by approximately 30% of the educational process by increasing volume and speed information to student learning (Figure 8).
Figure 8 Increasing volume and speed information to student learning

5. REFERENCES


3. Da Silva, M. Constructing the teaching process from inside out: How pre-service teachers make sense of their perceptions of the teaching of the four skills. Teaching English as a Second or Foreign Language, TESL-EJ, 9(2), 1-19 (2005).


6. Sorin Borza, Carmen Simion, Ioan Bondrea, Using virtual instruments in the educational process for teaching measurements and quality inspection, QMHE 2010 Conference, Tulcea (2010);

STUDIES REGARDING THE EVOLUTION AND DEVELOPMENT OF DOCUMENTS PRINTING TECHNOLOGIES

Nelu, Gora¹ and Vistrian, Mătieș¹
1 Technical University of Cluj Napoca (nelu@gora.ro)

ABSTRACT: The paper presents a study of the evolution in development of documents printing technology, characterized in terms of the technical performance like print speed, resolution, repeatability, gamut etc., and of meeting the requirements of sustainable development and environment protection. Are analyzed printing technologies with toner and ink. Ink printing technology is emphasized using liquid and solid ink and toner printing based on the xerographic process, using organic xerographic drums. The trend in the development of these technologies is to increase technical performance while meeting environmental requirements. In this context the main items are detailed on solid ink printing technology, widely promoted by the representative company in the market.

Key words: document printing technologies, sustainable development, environment protection, technical performance, solid ink

1. INTRODUCTION

In the last two decades, the digital printing technology had a vertiginous development in comparison with the analogical technology. This evolution can be explained by the development of the information technology.

"A printing press is a complex piece of high-precision industrial equipment that is designed to produce printed material at a high rate of speed and low cost per page" [1] if a large number of copies are printed. "Printing presses are commercially available which use several different types of printing technologies, but the most common type is called offset lithography" [1]. "An offset printing press has a separate printing unit, or tower, for each color of ink" [1], figure 1.

"Each printing tower has three main cylinders - the plate cylinder, blanket cylinder, and impression cylinder. Each of these cylinders is designed to have a surface which is slightly larger in area than the size of sheets which are printed by that particular press" [1].

Figure 1. An offset print unit[1].

Another type of typography is the one in tandem. Figure 2 "shows a schematic cross section of the tandem TOP-D printing system wherein three printing processes are carried out: 1) acceptor layer (AL) formation process onto the intermediate belt, 2) dye transfer printing process into the AL formed on the belt, and 3) the dyed AL transfer process onto the paper" [5].

Figure 2. "A schematic cross section of tandem TOP-D printing system" [5].

The analogical technology is specific to mass production and to high quality printings. In the last decade the printed information market (newspaper) leaves place to information posted on web pages. Therefore, the consumption of paper and ink has reduced, and in addition to that the information gets quicker to the reader.

Digital technology is addressed to variable data printings, the digital process may vary on-the-fly, the printed document is obtained in a very short time, compared with analogical technology.

The quality and speed offered by this technology is still in full development, for the market segments, figure 3, depending on the diversification of customers needs.
Compared to analogical technology, the digital technology is user friendly, the users not needing knowledge and special education in this field, usually a training of 1-8 hours, depending on the equipment, is sufficient for a new user in this technology. Another advantage that the digital technology presents is the fact that it does not use toxic materials and it is environmental-friendly. In the last decade the focus is on reducing waste.

Another major advantage of this technology is the ease of transmitting information in digital format, it can be transmitted and printed anywhere in the world in a very short time, practically in only a few seconds.

The two technologies became complementary, the analogical technology is addressed to printing a high number of copies in a long time and with qualified personnel in this field, while digital technology is addressed to diversified printing market obtained in a very short time and with users without detailed knowledge in this field.

The relationship between the quality of printed image and hardware factors allows for absolute performances comparison between diverse imaging technologies, both analog and digital [8].

2. DRY INK BASED TECHNOLOGIES

Xerography, a combination of the Greek words for dry “xeros” and writing “graphein” describes the phenomena by which images are produced by the creation of electrostatic charge patterns, which are then made visible by charged marking particles [Schaffert and Oughton, 1948], [9].

The xerographic process takes place in six steps, figure 5:

- Charging
- Exposing
- Developing
- Transfer
- Fusing
- Cleaning

In the original patent Chester Floyd Carlson used S and a mixture of S with Se. Since then, the photoconductive materials used for manufacturing photoreceptors diversified, today being used chalcogenide glasses, organic materials, amorphous silicon and other materials. In the past years they have laid the foundation on organic materials deposited in a single layer or two base layers. The first organic photoconductive materials used were the aggregate and PVK.TNF [9]. The photoconductive materials used and the concentrations are kept secret by the producers.

The equipments which rely on xerographic process that use organic photoreceptors can be found in the market as office equipments, graphic art equipments and production equipments. Practically it covers all the areas where documents are printed till mass-production where are entering typographic equipments.

Based on these technologies were built equipments both black & white and color depending on the market segment which is addressing to.

These kinds of equipments after the integration and modularity process need a few basic supplies such as: toner, photoreceptor, fuser, paper drive roller, etc.

We can tell that after using these kinds of equipments results a big amount of waste. Comparing with the printing technologies using ink, it has the biggest rate of recyclable waste.

The maximum printing resolution of this family of equipments is given by the exposure system, laser or led array unit. In case of exposure with laser, the generated beam by the laser diode is projected on a polygonal mirror which by rotation deflections the beam, following that this to be projected on the photoreceptor by a system of lens and mirrors. As configuration a laser module may have one or more beams. For
raising the printing speed it is used the exposure with multiple beams, figure 6, while for raising both the speed as well as the resolution, there are used multiple beams with optic fibers, figure 7.

![Diagram of multi-beam laser scanning system](image)

**Figure 6.** "Schematic drawing of multi-beam laser scanning system" [11].

Another alternative of exposure is the one with led array, figure 8.

![Photograph of the 600 dpi EF LED array unit](image)

**Figure 8.** "Photograph of the 600 dpi EF LED array unit" [6].

The correction of the grey levels at the LED Print heads can be realized by non-linear exposure uniformity correction method that uses center-weighted PWM system to generate the clocks.

Depending on the resolution, the size of the doth, the colors of the toner and the processing capacity of the equipments we can talk about the gamut (the color space) which can be reproduced by the equipment. This is smaller than the one of the equipments with liquid ink, because this uses only four colors, black (K), cyan (C), magenta (M) and yellow (Y). For reducing the quantity of color toner when forming the image it compensates with black toner.

For a more accurate reproduction of the colors are used dedicated systems of image processing (RIP systems - raster image processor) and color calibration (densitometers, photo spectrometer).

To assist users in order to reduce workload and increase final product quality, to the printing equipments can be attached optional finishing systems with various operations such as perforating, stapling and folding.

Digital equipments based on xerography with organic photoreceptors, due to its characteristics adapted to the requirements of the market and of the environment, are the most used ones today.

### 3. LIQUID INK BASED TECHNOLOGIES

The technology of printing with liquid ink is based on formation and deposition of droplets of ink onto the paper by printing heads.

At liquid ink based technologies, in order to expand the gamut, it was added vivid colors.

A scheme of technologies with ink-jet is presented in figure 5.

![Basic map of the ink-jet technologies](image)

**Figure 9.** A basic map of the ink-jet technologies [2].

"Fundamentally, ink-jet printing is divided into the continuous and the drop-on-demand ink-jet methods" [2]. "Depending on the drop deflection methodology, the continuous ink-jet can be designed as a binary or multiple deflection system. In a binary deflection system, the drops are either charged or uncharged. The charged drops are allowed to fly directly onto the media, while the uncharged drops are deflected into a gutter for recirculation" [2], figure 10.
Figure 10. "Continuous ink-jet: A binary-deflection system" [2].

"In a multiple deflection system, drops are charged and deflected to the media at different levels" [2], figure 11.

Figure 11. "Continuous ink-jet: A multiple-deflection system" [2].

"The uncharged drops fly straight to a gutter to be recirculated. This approach allows a single nozzle to print a small image swath. Both of these methods are widely used in the industrial coding, marking, and labeling markets" [2].

The office market is dominated by water-based ink. In figure 12 is presented drying mechanisms of a water-based ink-jet drop on a plain paper.

Figure 12. "Wetting, evaporation and penetration sequence of a water-base in a droplet landing on a plain, uncoated paper substrate" [2].

Printers with liquid ink are used for reduced workload and/or special support with high resolution. This technology is used from the small office printers to plotters for printing engineering drawings, to printing of the meshes from advertising industry.

There were developed also dedicated equipments with deposition of the droplet on special supports such as textiles, plastics, etc.

The big advantages presented by these equipments is that they occupy a smaller volume than the xerographic equipments, have more diversified media and supports a big thickness of the printing support, reaching up till cardboard packaging, very big printing areas, few meter wide and tens of meters long, the consumable’s dimensions are significantly smaller, also their amount.

The disadvantages of this technology are the leaking of the ink on the printed surface, needs drying time, waving of the printed support in case that is printed on thin paper, print head clogging, expiring the validity term of the consumables, etc. For this purpose were created printing heads in a big diversity of solutions of forming the droplets.

The resolution and the color of the ink used are defining concerning the color space. On the office market, the equipments with ink have a descending trend in favour of the ones that are based on xerography. A well defined place on the office market is wide format printing.

4. SOLID INK BASED TECHNOLOGIES

Solid ink was introduced in 1991 by company Tektronix, and in year 2000 Xerox bought the patent and developed the printing technology with wax by using technique drop-on-demand, using heated piezo-ceramic printing heads.

The printing principle, figure 13, supposes melting of the ink and transporting it in the printing head, which eliminates ink droplets through the order of piezo elements and deposits them on a drum, figure 14, from which the ink is transferred on the printing support that was heated first.

Figure 13. "The basic configuration of the drum transfer ink-jet printer" [2].

Figure 14. "(a) A “bend mode” piezoelectric drop-on-demand printhead. (b) When the printhead operates with low jetting frequencies, each pulse generates a liquid ligament. (c) For high frequencies, a pulsed jet is formed."[7]
Initially this technology used a single printing head which covers the wideness of the page, which had improvements developing more efficient constructive solutions, figure 15.
Figure 15. "Print head technology migration over time, highlighting the evolution of the full-width head and the advances of the modular head" [10].

Today are used modular print heads, figure 16, aligned around a drum, figure 17, with the help of which has increased the performances, such as speed and quality of printing. In the service routines there are offered the possibility that the defect nozzle can be taken out of using, its function being taken over by the ones from the neighborhood, this fact prolonging the life-time and the quality of the print until it will be replaced.

Figure 16. "Modular solid ink print head, with approximately 3” active array" [10].

Figure 17. "CAD model of modular print heads aligned around a drum (translucent for illustration purposes)" [10].

Figure 18. "Solid Ink Print Head drop deposition performance over time, both in terms of data rate and mass flow rate" [10].

Once developed and integrated this technology, the price per printed page became lower.

Due to the viscosity of the wax, the support on which can be printed has to be a good absorber, which reduces the diversity of materials that can be used. For example, part of the ink from the printed paper is transferred to the next sheet under the effect of pressure applied by a writing instrument, like pencil.

Another disadvantage of this technology is the warm-up time, depending on the size of the equipment it can reach up to one hour. For minimizing this drawback, the manufacturer has developed a routine whereby the equipment "learns" the user's work program, so if the use of the equipment begins at 8 am, will exit from standby earlier and at this time will be ready for printing. This function is named "Intelligent Ready".

For these reasons, this technology is addressed only for office equipments, proofing etc.

Although it has these disadvantages, using of solid ink has several major advantages revealed by the market, such as price per page, the fact that it does not use toxic substances, has clean printings, the volume of the supplies is very low compared to equivalent laser equipments, and the volume of waste is 90% less, figure 19 [14].
5. CONCLUSION

A comparative study was made regarding document printing techniques, considering the analogical and digital technology, motivating the quick development of the digital technologies compared with the analogical ones. Also, it were analysed comparatively the printing technologies based on toner, liquid ink and solid ink. Research for developing in the past few years of the solid ink printing technology has in view both technical-economical aspects but also the ones regarding the protection of the environment.

6. REFERENCES

7. Ri Li, Droplet deposition in solid ink printing, University of Toronto, (2008).
MANAGEMENT OF ENGINEERING AND BUSINESS INSTITUTIONS
ABSTRACT: This paper deals with computational techniques used in management engineering in order to support enterprise managers in the decision-making process. Thus, the paper presents an application, built with web technologies for extracting and interpreting information from various sources, enabling the user to analyze data both in text files and the data available on the Internet, results that greatly improves the decision-making process through an efficient and fast analysis of data which, due to large the volume growing exponentially can no longer be covered and analyzed "manually" by a human factor.

Key words: computational techniques, management engineering, decision-making process

1. INTRODUCTION

Given that both the field of computers and computer science and the data volume has grown exponentially, the need arose for the use and development of new methods and techniques necessary for discovering information "hidden" in the data, information that is almost impossible to detect by traditional means which employ human capacity of analysis [15].

If communication is to man both means and purpose, to agents it is not (yet?) anything else but means, and thus we should start with the object of communication, namely information [2].

Since "data" bear and contain this "information", in order to reach it, we inevitably came across the so-called Data Mining (DM) applied, in this example, in order to see and analyze which products are required by consumers to make decisions regarding the adjustment of production according to customer requirements and efficient supply with stocks that tend to zero.

There are numerous definitions of DM; however, we only refer below to the result returned by [20], namely "data processing using sophisticated data search capabilities and statistical algorithms to discover patterns and correlations in large preexisting databases; a way to discover new meaning in data."

This paper presents our own application, built in the PHP language, (Hypertext Preprocessor) for extracting and interpreting information from various sources, allowing analysis of data both in text files and of the data available on the Internet (e.g. blogs, websites, online product marketing websites, Twitter, rss, etc). For example, the data analyzed are from websites selling IT products online (the data to be analyzed can be taken from any field as long as a specific vocabulary is defined). In order to identify the bestsellers on the market, results that help top management of a company to make better decisions, an IT-specific vocabulary was defined.

2. LITERATURE REVIEW

The online and print Romanian and international literature in the field of DM and text analysis is impressive. The multitude of solutions, theories, techniques (models, methods, paradigms, etc. is overwhelming. After a simple and the first search on GOOGLE, we faced the situation shown in figure 1 by [1].

![Figure 1](https://example.com/figure1.jpg)

**Figure 1.** It's a jungle out there – from [1]

After a careful approach of the field and the accomplishments of Romanian and foreign scientists things became clearer and we came to the conclusion, in figure 2 adapted after [1].

![Figure 2](https://example.com/figure2.jpg)

**Figure 2.** Theories, techniques (models, methods) and paradigms used in DM – adapted after [1].

Moreover, DM may be applied to many other fields (cultural, social, economic, political) illustrated in [3], [4], [5], [6], [7], [8] or in engineering [12]. In addition, in the development of such applications, the recommendations and guidelines formulated by the Data Mining Group [9], whose main aim is to standardize the field, should also be taken into account. The accomplishments of Romanian scientists have also inspired us – one way or another – in developing the application and commencing this study. Noteworthy are the accomplishments...
of Institutul de Cercetari in Inteligenta Artificiala (RACAI - the Artificial Intelligence Research Institute) [18] and the research published by [13], [11], [19].

3. CURRENT RESEARCH

Regarding the analysis of various sources, we sought to determine the buyer profile (to see which products are in demand) in order to support management in decision making and regulation of future production as well as the effective supply with products of major retailers, and last but not least for the supply of raw material.

Therefore, this study has three objectives (the first two for 2012, and the third for 2014):

- The development of a software application; practically, in a DM process we performed a pre-processing of data;
- Analysis of various profile sources on the Internet;
- The development of a real data-mining application, by developing a meta-classifier based on the results of several theories and techniques such as (Naive Bayes, Support Vector Machines, Neural Networks, etc.), and directing the application towards the concept of Machine Learning.

We might argue that, we have already accomplished the first objective (see results obtained), the pre-processing of data being available and functional, and for the third objective we still have available time left, i.e. two years.

The main benefits of the study are:

- The possibility of analyzing and extracting information from Internet data (e.g. blogs, online product marketing websites, rss, etc);
- The possibility of automatically generating line and tower graphs (integrated into the application);
- The know-how resulted from developing the application;
- The possibility of subsequently improving the application and developing it to match the Web 3.0 requirements (the development of our own application enables us to develop and achieve the third objective).

4. THE METHOD

For the achievement of objectives we observed the scheme presented in figure 3. The vocabulary used by the application contains 4 classes (however, it may contain any number of classes)

Due to the fact that all classes (categories) defined and used by the application are balanced from a quantitative point of view, (they contain five or six words) in the application only the PAF normalization is performed (see figure 3), namely a qualitative normalization. Moreover, the application uses a special class populated with "link words", which are not counted, in order to reduce the "noise" of the results obtained during the data pre-processing stage.

The algorithm shown in figure 3 is described below.

4.1. Requirements

a) The structure of primary elements, termed as word classes, specified in a "source word" format (the word without a prefix or suffix [the word root])

b) The link pool to be classified

Note: These sources are in a standard configuration files (*.ini)

4.2. The Application Methodology

a) All categories are loaded in an accepted format

- wordCountcat=[total no. of words / category]

b) Every link is downloaded

- The algorithm does not generates links from a source document, that is if it finds a link it does not follow it, thus, the algorithm operates on the level 0;

c) Tags are extracted

d) A structure based on the word is thus created, and all categories connected with that word are linked to it

- It can also be checked whether there is at least one word in two categories and that word must be deleted from both categories, to prevent conflicts;

e) Each word is searched in the word source extracted and a distribution network is created in the following format

- [Word (root)]cat/link=[number of occurrences in the linked document]

f) The absolute probability between the total number of words and the number of occurrences in a certain category is calculated

$$PA_{cat/link} = \frac{\text{wordCountcat}}{\text{wordCountTotalLink}}$$

g) The normalized probability is calculated

$$PA_{Finalcat/link} = \frac{PA_{cat/link}}{\sum PA_{cat/link}} \times 100\%$$

4.3. Output

a) Unix like configuration file - a format compatible with the large majority of programming languages, parsers are included at the API level, and thus is a format which allows further cross-platform processing. The problem is that it does not allow specific information about the types of fields used, and thus a wide range of interpretations remain at the level of source code of the data stored in this output format;

b) HTML Table – a format which ensures user interface, UI cross-platform compatibility, but it is difficult to work with it at an interoperability level of applications which use these output data;

c) XML - using DMG [9], ensures the best interoperability between applications which use this type of data. The advantage is due to the XML, which incorporates specific types of data used in the output document, but also to the DMG specifications which provide a full understanding of the output data;

d) Google API Charts [14], ensure visual comparison. Google Charts is integrated in the application using Javascript and HTML, which gives it versatility and enables it to clearly display results.

5. RESULTS

The results obtained by our application are shown in figure 4, and represent the sale analysis through the pre-processing of data from four different sources. The results are show as tower and line graphs facilitate the decision-making process. Based on this decision, a manager can quickly analyze and learn where computers/monitors/tablets etc. sold better. Moreover, it should be noted that if an adequate vocabulary is developed (the application enables the user to do that) the best selling brands of laptops/computers etc. can easily be analyzed as well. We selected IT sales in order to obtain concrete data, but just as easily an adequate vocabulary can be developed for any field, to enable the top management to make decisions regarding the production (customer requirements) and efficient supply of the stocks (which may be geographically dispersed).
The benefits of such applications can extend along a "life cycle" of the product through decisions regarding suppliers who supply the raw material.

In conclusion, such an application, besides providing information "hidden" in the data quickly and effectively, facilitates decision-making in an organization, both upstream and downstream, on the one hand by acknowledging customer needs and preferences, on the other hand through the possibility of reaching an efficient production supply strategy. Basically, the "just-in-time" concept can be applied to stocks that tend to zero at the level of both supply and output.

6. CONCLUSIONS AND FURTHER RESEARCH

As shown in the outline scheme (figure 3), the pre-processing of data was performed (stage I) as well as their representation in XML taking into account the DMG recommendations, and in graphical form (tower, line) integrating into the application the possibilities provided by Google Chart (stage III).

Considering the fact that in a "knowledge-based society" we must develop "more intelligent" computers able to provide more consistent data, without daring to mention, yet, the concept of the "society of consciousness" launched by the late scientist and academician Mihai Draganescu in 2000 [10], in the future we aim to expand the "black box" in figure 3 (stage II), turning towards Web 3.0, on the one hand through defining some semantic classes, and on the other through developing a meta-classifier providing solutions such as Naïve Bayes, Support Vector Machines, Neural Networks, etc. For simulating these solutions we shall use the development environment MatLab which quickly facilitates analyses such as Naïve Bayes [16] or Support Vector Machines [17] etc., the final implementation (which shall comprise all the three stages) being performed in JAVA.
Figure 4. Results obtained by analyzing four URL_s to determine sales for each URL separately in a tower and line graphic presentation.

7. REFERENCES
COLLABORATIVE ENGINEERING IN THE MANAGEMENT OF BUSINESS IMPLEMENTING INITIATIVES

Carmen, Dobrin\textsuperscript{1} and Ioan, Bondrea\textsuperscript{2}

\textsuperscript{1} Romania, Sibiu, carmendobrin12@yahoo.com
\textsuperscript{2} Lucian Blaga University of Sibiu, Romania, ioan.bondrea@ulbsibiu.ro

ABSTRACT: Creating a systematic approach in designing and implementing a new product, by considering all elements from lifecycle is integrating all the aspects of product, manufacturing and services process is one of the most advanced manufacturing method. The constantly team work between designing and manufacturing compartments is always reaching to the same point: higher quality-cost-time. Maturity of internet technologies, market shifts and increased competition forces the adoption of establishing offshore engineering centres where the combination from engineering and CAD software are working together for achieving new market goals. Collaborative Engineering is the key of business competitiveness.

Key words: collaborative engineering, business competitiveness, collaborative negotiation, CAD software

1. INTRODUCTION

Integrating development technology and development process into a single competitive system in today’s global economy includes a set of activities and functions with clearly defined tasks. The efficiency of this process is considered achieved when the final output satisfies the product and customer requirements. The discipline that “studies the interactive process of engineering collaboration, whereby multiple interested stakeholders resolve conflicts, bargain for individual or collective advantages, agree upon courses of action, and/or attempt to craft joint outcomes which serve their mutual interests” is collaborative engineering, which due to the “explosion of internet technologies has quickly become a topic of great interest”\textsuperscript{19}

Collaborative engineering is about development of innovative methodologies. Some of the most preferred methodologies that are already used in companies are Extreme Programming (XP-rules to establish and follow), Capability Maturity Model (CMM), or Six Sigma (efficiency and effectiveness measures) which significantly contributes to company success. In the mean time, recommendations for a quality management system are given by ISO 9000 which also have the capacity to measure the success and safety of the process. Well documented measurements help developers in their work for process improving, which has like final goal, a higher level of maturity, and a better activities management in the organization \textsuperscript{12}. From developer’s point of view, a process can be divided and developed in four phases:

- Inception phase, where the business product is defined;
- Elaboration phase, where technology is defined;
- Construction phase, for design;
- Transition phase, where the system is implemented.

The increased competition and the market shifts, force companies to adopt new business models. Problems like finding requirements, developing human capital, service management can be achieved in better time by the proposing of a prototype model where business workflow scenarios are well developed.

2. VIRTUAL ENVIRONMENT FOR COLLABORATIVE ENGINEERING

2.1. Collaboration in engineering environment

Collaborative on-line secure services are sharing already sets of data needed in the design process, but even into an established group setting, sometimes users aren’t pleased to make their data available. There are systems, like Distributed Knowledge Technologies that can negotiate the collaboration form for the access of members. If it is well done, sharing can be a pleasant practice, where all contributions are accountable. Having in mind the fact that the team members can be all over the world, and that the team has to work twenty-four hours a day, seven days a week, there has been developed distributed practices for achieving a good collaboration between the teams from different zones of the globe, taking care in the same time of the costs. \textsuperscript{14}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure_1.png}
\caption{Design team geographically distributed \textsuperscript{11}}
\end{figure}
“Collaboration is a sine-qua-non to creation of value in organizations. The word, collaboration, derives from the Latin com and laborare to labor together, as making a joint effort toward a goal” [16]. Because of the design complexity, team working developers, each with their own specialist, interact during the conceptual phase of a new process. Sharing information’s and making agreements in the virtual environment it’s a necessity for significantly activities relief and functions from life cycle process integration.[5], [6], [7], [8], [9], [10] Internet provides all the required tools used in this geographically distributed engineering environment in which collaborative engineering is necessary in exchanging design information for a better models development.

The objectives of collaborative engineering (CE) are: better resources, activities and process integration. The implementation of this concept reduces the time-to-market cycle, by integrating capabilities and know-how for “intelligent information support and group decision-making utilizing a common enterprise network model and knowledge interface.” [11]

Collaborative engineering, while working in connection with Virtual Reality, can create a platform where information could be seen together in visual applications to allow a faster development in finding facilities for life cycle engineering. By providing the right mix of technology analysis, using extractor programmers interfaces like CAD for exchanging dates, can be delivered the optimum business solutions with competitive advantages. [16]

2.1. Collaborative Negotiation (ECN)

The new paradigm of Engineering as Collaborative Negotiation (ECN) technologes the power of tools and analysis between engineers and computer systems. Looking to computers for negotiation and not for optimization, opens new fields for engineering applications in finding best solutions in achieving goals. In every moment, the dialogue must be an iterative process with positive impact on performance. Exploring the negotiation ways requires the collaborations from specialists from different domains. The team behavior is a

2.2. The power of tools and analysis

Ensuring effective collaboration in the team works is essential. The Cognitive Collaborative Model is necessary for the engineering teams, while individual mental models might have no impact in the collaborative efforts. The dissemination of information during the collaborative process needs engineering tools and technique. The German Collaborative Research Centre “Distortion Engineering”, developed the Distortion Engineering methodology. During the process chain, from the multitude of changes, it is sometimes difficult to choose all the correct characteristics to reduce the distortion. Understanding and minimizing distortions is the new effort that is made by researchers, in order to reduce the amount of prototyping and of consumables needed [20]. “The management of distortion remains to be one of the crucial factors in economic production of today. Nowadays common understanding is that the causes of distortion is spread over the entire manufacturing chain, each production step contributing to the final dimensional changes.” [21] Because engineering is already an interactive process in which the participants are joining the same interests, the new topic about collaborative engineering based on internet technologies is having great success.

In future, this will be one of the economical criteria in choosing the best process chain. The Pathfinder analysis is a tool based on modeling and simulation technologies which enables early prototyping and also a robust and flexible data analysis. Focusing the system this software supported through computing infrastructure allows verifying the equipment and operations as a whole and also allows designers to work easily in 3D. The obtained models are used in two ways: “simulating the outputs of the system for given parameters value, and generating outputs which can be compared to measured outputs in order to determine different parameters of the system.” [23] The relations between engineering decisions supported by the computer tools must justify negotiations.

2.3. The new paradigm of Engineering as Collaborative Negotiation (ECN)

The revolution made by computers has change the way of implementing engineering. The digital era of computers, have increased the possibilities of optimizing productivity through the collection of computational databases. In the same time, it exist the possibility of using several different versions, so engineers can find alternatives for the best design. To reach the best solution, engineers must communicate in the same time, like in a social process where information must be sharable between engineers and computer systems. Looking to computers for negotiation and not for optimization, opens new fields for engineering applications in finding best solutions in achieving goals. In every moment, the dialogue must be an iterative process with positive impact on performance. Exploring the negotiation ways requires the collaborations from specialists from different domains. The team behavior is a
human integrated one which allows the understanding of collaboration in organizational cloud/ internet infrastructures. Developing intelligent CAE tools, is the success key for supporting collaboration in the future computer applications. [22]

Designing processes using CE need to follow the next five ways:
1. Way of thinking (drafts and theoretical base);
2. Way of working (design methods);
3. Way of modeling (representing appearance);
4. Way of controlling (methods for measurement);
5. Way of supporting (tools, techniques).

For obtaining the best process results, engineers had to collaborate, by using a research methodology for attaining the goal. There is a six modeling collaboration defined by actions like:
- Generating more concepts;
- Reducing;
- Clarifying;
- Organizing;
- Evaluating;
- Building consensus. [3]

Analyzing and combining this data collection, is transforming the research into a methodology. To measure the CE effectiveness we need to use research methodology. 

Case study research (CSR) is defined as “an empirical inquiry that investigates contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” [15]. Developing, testing theory or exploring new hypothesis is based on knowledge. The techniques for arriving to the answer/result, are probably consuming time to obtain the conclusions validity. This methodology is useful to the researchers in viewing the studied phenomenon.

Implementing the design actions can be also done by applying Action Research (AR) methodology. This is mixing together theory and practice for solving new processes generating knowledge by involving improvement in practice and learning, or in solving process of a problem.

When the need in solving problems is related simultaneously to empirical observations or data, the base can be Grounded Theory (GT) which allows the researcher to do this. When depending on reaching various goals, the advanced scientific knowledge will help the researcher in collecting information by examination of a wide variety of models. The result of the precise collaboration process with design process is Survey Research (SR). Using performance analysis, algorithms and more for constructing knowledge during the design process, can be made by Design Research (DSR) which is divided into two parts: research and design. [13]

The continuous improvement of collaboration engineering process for gaining competitive advantages needs benchmarking analysis on assessment models. For a proper design, the approach must follow the next sequences:

**Figure 4. Four step cycle for action research [24]**

F.I - Field Interview is the meeting phase of collaboration engineers with the stakeholders for determining the problems or tasks, the context and the desired purpose.

D.P - Design Phase is the decomposing phase of tasks into single collaboration activities, for a better evaluation and elaboration.

T.P - Transition Phase, is the adjustment phase of design process, where collaboration engineers had to enter a training program and to learn how to become a good practitioner and facilitator.

P.I - Practitioner Implementation is the moment in time when the already made practitioners are assuming the facilitator’s role to begin collaboration sessions for optimizing the implementation of the design process.

S.O.U - Sustained Organizational Use, is the assuming phase of the process created by the collaboration engineers, and also the place where last changes can be done to allow a faster and with out risk way in the future.

The model “will incorporate cognitive, economic, political, social, affective and physical factors to determine the extend to which collaboration processes can become sustained and thus optimized over time within an organization. [4]

3. CONCLUSIONS

The tactical development of CAD techniques and the reliability integration of information, evaluations and analysis are permitting an easier faults identifying through simulation by creating aesthetically iterative graphics. Understanding customer hierarchical requests and so minimizing technical risks are important characteristics of the process. A synchronized development between technology and product, and a logistic support is the optional solution. Putting in work of a unique information system accessible to all in the same time through a communication policy will increase the group influence through project.[1] The development process will be
more visible for every team member as well as for the management team, by this collaborative engineering. Using models in collaborative engineering can help managing the processes, making them predictable and optimizing them. This also will offer an ensemble view of the research for an easy measuring of success.

The use of the structural, dynamic and precision analysis lead to design improvement by performing useful functions like: geometrical modeling, dynamic simulation, structural analysis, reliability prediction, faults analysis, human factors and working environment analysis which all are together working for success, like H.Ford says:

‘Coming together is a beginning, keeping together is a process, and working together is success’ H.Ford

4. REFERENCES

16. http://tusofia.academia.edu/AngelBachvarov/Papers /1120129/COLLABORATIVE__ENGINEERING_IN_COMMON_VIRTUAL__REALITY_ENVIRONMENTS

476
ABSTRACT: Business environment and changing markets are the competitive challenges of today. There is not one universal solution for this, but agility is the key of success in creating the customer responsiveness and in mastering uncertainty, which are two of the most relevant items in managing performance. The integration of agile systems in the organization structure is improving the permanently interaction with the customers wishes. The study of agility’s indicators, including also the concepts of AM are far from new, but can they contribute in constructing an agile supply chain. The constantly changing in global environment, has a directly impact in the future of the company, and one of the most important questions will be how to achieve supply chain agility. And this paper will try to find an answer to the question in how to achieve competitive advantages in the global market and to improve financial performance of the company.

Key words: agile system, business environment, competitiveness, digital economy

1. INTRODUCTION

The step to the Information Society in which we live, was put into reality by a wave of technological renewal adapted in all social plans. The integrated vision from this millennium times, combined with a performing management and a high software and hardware automation level, has transformed the modelling of industrial process from concept in necessity. Unprecedented dynamism, due to global market competition, frequently leads to production rehabilitation, to a permanent improvement of company resources control with a special attention on the non-manageable hidden resource, time. In the '70, the Japanese are improving a big step in production activities management, by putting in practice the lean system, which, afterwards will be completed by the Kaizen philosophy of continuous improvement.

2. AGILE VERSUS LEAN

The great variety of products and the increasing demands of lower prices and higher quality, forced the companies to make various changes in the traditional way of mass production. Improving manufacturing processes by implementing lean or agile manufacturing was the first step. The beginning was with lean manufacturing and after bettering the principles appear agile manufacturing, which includes the best from lean. Pros and cons will always be between them, but there are advantages and drawbacks easy to be highlighted. [20]

Lean system, needs only half of human effort, half of production space, half of investment in tools and machines, half of the needed time for introduction of new products in analogy with mass production system.” [17]. This production type or manufacturing philosophy was first implemented by Toyota Motors, in order to consider “expenditure of resources for anything other than creation of value for the end customer as wasteful, and thus a target for elimination. Lean implies more with less.”[20]. The results of the company were better and better, that means the adoption of this Lean approach was the best future solution. The purpose was optimizing the workflow for achieving a higher productivity by using all the advantages of Lean. The most important of them are:

- The improvement of product quality through all new possibilities;
- Attempting of products, and the use of feedback, eliminate almost all the risks;
- Reducing cost and growing process efficiency;
- Attention on learning and improving all the time.[21]
that Lean manufacturing is like a guideline of mass production, because of just in time deliveries, higher products quality, the use of flexible production systems and not at last the continuous improvement, in front of the acceptable quality level of the mass production.

The every day changes need a perfect technical support and a quick response to all new market demands. Lean manufacturing principles can be applied in the floor level of a factory, for facilitating the ability to adapt to the demanding changes and to bear competition.

While meeting rapidly changing of the market, at Iacocca Institute of Lehigh University from USA was born a new manufacturing system with hard and software technologies named “agility”.

**Figure 3. Agile manufacturing [20]**

“Agile manufacturing (AM) is the ability of surviving and prospering in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-defined products and services.” [13]

"Agility is a rapid and proactive adaptation of enterprise elements to unexpected and unpredicted changes”. [14]

“Agility is the synthesized use of the developed and well-know technologies and methods of manufacturing” [16]

“AM is the assimilation of all flexible production technologies, together with experience gained from total quality management (TQM)” [14]

Agile manufacturing is based on flexible and easy adaptable targets to the changes required by the new concepts where the qualified workforce has an important role. The ability of the company to respond to the changes often creates problems.

So, using mathematical statistics with new analyzes methods led to a systemic management approach, by perceiving of each entity like a component system which interacts permanently. The system concept means that it is possible that the whole expert knowledge could be captured and stored in a computer memory where it exists all the time the possibility to be invoked and applied by other persons when necessary.

In a larger vision, agility means a continuous transition and a complete adaptation to the unpredictable changes that permitted the build of innovative systems carefully close to leadership and new market opportunities.[5],[6],[7],[8],[9],[10]

The ability to adjust to internal and external changes can be done at the enterprise level, because of the suitability of agile principles in work co-operation. Also, as other advantages of agile production, can be mentioned the competitiveness’s enhance in mastering the changes and the good impact of information. It is important to apply agile manufacturing in virtual/ wide enterprises for obtaining the needed products flexibility.

Thriving in the unpredictable environment is being responsive to the changes, which is one of the most important attributes of agile manufacturing.

So, there were created performance methods for storing and information processing as well as management system for relational databases. Is important here to be mentioned the difference between the notion of knowledge (cause-effect dependence between the same characteristics of the same object, or two different objects) and the data notion (represented by particular values in some certain moment).

That means that knowledge can not exist in the absence of data, and the computer transformation from one engine into a collaborator became very useful to the manager. [2]

### 3. AGILE SYSTEMS INTEGRATION INTO THE DIGITAL ECONOMY STRUCTURE

The internet interaction between the electronic techniques applied to the economical-engineering systems, led to the implementation of the digital economy concept, by creating models based on e-business, e-commerce, e-banking. Some of the most important characteristics are:

- The new ideas source for business developing is the consumer with his needs and wishes;
- The link between demand and supply requires cooperation of all stakeholders involved;
- Conception of new products by adding value means the respecting of certain rigorous principle.

The communication techniques of digital economy involve productivity growth, investing in innovation became one of the reducing production costs methods. Encouraging the implementation in small and medium companies of the informatics systems of digital economy led to advantages like:

- Collaboration liberalization between suppliers and customers;
- Rapid internet access;
- Allowing digital signatures;
- Modern infrastructure, international adapted with involved employees;
- Loyal cooperation in innovation and creativity, respecting the intellectual rights.

The companies based on intellectual systems of knowing are the intelligent pillars of the digital economy that determine the evolution based on innovation and creativity. The knowledge storage into the agile company database is the performance key of global strategies. [3]

### 4. MANAGEMENT OF AGILE MANUFACTURING PROCESS

The business engineer has a leadership role in agile manufacturing management. Four of the most important features are: mission, responsibility, ties and performance evaluation criteria from inside the company. He has the formation of a team responsibility, in which he must be trainer of views for an efficient business developing through optimizations to progress into the competitor market. The business engineer improves in the technique, commercial and
administration domain and also in the sale of the business as a specific product for a particular customer.

In order to innovate, a new approach in business modeling is reengineering of company correlations with the market into a unitary holistic concept. In the current industry context the growth of holistic indicators of quality, performance and customer satisfaction, require the business redesign according to correlation between technology and market, production and marketing, managerial and business process.

To this purpose, the business will be reviewed and holistic redesigned by respecting all new correlation between productive, managerial, commercial and decisional process.

A flexible management, easy adaptable to the market changes will have to think through reengineering, a new production system which will achieve profit on a market with customer satisfaction. Event teams made from responsible and qualified specialists, and on-line assisted by a manager, understand the business process as a whole one, and will work on promptly solving any radical transformation. [2]

Applying reengineering, increase people involvement, and their role will pass from the great decision makers’ specialist area, to one of self control and self lead. In reengineering is essential the changes impact review on market customers, not avoid the interest of a together work for a better understanding of the business from their point of view, as well as for the synthesis of new ideas from the market. [1]

5. PROFITABILITY INDICATORS OF AGILE MANUFACTURING SYSTEMS

Some of the essential indicators of AM are:” speed, flexibility, innovation, pro activity, quality, and profitability. In this framework can be included four core concepts of AM: core competence management, virtual enterprise formation, capability for re-configuration, and knowledge-driven enterprise.”[16]

There are identified four main aspects of AM:

1. agility drivers-that is about the influence of external environment,
2. strategic abilities- competency, flexibility,
3. agility providers- organization, technology, people, and innovation, and
4. agility capabilities- a company’s ability that is providing the basis for productivity, efficiency, and effectiveness .[15]

Because of the multidimensionality of agile manufacturing concept, the main structure is defined by the next four parameters: production (plant, equipment, materials), market (external environment), people (level of training), and information (the ability of capturing and managing them). Working pairs like: innovative ideas and right decision, flexibility and integration, proactive behavior and formation of new partnership, quality and costs or speed of responsiveness to external changes, are agility attributes that are influencing the competitive bases of a company.

6. AGILE SUPPLY CHAIN STRATEGIES

Finding a solution that will respond to the competitive challenge of today’s reality will be a difficult task, but agility is a concept that is responding to it. The constantly changing global environment, has a directly impact in the future of the company, and one of the most important questions will be how to achieve supply chain agility.

The existing flexibilities of the supply chain will be the first step in the development of its agility. [4] The unpredictability of production industry made organization reconsidering ways in finding new solutions for old problems, and for this they have to allow a good communication between operations, management and vendors, and to try to establish an audit of agility in the supply chain.

While mastering market turbulence, the key of success will be customer responsiveness, because agility is about creating that responsiveness and mastering uncertainty. These elements are far from new, but they can contribute in constructing an agile supply chain.

Figure 5. Elements of supply chain agility [19]

Figure 6. Characteristics of supply chain

Figure 4. A conceptual model for agile manufacturing

“The world is in the era of supply chain competition, where organization no longer acts in isolation as an independent entity, but as a supply chain to create value delivery systems that are more responsive to fast-changing markets, more consistent and reliable. “ [11] The two most important strategies in supply chain are lean, which is developing value by eliminating any waste and agility which is transferring all opportunities from a virtual market to a supply chain, and newly is accepted as a business unit.

For being agile, a must have for the supply chain is: market sensitivity, virtuality, process integration, and networking. Taking the best features from Lean and adding some new was born a new manufacturing strategy, focused on the ability of the company to have a flexible organization, to have an innovative staff and relationship with customer, based on knowledge. [12]
Market sensitivity includes customer understanding and rapid response, virtual integration relates to leveraging information, process integration is mastering changes and network integration relates cooperating to complete. Through all this, measurement is an all-round element, measuring the capabilities in achieving competitive advantage, and the supply chain is part of it, and behaving to improve financial performance of the company.

Figure 7. Link between Agile Supply Chain and Competitive Strategies [18]

“The strategy of agile supply chain, is the “change” which is the only constant thing in the business environment and if the company is not agile, it just can’t do it, because customer expectations are never static” [11]. Companies today are faced with a lot of new challenges like demand variability, shorter customer times or lowering costs, increasing quality and competency of services, and in order to survive into this environment, they need to respond quickly and with great agility to the market changes, and the strategy of an agile supply chain is the answer.

7. CONCLUSIONS

In the complex business environment of today, agility is a major factor of influence, which is determining winning strategies for the company. Achieving success is a hard work, where the organizations had to focus all their efforts in building an agile strategy and aligning it to market’s objectives, and for this, the company should implement all solutions for growing the responsibility and flexibility in adapting new plans for change.

8. REFERENCES

1. Bărăgan (Stelea) Niculina-Teza de doctorat Managementul productiei agile a sistemelor de mecanica fina asistate informatic, Brasov 2010
ALIGNING FURTHER EDUCATION AND TRAINING WITH THE ADVANCED MANUFACTURING TECHNOLOGY STRATEGY: SOUTH AFRICA CASE STUDY

Partson, Dube\textsuperscript{1} Goodwell, Muyengwa\textsuperscript{2} and Kimberly, Battle\textsuperscript{3}
1 University of Johannesburg, Johannesburg, South Africa, partsond@uj.ac.za
2 University of Johannesburg, Johannesburg, South Africa, gmuengwa@uj.ac.za
3 University of Johannesburg, Johannesburg, South Africa, kbattle@uj.ac.za

ABSTRACT: Academic institutions need to exhibit the appropriate flexibility to meet the demands of industry. This descriptive study seeks to identify the problems both in the private sector and in the education sector with regards to engineer training and to utilise the strengths of both to provide a solution. The study highlights the current growth of the manufacturing sector and the continuing skills gap. It identifies the problems faced by the manufacturing industry and also changes that can be made to the further education training curriculum. Investigations of the impacts of the engineering training and the factors affecting training and that inhibit or facilitate the engineering training were done. Based on experience and many discussions with the private and education sector with regards to the particular problems currently being faced by those wanting to use advanced manufacturing technology it is hoped this document will generate a lively debate between the private and public sector. This paper fulfils an identified training need and offers a practical solution to overcome a national skills shortage.

Key words: engineering training, manufacturing technology, skills gap, Further Education and Training (FET)

1. INTRODUCTION
Manufacturing is important to South Africa. It contributes over 15\% of the national gross domestic product (GDP),\textsuperscript{[1]}, over half of all exports and is the second largest employer. As important as it is, there are signs that the manufacturing sector is in decline, as evidenced by:

- A declining value-add from the sector (5.2\% in 2007 compared with 2.6\% in 2008)
- A declining rate of change in manufacturing export growth
- A dramatic decline in gross domestic fixed investment in the sector between 1991-1996 and 1996-2005
- A low labour intensity
- A decline in employment across the sector

The South African Government, in recognizing the importance of manufacturing in the economy, recently developed two strategies: the National Research and Development Strategy (NRDS),\textsuperscript{[2]} and the Integrated Manufacturing Strategy (IMS),\textsuperscript{[3]}. The former, released by the Department of Science and Technology (DST),\textsuperscript{[4]}, aims at ensuring that technology resources are better developed, focused and utilized. The latter, by the Department of Trade and Industry, recognizes that South Africa's future competitiveness will depend on the capacity of the manufacturing sector to master advanced technology domains, to innovate and to meet the precise needs of customers.

The IMS recognizes the need to move from raw material-intensive manufactured goods towards increasingly knowledge-intensive goods and services. The NRDS regards Technology and Innovation Missions as central elements for accelerating economic growth, the creation of wealth on a sustainable basis, and the improvement of quality of life of South Africans.

South Africa's traditional industries have been resource based, particularly in minerals. Today most minerals are exported in primary metal forms, the main exception to this being fabricated steel structures. This prevents South Africa from reaping the full benefit of its very rich resource base. Manufacturing can add value to these exports by converting ores to primary metals and primary metals to higher value-added manufactured products. Manufacturing will also complement the service sector. High-value manufacturing will generate demand for the provision of technology-intensive services. On the other hand, failure to upgrade resource-based industries will make South Africa vulnerable to the global trend of deteriorating terms of trade for commodity producers, which has been evident over the last few decades. Thus manufacturing can be seen as an important catalyst for the upgrading of the entire economy.

The goals and objectives of the National Advanced Manufacturing Technology Strategy are to:

- Develop a vision of the technological profile of the industrial sector in the year 2014
- Identify priority sectors which have the greatest potential for supporting relevant goals contained in the IMS and the NRDS. These goals include national and social goals such as job creation and equity
- Stimulate technological upgrading in industry
- Facilitate the flow of technological resources to industry through new knowledge networks to foster innovation
- Facilitate the building of an environment conducive to innovation, particularly through the supply of skilled manpower, technology infrastructure and funds.

The strategy was developed through extensive consultation within the private, public and education sectors, and care was taken to ensure strategic fit with other national strategies and the avoidance of unnecessary duplication. The approach (see Figure 1) ensured:
• Wide consultation with industry, local and international science councils, Tertiary Education Institutions (TEIs), labour and government; and
• Learning from international best practices and processes - successes and failures.

The need for human resource development is critical in each of the three key requirements for developing the manufacturing sector. This is demonstrated in Figure 1.

![Diagram](image)

**Figure 1.** The importance of human resource development in the growth of the manufacturing sector, [2].

The available evidence indicates that there is indeed a significant demand for people with skills,[5], which is not matched by their availability. Factors such as economic growth, sectoral levels of labour intensity, projections of net migration, sectoral age profiles, the business cycle, government expenditure decisions, projections of HIV/AIDS morbidity rates, industrial policy and foreign direct investment, all affect this supply and demand dynamic.[6]. Without an understanding of the dynamics of the skills environment, it is not possible to plan appropriately. The consequences of skills imbalances are undoubtedly negative. This needs to be corrected through a focus on industry-driven and academic institution supported human resource development.

A well developed Further Education and Training (FET) sector in South Africa will no doubt make a considerable contribution to the envisioned economic growth of the country,[7]. The reason for this is that this sector is situated at the intersection of a wide range of government policies, which are critical to the new information-based economy [7]. These include macro-economic, industrial, labour market and human resource development policies. Government coordination across these domains is key to their success and to the establishment of a policy framework which will promote the development of the human capacities, knowledge and skills of our people.

Moreover, as we approach the 21st century, FET is fast becoming an important strategic force, in a context where a country's ability to compete effectively in the global economy increasingly depends on the knowledge and skills of its people, [8]. The pace of scientific and technological advancement, and the challenges and opportunities of the information age, mean that high quality education and training, and lifelong learning, are essential if South Africa is to keep abreast of changes in the nature of knowledge and in methods of production.

Skills education training authority (SETA) research have identified middle level skills needs in their sectors and put in place strategies to address them, particularly through the use of the public FET colleges and universities of technology working in partnership with employers providing workplace-based training.

2. LITERATURE REVIEW

2.1. A definition of Further Education and Technology (FET)

The public FET college system is central to the government’s programme of skilling and re-skilling the youth and adults. Its transformation is key to the integration of education and training and responding to the skills needs in our country. In recent years, FET colleges have been striving to make the transition from their former status as technical colleges to being responsive and vibrant post-school institutions for vocational education.

FET consists of all learning and training programmes from National qualifications framework (NQF) Levels 2 to 4, or the equivalent of Grades 10 to 12 in the school system. It is the band within the NQF which follows directly on General education and training (GET) and precedes higher education (HE). Learners enter FET after the completion of the compulsory phase of education at Grade 9 or Level 1 of the NQF. 3.2 FET is not compulsory education,[9]. By definition, it has no age limit. Its goal is to promote lifelong learning and education on-the-job. FET is provided directly or through distance education by public schools, public colleges, independent colleges and on-the-job trainers. This research only focussed on public college FET.

The mission of FET is to foster intermediate to high level skills, lay the foundation for HE, facilitate the transition from school to work, develop well-educated, autonomous citizens and provide opportunities for lifelong learning through the articulation of learning programmes.

2.2. State of the industry – forecasts

In the Industrial Development Report for 2011 of the United Nations Industrial Development Organisation (UNIDO), the competitiveness of 87 countries was determined using an index called the Competitive Industrial Performance Index or CIPI. South Africa's rating in 2009, somewhat below Brazil and India (CIPI ratings of 0.202 to 0.206) BRICS counterpart,[10]. An increasing competitiveness is the reason that justifies technological upgrading; the principal element of the Technological Vision for South Africa must be the achievement of a substantial upgrading of the CIPI index by 2014, [11]. The most appropriate indicator for this strategy is technology intensity, defined as technology spending per capita. The latter includes domestic Research and Development R&D as well as the acquisition of foreign technology.

Much attention has been focused on the use of computer-integrated manufacturing systems (CIMS) and advanced manufacturing technology (AMT) as possible solutions, in part, to the much discussed problem of the of competitiveness of South Africa manufacturers.

2.3. Advanced Manufacturing Technology

The benefits of CIMS and AMT such as increased flexibility, increased quality, shorter product development times, etc [12]. Have been widely accepted, however, SA manufacturers have been slow to adopt these technologies.

Computer-integrated manufacturing systems (CIMS) have been commonly defined as the use of computers, information technology, automation, and people in the integration of
manufacturing systems. A specific definition for CIMS that all interested parties can agree upon has been elusive. A representative definition for CIMS is given by [13]: “Computer integrated manufacturing (CIM) is the term used to describe an integrated automation of the factory. Its aim is not full automation, but running a profitable business by: (1) achieving a productive balance through the integration of people and automation, and (2) using such technologies as a database and data communication to integrate the design, manufacturing, and business functions that comprise the automated segment of the factory.”

This definition allows some flexibility in determining whether a specific facility constitutes CIMS. Such flexibility is necessary due to differences in individual characteristics of implementing companies. An alternative definition is given by Gunn [14]: “Computer integrated manufacturing (CIM) represents the integration of all information involved in manufacturing from product and process design through manufacturing planning and control, production, distribution, and after-sales service and support. CIM is absolutely vital to achieve world class quality, speed, flexibility, and productivity.”

This definition represents the more narrow view of what constitutes CIMS. Regardless of what specific definition is used, CIMS can generally be considered to be the use of computers, automation, information technology, and people used in an integrated fashion.

The following represents the technologies and components most often used in CIMS implementations:

1. Computer-aided design (CAD)
2. Flexible manufacturing systems (FMS)
3. Cellular manufacturing
4. Group technology (GT)
5. Computer numerical control (CNC)
6. Computer aided manufacturing (CAM)
7. Computer aided process planning (CAPP)
8. Automated materials handling
9. Robotics
10. Just-in-time (JIT)
11. Manufacturing resource planning (MRP II)
12. Material requirement planning (MRP)

The research shows that there is evidence of AMTs technologies being taught in FET institutions, the graph Figure 2, shows the number of AMTs technologies per institution, FET 1 has three AMTs namely AMS and MRP, and FET 8 has the highest number of AMTs. The research shows that there are no CNC courses being offered in all FET public colleges and there is no consistency in the number of AMTs taught per institution. Most of the FET laboratories consist of islands of AMTs, with only one institution (FET 8) showing a higher level of integration in Figure 3. Level 0 - means that there is no integration, Level 1 – integration of 2 AMTs, Level 3 – integration of 3 AMTs. The level of AMT integration in FET institutions shows the level and depth of appreciation of advanced manufacturing technologies curriculum in further education institutions.

**3. METHODOLOGY**

A purposive sampling procedure was employed and prior knowledge was used in selecting the respondents or FET colleges to be sampled. Questionnaires were prepared and sent to targeted individuals by e-mail and in print form. The data collected were analysed by using an Excel Spreadsheet and charts. The differences observed between the groups were then attributed more to the variable of interest.

**4. FINDINGS AND DISCUSSIONS**

The South African FET sector faces a number of challenges; one of the challenges facing the FET sector is one of perception that FET colleges are inferior institutions producing low-status qualifications. Despite noble attempts by the government to improve the FET system the uncertainty remains in the country about the extent to which FET colleges should be viewed as suitable alternatives to higher education. Another challenge facing the FET sector is the fact that a significant number of teaching staff at FET colleges are either under-qualified or unqualified. According to available statistics, in 2002, eight percent of FET educators were not in possession of a recognised tertiary qualification, [23]. Lecturers in FET colleges with the necessary trade and industry experience generally do not hold formal teaching qualifications, [23].

The research shows that there is a significant number of teaching staff at FET colleges are either under-qualified or unqualified. According to available statistics, in 2002, eight percent of FET educators were not in possession of a recognised tertiary qualification, [23]. Lecturers in FET colleges with the necessary trade and industry experience generally do not hold formal teaching qualifications, [23].

The research shows that there is evidence of AMTs technologies being taught in FET institutions, the graph Figure 2, shows the number of AMTs technologies per institution, FET 1 has three AMTs namely AMS and MRP, and FET 8 has the highest number of AMTs. The research shows that there are no CNC courses being offered in all FET public colleges and there is no consistency in the number of AMTs taught per institution. Most of the FET laboratories consist of islands of AMTs, with only one institution (FET 8) showing a higher level of integration in Figure 3. Level 0 - means that there is no integration, Level 1 – integration of 2 AMTs, Level 3 – integration of 3 AMTs. The level of AMT integration in FET institutions shows the level and depth of appreciation of advanced manufacturing technologies curriculum in further education institutions.

**Figure 2. AMTs per institution**
5. CONCLUSION AND RECOMMENDATIONS

Expertise in FET teaching staff is a necessary precondition to meet the advanced manufacturing technology strategy objectives. An advanced manufacturing technology focus in FETs requires a significant resource commitment to derive suitable economies of scale or scope; this is likely to apply to capital equipment intensive innovation and critical interactions between technology providers. Developing a consistent curriculum in line with advanced manufacturing technology strategy is also very important in FET engineering programmes.

6. REFERENCES

4. www.dst.gov.za, Department: Science and Technology, Republic of South Africa
7. www.education.gpg.gov.za Green paper on further education and training
8. www.sace.org.za Professional%20Registration%20FET%20Lecture, Review and analysis of current further education and training - SACE
CREATIVITY AND BENCHMARKING INFLUENCE ON RESEARCH, PRODUCTION AND MARKETING IN ROMANIAN ORGANIZATIONS

Gina-Maria, Moraru
“Lucian Blaga” University of Sibiu, Romania, gina.moraru@ulbsibiu.ro

ABSTRACT: The paper is a small part of a research made for identify if benchmarking is or can be used in creativity management in Romanian organizations, in order to combat the effects of the economic-financial crisis and to increase organizational performance. Using questionnaires, the author collected data from the academic and industrial environment. The paper related the creativity and benchmarking influence on three of the organizational functions: research and development, production and marketing. First, it presents an original synthesis about the theory in this field. Second, it presents the results of a research performed on three categories of respondents: PhD candidates in management, university management professors and managers from industrial organizations. Finally, it suggested some modalities for an efficient use of creativity and benchmarking in Romanian organizations.

Key words: benchmarking, creativity management, organizational performance

1. INTRODUCTION

The paper is a small part of a research made for identify if benchmarking is or can be used in creativity management in Romanian organizations, in order to combat the effects of the economic-financial crisis and to increase organizational performance [4].

Using questionnaires, the author collected data from the academic and industrial environment. The paper related the creativity and benchmarking influence on three of the organizational functions: research and development, production and marketing.

2. THEORETICAL CONSIDERATIONS

Particular importance was given, lately, on one hand to creativity in the organizational context, on the other hand, to the use of modern management methodologies. However, creativity can not solve all of the problems of an organization without any limitations or restrictions. Through creativity, these limits and restrictions can only be reduced. ([4], p.41). The same happens with modern management methods.

Contemporary experts claim that in a modern economy, creativity is an essential factor in obtaining added value to any organization. For example, Suleiman K. Kassicieh, following a research conducted on the 361 U.S. metropolitan areas, designated creativity as one of the key factors of sustainable development by creating new businesses, the contribution which brings him to the establishment of jobs and prosperity of society: "jobs and wealth" ([1], p 26, Fig. 1 - Link between government Policies, Factors, and economic development). If these issues were acknowledged by the Romanian managers, creativity could help at overcoming any economic and financial crisis.

"Creativity is actually a lever for economic innovation of the whole concept. From systemic perspective, its role is to accelerate economic progress, by printing the harmonious development of all the functions it combines in an economic system" ([4], p. 87).

However, there is a risk when the organization wants to make discoveries on its own, as a closed system, on the grounds of the protection of knowledge, innovations and inventions. It is likely to rediscover something that had been implemented long ago in other organizations. This is where benchmarking becomes involved, which allows interaction with the environment organization and the use of factors, data, information or knowledge as factors outside “triggers of creativity”. This way, researchers and creative people can enhance others creativity with their own ideas. It saves material, financial, human resources and, especially, time ([4], pp. 12-13).

These are the main arguments that the research conducted, creativity and benchmarking were discussed together as a value-generating mechanism in the organization. We are not trying to create a myth that only two elements can work together. We only point out their power and effectiveness when used in tandem.

The impact of this tandem on the research, the production and the marketing in Romanian organizations was studied on three categories of respondents: PhD candidates in management, university management professors and managers from industrial organizations.

3. THE RESEARCH AND ITS RESULTS

In one of the questions, respondents were asked to assess the impact that they believe that benchmarking - creativity association has on the organization’s functions. In this paper, we examined respondents’ opinions regarding three of these functions: research, production and marketing.

The responses were quantified using the following rating scale: 0 – I do not know, 1 – very small, 2 – small, 3 – ordinary, 4 – strong, 5 – very strong.

PhD candidates and teachers opinions recorded many similarities (Fig. 1).
Regarding the influence of creativity and benchmarking on research functions within an organization, most respondents felt that is very strong: 88% of PhD candidates and 95.45% of the professors.

Most PhD candidates appreciated the influence of creativity and benchmarking on the production function as strong (48%) or very strong (40%). Most professors have appreciated this influence to be strong (63.64%), the following quotation (22.72%) was for the very strong influence.

The impact of this tandem on marketing organizations was appreciated by PhD candidates (Fig. 1) as very strong (60%) or strong (32%) and by professors, strong (50%) or very strong (50%).

Interesting, all PhD candidates and professors evaluated the influence of the creativity-benchmarking tandem on the three organizational functions mentioned as strong, very strong, or ordinary (Fig. 1). This has led to high average values of responses (Table 1).

Also, it can be noticed that the views of those two categories of respondents had a high degree of homogeneity, all coefficients hovering well below 0.35 (Table 1). So, very good averages, with values above 4, are representative for the sample and indicate that professors and PhD candidates consider the influence of creativity and benchmarking on the research, on the production and on the marketing as more than strong.

The same question about the impact of the creativity-benchmarking tandem on the organizational functions was addressed to managers at different levels in different organizations operating in Romania. The managers have been requested personal opinions, even if their companies have practiced little or no benchmarking (see [4], §16.2, pp. 315-381). The questionnaire revealed, in many cases, poor managers concern in these companies on the employees' creativity, too. However, we considered that they can answer this question, even if they do not pay enough attention to creativity and benchmarking during their work. And we were not wrong. Furthermore, we believe that we pointed out to them the negative aspects of their work, showing that it is not enough to know modern theories, unless one applies them.

Managers' opinions are represented graphically in Figure 2. Their diversity is higher than the opinions of professors and PhD candidates in management. In large part this is due to the fact that some managers have recognized that they do not know what benchmarking means. Other ignorant managers were found using the questionnaire’s construction.

**Table 1.** Statistic values for PhD candidates and Professors answers about the influence of tandem creativity-benchmarking on research, production and marketing

<table>
<thead>
<tr>
<th>Number</th>
<th>Creativity &amp; benchmarking influence on the following organizational functions</th>
<th>PhD candidates in management</th>
<th>Management Professors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Variance</td>
<td>Standard deviation (STDEV)</td>
</tr>
<tr>
<td>1</td>
<td>Research</td>
<td>4.880</td>
<td>0.108</td>
</tr>
<tr>
<td>2</td>
<td>Production</td>
<td>4.280</td>
<td>0.451</td>
</tr>
<tr>
<td>3</td>
<td>Marketing</td>
<td>4.520</td>
<td>0.418</td>
</tr>
</tbody>
</table>

486
Most managers (Fig. 2) have agreed that the impact of creativity and benchmarking on the production and marketing is high (51.22%), and on the research is very high (60.98%).

Opinions of respondents are still homogeneous, low, the coefficient values ranging between 0.35 and 0.45 (Table 2). Because of that, and averages had lower values than those of professors and PhD students: over 3.5 but under 4.1.

Table 2. Statistic values for managers answers about the influence of tandem creativity-benchmarking on research, production and marketing

<table>
<thead>
<tr>
<th>No.</th>
<th>Creativity &amp; benchmarking influence on</th>
<th>Average</th>
<th>Variance</th>
<th>STDEV</th>
<th>Uniformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Research</td>
<td>4.073</td>
<td>2.637</td>
<td>1.624</td>
<td>0.399</td>
</tr>
<tr>
<td>2</td>
<td>Production</td>
<td>3.512</td>
<td>2.278</td>
<td>1.509</td>
<td>0.430</td>
</tr>
<tr>
<td>3</td>
<td>Marketing</td>
<td>3.805</td>
<td>2.060</td>
<td>1.435</td>
<td>0.377</td>
</tr>
</tbody>
</table>

Overall, however, the averages obtained on the sample of managers indicated their appreciation of the strong influence of benchmarking and creativity of the research, the production and the marketing.

After this questions, the three categories were asked to indicate “at least two measures applicable in Romania” to increase creativity and benchmarking impact on the organization functions, “for the firms’ and society’s benefit”.

Professors and PhD candidates have suggested many possible changes in the activity of the firms or in the business environment. We grouped by category and we name those that could have a major effect on the organizational functions analyzed in this paper ([4], Fig. 16.39, p. 277):

- proposals on changes in the structure of the national businesses environment (24.4% of the solutions offered by PhD candidates and 21.9% of them offered by managers);
- measures relating to the joint function of the marketing research (12.2% of PhD candidates and 3.1% of professors);
- measures for organizational reorganization / restructuring (2.4% of PhD candidates and 12.5% of professors);
- practical suggestions for a more intensive use of creativity and benchmarking in the Romanian business environment (36.6% of PhD candidates proposals and 40.6% of professors proposals).

Managers have indicated several solutions, but the range of these solutions did not allow us to group them into categories. We name a few, the ones we have found most important ([4], pp. 341-342):

- To involve the Ministry of Education in support of the Romanian research by providing funding and disseminating media inventions. Creation of special national funds allocated to R & D on long, medium and short terms was supported by 11% of respondent managers.
- Increase the availability of real and useful benchmarking information in different industries nationwide.
- Change the shape and content of reports issued by the National Institute of Statistics or by consulting firms that have conducted benchmarking processes in order to make them easier to understand.
- Participation of senior management of Romanian organizations at international conferences and periodic training on the topic of creativity and modern management methodologies.
- Facilitate absorption of EU funds grants by reducing bureaucracy in developing and implementing regional development projects.

4. CONCLUSIONS

The three categories of respondents ranked the impact of creativity and benchmarking tandem on the three
organizational functions as follows: the first place – research, the second – marketing and third – production (see averages in Table 1, 2).

After processing several open questions in the questionnaire, aimed at improving business in Romania by using creativity and benchmarking, several categories of suggestions were detained, with direct impact on the research, the production and the marketing of the organization [4]:

- Using benchmarking in creativity management, as well as creativity stimulating techniques and management through projects, and the various combinations of techniques and methods.
- Recommendations regarding the access of the employees in general and experts in particular to the specialized literature necessary and useful for maintaining the flow of knowledge and the creative atmosphere in the organization.
- Using the tandem creativity - benchmarking as strategic “tool” in the management of change, supported by a national growth of competitiveness in each sector.
- Intensifying the cooperation within the Romanian business environment and between it and the scientific areas (one way would be developing the chains of technological transfer), but also the cooperation between the public, private and social sectors.
- Proposals for more profound modifications in the theory and practice of management, such as: creating an innovating development model, which includes creativity in the model of sustainable development, creating new functions of the firm – the knowledge function – and opening the knowledge markets.
- A new manner of collecting and managing information and knowledge, by using the digital bases at the level of the firm and at a national level, on areas of interest, thus obtaining a system that would allow fast benchmarking processes, through the access to a computer.

5. REFERENCES

CREATIVITY AND BENCHMARKING INFLUENCE ON FINANCE-ACCOUNTING AND HUMAN RESOURCES ORGANIZATIONAL FUNCTIONS

Gina-Maria, Moraru
“Lucian Blaga” University of Sibiu, Romania, gina.moraru@ulbsibiu.ro

ABSTRACT: The paper presents the creativity and benchmarking influence on two of the organizational functions: finance-accounting and human resources. After a short presentation of the representative conceptions in the managerial literature, it focuses on a part from a research performed on three categories of respondents: PhD candidates in management, university professors (who teach management related subjects at various faculties) and managers from industrial organizations. Even the respondents agree that creativity and benchmarking are insufficient used in Romanian organizations, they considered that these two elements can improve the finance-accounting and the human resources organizational function.

Key words: benchmarking, creativity, organizational functions, finance-accounting, human resources

1. INTRODUCTION

This paper approaches creativity and benchmarking as a tandem whose purpose is to optimize the activities in organizations. It deals with the influence of this tandem on two of the organization’s functions: finances-accounting and human resources. Therefore, it is a continuation of the work began in the previous study, in which was followed the impact of creativity and benchmarking on the other three functions of the organization: research, production and marketing.

Why does coupling creativity with benchmarking in the organization seem important? We have shown on other occasions [4] that benchmarking facilitates comparisons in any field, discovering important values for that field and what is the position of the organization. Then creativity is going to find ways to improve the situation of the company. Benchmarking offers information and eventual knowledge and creativity develops and adapts theme. The creation process is more efficient because it is based on what has been discovered and used so far. There is no risk of rediscovering a discovery already made.

2. CHANGE, FINANCIAL RESOURCE AND THE CREATIVITY OF HUMAN RESOURCE IN ORGANIZATIONS

Organizations today confront with an increasing turbulence of the business environment, limited conventional resources and lack of cash-flow. More than ever, managers need to understand the power of knowledge as a ware and the power of people who have knowledge. When each employee has specific knowledge and can improve its usefulness by a pioneering spirit, management only needs to know how to manage innovation in a profitable way for the company.

Not all members of an organization have the same creative capacity, but certainly everyone has skills that contribute to the progress of the company ([4], p. 69). These skills are the “power” of the employee. By creating appropriate climates and methodological frameworks for the efficient use of these “individual power”, group and organizational creativity will increase and the company will innovate itself and develop. The main carrier of knowledge is the human resource. Therefore individual progress should not be ignored and should not be blocked, for none of the organization’s employees. Different employees have different skills and characteristics, different desires and directions of development. A manager has to confront two challenges: to encourage positive individual skills and overlap and individual desires and development directions over the ones pursued by the organization. Thus, he will eliminate the most dangerous obstacle to the development of creativity: the lack of interest [4].

Heraclitus said: “great results require big ambitions”. The immediate effect of suppressing the lack of interest will be the growth of human ambitions. After the doctoral research completed in 2011 [4], we say that the two main causes of lack of interest are the low rewarding of the employees and the bottlenecks created by bureaucracy. Given the outdated procedures from the accounting department, it is not surprising that research has shown here the biggest resistance of staff to change. Therefore, the functions of the organization that have many weaknesses in Romanian organizations are the function of financial accounting and the function of human resources.

Benchmarking can be used here, by helping the organization to adapt financial accounting procedures and human resources that have worked well in other organizations. It would be a waste of too much energy, creativity and money for Romanian organizations to find a way that others have already found. Creativity should be used to improve methods / procedures that are already used successfully in the world and for their optimal combination. An example is even triggering creativity through benchmarking, which union of the two elements makes a real organizational innovation tool.

After the imposition of an appropriate and high-level methodology to stimulate creativity, that is able to eliminate bureaucratic loops, the long-term effect will be to increase results and organizational performance. Then, this methodology must be permanently adapted to a dynamic environment, to the challenges and opportunities arising for the organization and its people ([4], p. 69). But first, this methodology must comply with the following basic logic: not money has made the man, but man has made money.
In the context of methodological adaptation, Professor Ioan Bogdan recalls two categories of “rules able to accelerate the innovation process” in any organization, drawn from “American pragmatism management”. The first category includes rules to stimulate creativity: taking risks, changing the rewards and being open to human diversity. The second category includes “rules to implementing creativity”, among which [2]:

- Climate and organizational culture based on: consensus, goals, pride of belonging to staff, job flexibility, respect and mutual trust.
- Decentralization, increasing operational and decision-making autonomy at all levels of the organization, freedom of action, delegation of powers and responsibilities, highlighting the role of each employee in the steps taken, reducing bureaucracy etc.
- Focus on action and results, consistency in its promises, timely and persuasive appreciation of work well done and permanent focus on quality.

The picture of innovation was described by Professor Ioan Bogdan: “Innovation has, in the upstream, stimulating creativity of people and, in the downstream, turning into account the new knowledge generated by management innovation.” [2] In other words, alpha is management support creativity and omega exploitation of obtained knowledge [4]. The formula works well during any changes. Organizational human resources function acquires a new dimension: stimulating the creativity of all employees. This is a fundamental objective of management and it opens a new field of action in the modern organization: creativity management.

Creativity management has as an important step the stimulation of group creativity, therefore increasing its qualities as they were listed by Mihaela Roco ([5], § 1.3.2, p. 18):

- **Productivity** – which is the large number of creative material and financial results;
- **Utility** – which should not necessarily be immediate, but should be included, in time, in a large number of business activities, departments and areas;
- **Efficiency** – which refers to the output and performance on creativity results;
- **Value** of the results – that (we consider) their increased importance to the organization, business, social and ecological environment;
- **Ingenuity** – the elegance and effectiveness of the methods used for obtaining results;
- **Novelty** – distance over time of ideas, new products etc., which can be a competitive advantage for the organization;
- **Originality** – that rarity or uniqueness of the product of creativity.

Another necessary step to be performed by creativity management in Romania is to increase understanding and stimulating human resource diversity in the organization. I pointed in other researches that Romanian entrepreneurs’ and managers’ tolerance towards diversity is unsatisfactory [3]. Group creativity is, therefore, insufficiently exploited.

We must not forget the importance of financial decisions in all other functions of the organization ([2], § 1.3, pp. 45-54). In research, production and marketing, the quality of these decisions and their implementation is further reflected in the way of rewarding and utilizing human resources creativity.

3. CREATIVITY AND BENCHMARKING INFLUENCE ON FINANCE-ACCOUNTING AND HUMAN RESOURCES ORGANIZATIONAL FUNCTIONS

The research was conducted based on questionnaires containing closed and open questions. At one of them, respondents were asked to assess the impact of finance-accounting and human resources organizational functions. The rating scale used was: 0 - I do not know, 1 - very small, 2 - small, 3 - ordinary, 4 - strong, 5 - very strong. The opinions were collected from three categories of respondents:

![Figure 1. PhD candidates and Professors opinions about the influence of tandem creativity-benchmarking on finance-accounting and human resources organizational functions](image-url)
PhD candidates in management;
Professors who teach management related subjects at various faculties;
Managers from industrial organizations.

Figure 1 presents the views of management PhD students and staff on the issue specified above. Remember that the two elements - creativity and benchmarking - have been addressed as a unitary mechanism in a wider research that was carried out. In [4] it was first demonstrated theoretically the opportunity to use this mechanism in Romanian organizations.

Note that most PhD students assess the impact of tandem creativity - benchmarking, financial and accounting functions as ordinary (32%) or high (32%). Management professors are more reserved, most of them (31.82%) saying this impact is ordinary (Fig. 1).

The influence of creativity and benchmarking on human resources function is appreciated by most respondents as strong: 48% of PhD students and 31.82% of professors (Fig. 1).

The values for average, variance, standard deviation and uniformity of the sample are shown in Table 1. We note the increased homogeneity of PhD opinions: 0.339 and 0.205 are values below 0.35. Instead, professors’ opinions were slightly inhomogeneous, coefficient values ranging between 0.4 and 0.45.

Managers’ opinions about the influence of tandem creativity-benchmarking on finance-accounting and human resources organizational functions are shown in Figure 2. The impact of creativity and benchmarking on financial and accounting duties was considered of 45.12% of the managers as ordinary, and 50% considered the impact on human resources function as strong. However, the sample of managers is heterogeneous (see Table 2), compared with the PhD students or academics (see Table 1). Consistency coefficients have the values 0.571, 0.500 respectively.

In conclusion, average values for managers’ opinions are much lower (Table 2).

The next question in the poll addressed to PhD, professors and managers was an open one, by which they were asked to indicate “at least two measures applicable in Romania” to increase creativity and benchmarking impact on the organizational functions, “for the firms’ and society’s benefit”.

Managers’ answers were extremely diverse and extensive, with implications both in the Romanian business environment and in the political, legal, social environment etc. For example: the orientation of Romanian education toward the creative side, a clearer legal code, human resources training and more.
PhD students’ and professors’ responses could be easily grouped by category. Of these, we mention the categories related to human resources, financial and accounting functions:

- Changes directly related to human resources management – the suggestions of 19.5% of the graduates and 21.9% of the professors. We illustrate: introducing “scales of creativity” for human resources, the emergence of “training function” in the organization, creating a “culture of creativity”;
- Reorganization of the business or organizational structure change – the suggestions of 2.4% of the graduates and 12.5% of the professors;
- General suggestions on creativity and benchmarking, which were found and other questions in the survey – the suggestions of 36.6% of the graduates and 40.6% of the professors. For example: the national promotion of modern management methods, including benchmarking, creating a national databases of creativity, stimulating Romanian business orientation to the customer.

4. CONCLUSIONS

After processing data collected from several closed and open questions in the questionnaire, several recommendations for Romanian managers have been made. We mention those related to changes aimed especially towards the finance-accounting functions and human resources organizational functions [4]:

- The necessity of having a new approach of the creative human resource in Romanian organization, which means stimulating, motivating and protecting it, investing in it, leading it on the path of continuous learning and increasing its degree of interdisciplinary and interdepartmental flexibility.
- Creating a system of performance indicators in the individual evaluation of the human resource in the organization, complete with creativity benchmarking processes, and a system of identifying creative persons, groups or “areas” in the organization, which could be possible value creators.
- Changing the attitude of Romanian managers towards knowledge and modern managerial methodology, favouring the appearance of knowledge entrepreneurs.
- Using benchmarking in creativity management, on the background of financial decisions that take into account the best use of intangible assets of the firm, especially the knowledge held by human resource.
- Increasing the use of creativity management and benchmarking in Romanian organization, with the aim to obtain competitive advantage.

5. REFERENCES

EVALUATING CHALLENGES FACED BY SMALL AND MEDIUM ENTERPRISES IN MANAGING NEW TECHNOLOGY

Goodwell, Muyengwa¹  Forbes, Chiromo² and Kimberly, Battle³  
1 University of Johannesburg, Johannesburg, South Africa, gmyuengwa@uj.ac.za  
2 University of Johannesburg, Johannesburg, South Africa, fchiromo@uj.ac.za  
3 University of Johannesburg, Johannesburg, South Africa, kbattle@uj.ac.za

ABSTRACT: The paper discusses challenges faced by small enterprises in acquiring new technology. Technology acquisition is associated with business performance measures such as competitiveness, productivity, quality and business growth. Prior research suggests that small enterprises face problems in acquiring and adopting new technologies. Technological changes do not follow a linear straightforward path; it is a complex and an iterative process. A case study research was done on three small enterprises which acquired new technologies over the past two years. The Force Field methodology was used to evaluate the need for the new technology and to manage the change in all three small enterprises. Noticeable challenges included poor absorptive capacity due to staff resistance, lack of skill, non-availability of research and development and lack of both horizontal and vertical networks in their specific industries.

Key words: Technology acquisition, business performance, iterative process, Force Field, Analysis, absorptive capacity

1. INTRODUCTION

Managing new technology include acquiring and using new technology to create competitive advantage, [1]; to improve economic, social and wealth quotient of enterprises, [2]. The need to acquire new technology stems from the dynamics that evolve in a manufacturing set up such as new materials, new products and the need to satisfy ever changing customers’ needs, [2], [3]. Technology management employs various concepts that include technology strategy, technology forecasting, technology roadmapping, technology project portfolio and technology portfolio, [4]. These concepts require a lot of resources and skill which are not usually found in Small and Medium Enterprises (SMEs), [5].

Acquisition and use of new technology by SMEs brings challenges that include staff resistance from fear of losing jobs, hostility from labour unions, [2]; poor sourcing due to lack of resources and scouting, [6], poor identification due to lack of knowledge management, poor or weak absorptive capacity due to lack of skill,[7].

The choice to acquire new technology is influenced by the company’s strategy. Strategy is the determination of basic long-term goals including objectives of an enterprise, the adoption of courses of action and allocation of resources necessary for carrying out these goals Chandler,[8]. Strategy enhances management’s focus on linkages between external market requirements and internal organisational and technological resources, capability and competitive advantage, [9]. Enterprise strategies include corporate / business strategy and functional strategies,[2] Business strategy is the common theme or strategic posture at higher levels of the organisational, encompassing all activities in an organisation. Functional strategies include manufacturing strategy, market strategy and Research and Development strategy, [10]. Manufacturing strategy is a pattern of decisions, both structural and infrastructural, which determine the capability of a manufacturing system and specify how it will operate to meet a set of manufacturing objectives which are consistent with overall business objectives, [11], [12], [13].

Acquiring new technology brings about organisational challenges that range from staff resistance to poor absorptive capacity causing the breed of lack of trust between management and staff, [2],[ 5]. The Force Field methodology is a tool that can be used to manage such changes. Force Field Analysis (FFA), developed by [14], is widely used as a decision making tool in planning and implementing change management programmes in organisations, [15].

This paper discusses these forces as faced by SMEs in acquiring and implementing new technology, a research gap identified by, [16] and [17], “of integrating human and organisational aspects with technology investments”, and supports the work of, [18] who indicated that in-order to realise full benefits of new technology there is need for a “systematic change in the management of people and machines including planning, plant culture, plant organisation, job design, compensation, selection and training, and labour management relations”. The need to manage organisational changes brought about by the introduction of new technology helps to prevent the impacts of failed technology investments, which include; harm to an organisation’s reputation; broken trust between workers and management, reduced management credibility and slower learning curve, [19].

Table 1. Summaries of companies’ case studied.

493
This paper evaluates the challenges faced by SMEs in introducing new production technologies such as computer integrated manufacturing (CIM), computer numerical control (CNC) and new information technologies such as computer aided design (CAD). Organisational challenges faced by SMEs are studied through training, absorptive capacity, communication and leadership which are part of technology transfer models. The Force Field Analysis was used to manage organisational challenges brought by technological changes. This paper does not cover business performance of the studied SMEs before and after acquiring new technology.

2. RESEARCH OBJECTIVES

(i) The major aim of this paper is to evaluate the challenges faced by SMEs when introducing new technology.

(ii) Through the Force Field Analysis the paper investigates how management of the three SMEs handled the organisational challenges brought about by the new technology.

3. LITERATURE REVIEW

3.1 Manufacturing Strategy

Manufacturing strategy ensures a match or congruence between the company’s markets and the existing and future abilities of the production system, [20]. It addresses issues that include: manufacturing capacity, production facilities, use of technology, vertical integration; quality; production planning / materials control; organisation and personnel. Four different types of manufacturing strategies exist namely market-based, product-based, capability-based and price-based, [21], [22]. identified and examined four manufacturing strategy content issues which are cost, quality, delivery and flexibility This research will focus on organisation challenges faced by SMEs in acquiring and introducing new technology that suits their chosen manufacturing strategy.

3.2 Competitive Strategies

A company can compete successfully in at least four basic ways, namely as a cost leader, a differentiation strategy, a focus strategy and flexibility, [23]. These SMEs wanted to enhance flexibility and productivity within their manufacturing workshops. This would enable them the ability to machine different products with quick cycle times, [1], and improved quality, [24].

3.3 Training

Training helps to avert failure through integrating technical, social and organisational factors, [25] as it assists subordinates to better understand their responsibilities, authority and accountability, [26], as they contribute to achieving the objectives and goals of the organisation. The aim of training is to impart new knowledge, skills and attitudes (KSA), on employees for the sole purpose of performance improvement, [27]. Training is enhanced by the application of KSA through factors such as goal setting, workload, peer support, coaching, supervisor feedback, individual motivation and job design, [28]. Modern and competitive organisations enhance their capabilities by setting up structures that foster a culture of continuous learning and information sharing, Wickramasinghe, [29].

3.4 Leadership

Leadership initiates change, with a new vision for the organisation, encouraging as well as motivating people to support the new initiatives, [30]. Top management leadership creates goals, values and vision that guide the pursuit of business activities of an enterprise, through the promotion of creativity, developing integrated teams, defining and communicating the shared vision, (manufacturing strategy), and generating compromise, [31], [32]. A good leader creates an enabling environment through their inter-personal relationships and influences others in the change initiative, such as during the introduction of new technology, Das, et al [33]. Leaders play three roles, namely setting direction, aligning people and motivating and inspiring people, [33]. Progressive leaders keep abreast of world standards of competition, [34]; they understand the global nature of their businesses and are able to analyze current trends and market conditions, [33].

3.5 Communication

Communication involves the process of transmitting meaningful information through three levels of intrapersonal, interpersonal and organisational, [27]. Formal network follow the hierarchical structure of the organisation while the informal network follows links grown out of relationships between employees and management, [27]. Use of strategy charts was advocated by [35] as a way that would help managers to communicate and verify a company’s manufacturing strategy. The diagramatic representation of the strategy chart includes events made up of verifiable objectives, decisions and actions called events, [35].

3.6 Absorptive Capacity

Absorptive capacity is the company’s ability to recognise the importance of new, external information or technology, assimilate it and apply it to commercial ends, [7], [36], [37]. The level of a company’s absorptive capacity is usually a function of prior related knowledge which includes basic skills, organisational learning and knowledge of recent technological developments, [38], [39]. Several models on how a company can manage its absorptive capacity have been presented by several authors. Investment in R & D as the driver of absorptive capacity was emphasised by [7], while [39] focussed on potential absorptive capacity (knowledge acquisition and assimilation capability) and realised absorptive capacity (transformation and exploitation capability).
3.7 Force Field Analysis

Force Field Analysis (FFA), developed by [16], is a managerial technique that is used for planning and analysing a situation. FFA provides a framework that looks at both driving and restraining forces affecting a problem situation. Driving forces are those that favour change and restraining forces are those that resist change. FFA addresses and stimulates both individual and team creativity by defining a vision, goal or proposed change. FFA identifies the strengths that should be facilitated and weaknesses which should be minimised. FFA helps management to integrate human and organisational aspects with new technological investments, [16], [46].

The planned change issue is graphically presented in the middle, as shown in figure 1 below. Two columns are drawn, one for driving forces on the left and one for restraining forces on the right. Each force is depicted as an arrow pointing to the middle, (planned change). The diagram must present all forces that influence the planned change. Steps followed in the implementation of a FFA, [46], are:

Start with a well defined change issue; it must capture the current and desired situation.
1. Draw a Force Field Diagram on a flip chart. Involve all participants.
2. Elaborate and list the driving and restraining forces. Allocate them to their respective columns.
3. Discuss the validity and relevance of each force. Identify critical ones and attend to forces that can be altered if necessary.
4. Allocate a score to each force; using a numerical scale from 1 (weak) to 5 (strong). The scoring must be based on the strength of the force and the degree to which it is possible to influence the force.
5. Calculate the total score for both columns.
6. Determine whether a change is feasible. If change is appropriate strengthen the driving and weaken the restraining forces.

Figure 1. Force Field Analysis Diagram, [16], [46].

4. METHODOLOGY

The research methodology of this study includes relevant literature review, and detailed multiple case studies on three medium sized engineering companies. Case studies, [47] can be used to explore, describe, explain and compare while [48] stated that case studies focus on one instance’s relationships and processes in a natural setting with the possibility of using multiple sources and methods for both data gathering and analysis. The triangulation method was used for data gathering as suggested by [49]. The method included extensive literature review, interviews with well prepared structured questionnaire observations and analysis of records.

Focus groups, [48], involving management and technical staff were assembled in all three SMEs. Discussions were guided by a structured questionnaire. Participants were guided on how to fill in the rankings of the Force Field Analysis, [16], [47].

5. FINDINGS

SMEs face several constraints in acquiring and setting up new technologies, including scarcity of resources, flat organisational structures and lack of technical skill. All three SMEs studied indicated that training staff was expensive and the nature of training required was not easily accessible. The research established that they are no horizontal technology transfer within the industry studied. Horizontal transfer entails transfer of technology from one company to another, generally located in different countries. Due to limited SME knowledge management it was discovered that these SMEs do not interact with technology leaders or creators directly but only through sales or distributing agencies.

SMEs do not have the capacity to enjoy vertical technology transfer. Vertical technology transfer involves transfer of technology from an R & D organisation to a firm. This type of transfer is within a country. Most SMEs do not interact with organisation such CSIR-Centre for Industrial and Scientific Research who normally help industry with accessing new advanced manufacturing technologies (AMT).

5.1 Training

Company C exhibited lack of employee training and this was cited as a serious challenge to the implementation of new technology. Companies A and B embraced new technologies and took their employees for training in Computer Numerical Control (CNC) software applications such as MasterCam, Edge-Cam and quality improvement courses. This was found to have enhanced their competetiveness, thus agreeing with the work of, [50]. Tangible and intangible factors, [51] were noticed in these two companies, namely reduced errors, improved quality and improved employee morale. Company A demonstrated three components of knowledge management that influence a firm’s performance, [52] which are the company’s ability to produce new knowledge, to build on that knowledge and to capture on subsequent spin offs.

The research could not quantify, in terms of monetary value, the return on investment made by these training activities. Another limitation was that the research did not look into the quality of training offered, the quality of the methods and techniques used, the quality of pedagogical resources used and the trainer’s knowledge as suggested by [53]. Barriers to job-related training that were discovered in this research were that workers were too busy at work, courses offered were too expensive, lack of employer support and that some courses were offered at an inconvenient time and location. Most SMEs workers attended CNC courses in private colleges.

Other factors that affect absorptive capacity and that are a focus of this paper are: knowledge management, [40]; organisational structures, [41]; human resources, [42]; [43]; external interactions, [42]; social capital, [44] and inter-organisational fit, [45].
5.2 Communication

Company C exhibited poor communication, during the Force Field Analysis exercise. This was revealed through emotional barriers that include fear, mistrust and suspicion; most of the workers were withdrawn highlighting interpersonal barriers. Communication was found to be better in companies A and B. Manufacturing strategy was well understood, [54], there was greater manager-worker trust and improved employee satisfaction. Companies A and B had sound process management, quality performance data such as defect rate, scrap and rework were effectively collected, analysed and shared this showed an improvement in their quality. This agreed with the work of [55] who established that quality metrics when calculated from reliable and valid data can be used for quality improvement purposes. These companies also exhibited formal networks of communication; it was evidenced by a much more understanding of manufacturing strategy and the need for new technology from shop floor up to management levels. The research established that all companies have very minimal investment in information systems, the link between costing office, drawing office and shopfloor was found missing, giving a negative impact on overall organisational performance. [56].

5.3 Leadership

Companies A and B had most successful leaders, they exhibited all four key leadership factors as reported by [57] which are the ability to proactively deal with problems, keep their workers motivated, loyal and committed, ability to make effective decisions and a willingness to take appropriate risks. The research also established that employee oriented leadership found in companies A, B and supported a smooth implementation of new technology as compared to a task oriented leadership, found in company C, this agreed with the the work of, [26]. Company C is owner-managed and exhibited lack of managerial expertise and organisational capabilities and this led to both poor strategic business planning and human resource management, Pansiri, [58] and [59]. Companies B and C exhibited poor managerial ability to delegate adequate power and responsibility to top managers, [60].

5.4 Absorptive Capacity

Management in all three SMEs showed that they had prior knowledge of computer integrated manufacturing (CIM), technologies. All SMEs understood that CIM would help them to reduce their lead times, increase flexibility and improve customer service, [61], [62]. Companies B and C exhibited slower rates of absorptive capacity due to lack of skill, lack of R & D, [7] and their organisational structures. Only Company A showed that they had invested more in their R & D, enabling it to have a higher level of absorptive capacity than companies B and C. Company A has the ability to create and produce better designed products of good quality which enables the company to match international competitiveness, [63]. Cross-function absorptive capacity that can create knowledge through job rotation, [61], was found missing in all three SMMEs.

All SMEs understood that information technology (IT), applications such as CAD / CAM can help their companies with development and growth, [64]. All SMEs had a relatively sound information technology platform. All companies had networks between management and costing offices. However the link between drawing office and the shop-floor was missing. Most workers on the shop-floor needed training on using the IT tools especially on programming CNC machines.

6. LIMITATIONS

The research did not look into any relationship between business performance and acquisition and use of new technology. Few SMMEs were studied making it impossible to generalise the results. Universities offering AMT courses were not visited, but from their literature it was evident that they interact with SMMEs.

7. RECOMMENDATIONS

The ability to acquire, diffuse and master new technologies as well as innovate can be achieved in many ways for example clustering and inter-firm cooperation or business linkages. Technology drivers that must be nurtured in an organisation for successful skills development are R & D capabilities, ability to attract Foreign Direct Investment (FDI), access to finance and good infrastructure. South Africa needs to set up technology diffusion centres which can be led by Universities, Further Education Technology Colleges or manufacturing technology incubators which can have operations that are similar to the Centre for Manufacturing Information Technology run by Georgia Institute of Technology in America and Japan’s prefectural and municipal technology centres, [65]. The current structure and focus of most South African Universities is not responsive to SMEs technological needs. Only three universities out of twenty five have an established centre for Advanced Manufacturing, namely North West University (NWU), Vaal University of Technology and Nelson Mandela Metropolitan University (NMMU). These three universities work hand in hand with Government support agencies such as The Department of Trade and Industry (DTI), Small Enterprise Development Agency (SEDA) and Centre for Scientific and Industrial Research (CSIR). However due to lack of external knowledge most SMEs do not know of these services.

SMEs are encouraged to develop industry portals that can aggregate flexibility and agility despite their lack of resources, [66]. Through alliances, external networks, [67]. SMEs can improve their competitiveness by sharing product, manufacturing technology, [2], marketing and R & D know how and resources, [68]. Uncertainty and vulnerability associated with new technology will be reduced, [69].

8. CONCLUSION

Impediments to technology diffusion are that SMEs face uncertainty, information, time and learning costs, lack of technical expertise, weak financial mechanisms and poorly organised inter-firm relationships. Many SMEs are reluctant to share technical, training and other business information within their sector for fear of competition. SMEs are not willing to form or join clusters which they can use to advance their operations. Challenges faced by SMEs in acquiring and using new technology can be solved by developing capabilities in external knowledge acquisition, improved man management skills and by liaising with local support agencies such as business chambers, technical colleges and universities.

9. REFERENCES:

AN ANALYSIS OF NEW GRADUATE-TRACING METRICS OF UNIVERSITY MANAGEMENT PERFORMANCE AT THE LUCIAN BLAGA UNIVERSITY OF SIBIU (ROMANIA)

Constantin, Oprean¹ Mihaela Alina, Vanu² and, Silvia, Florea³
1 Lucian Blaga University of Sibiu, presedinte@ulbsibiu.ro
2 Lucian Blaga University of Sibiu, alina.vanu@ulbsibiu.ro
3 Lucian Blaga University of Sibiu, silvia.florea@ulbsibiu.ro

ABSTRACT: Lucian Blaga University of Sibiu, Romania is moving rapidly towards more evidence-based accountability and, in this context, it has a growing concern with an ever more adequate provision for labor market demands in the region. The present paper analyzes the new graduate-tracing metrics of university management performance and goals between 2004 and 2012 and sets the short-term goals agenda for enhancement of graduate employment and employability at LBUS.

Key words: graduate tracing metrics, management performance, employability

1. INTRODUCTION
The need of higher education institutions in Romania (and elsewhere) to conduct graduate-tracer studies derives from a constant concern with how adequately or not higher education provides for labor market demands. Universities are held increasingly accountable to the public and policymakers these days and thus ever more interested to obtain a systematic feedback from their graduates, so to better provide empirical evidence regarding the professional relevance of their study programs. This drive for greater relevance encourages them to improve their study programs, revise curricula, increase their graduates’ employability and hence strengthen the links between higher education and industries. However, very often such studies are done on a questionable level of professional expertise, resulting in low response rates, incomplete data, simplistic data analysis and poor interpretations of the findings.

In the case of LBUS, the so far randomly collected data has rendered critical the necessity for a more integrated complex tracer, as we have argued elsewhere [2], which would look more closely into such indicators as: graduates’ socio-biographic background, study trajectories, transition from higher education to employment, early career determinants, links between university study programs and future employment, etc.

In the following article, we will closely examine the graduate-tracer study results of the first survey conducted by the Lucian Blaga University of Sibiu (LBUS) in 2011 in the context of changes in university management goals between 2004 and 2012. The core objectives of this survey were: to examine changes in the career pattern of the graduates so as to provide a basis of evaluation of current academic programs of LBUS; to investigate the transition process from higher education to work settings of LBUS graduates; to shed light on the course of their employment and career over a 1.5 and a 5 year period after graduation, with the intent to gauge the usefulness (or otherwise) of both the theoretical and practical aspects of the respondents’ education in relation to their job performance and observe the employment and welfare structures of respondents in terms of the immediacy of sideline jobs, career expectations, actualization and changes; to identify key aspects of the continuing professional education of LBUS graduates; to retrospectively evaluate, on the basis of the experience and views of graduates, central aspects of LBUS, including resources, facilities, individual study requirements and curriculum; In undertaking the above survey, the concern of LBUS was geared primarily towards identifying its graduates’ competences upon graduation, the correlation between the graduates’ education career and acquired competences, as well as the use of these competences over their professional career.

2. SPECIFICS OF THE STUDY’S METHODOLOGY AND TARGET GROUP
The survey was the first to track the relationship between university studies and work activity of LBUS graduates and was conducted between November 29, 2010 and March, 21, 2011, with university graduates of 2005 and 2009 being surveyed (marking approx. 1.5 years and 5.5 years after graduation. The targeted graduate population consisted of a total of 7.958 university graduates, 2,858 of whom represented 2005 graduates and 5.100, 2009 graduates respectively (see Table 1. Graduation population and database).

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2005</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. of BA graduates</td>
<td>2,858</td>
<td>5,100</td>
</tr>
<tr>
<td>Nr. of registered graduates</td>
<td>1,018</td>
<td>4,363</td>
</tr>
<tr>
<td>Nr. of registered grads with contact details</td>
<td>1,018</td>
<td>4,363</td>
</tr>
<tr>
<td>Nr. of contacted graduates</td>
<td>1,018</td>
<td>4,038</td>
</tr>
<tr>
<td>Nr. of contacted graduates (with at least one valid contact address)</td>
<td>986</td>
<td>4,038</td>
</tr>
</tbody>
</table>
The in-field phase consisted of three contacts by mail and/or email. The questionnaire was online (http://granturi.ulbsibiu.ro/apnm/) and was answered by 1,082 graduates (317 from 2005 and 765 from 2009). The gross return/response rate was 13.59%, of which 11.09% was by 2005 graduates and 15% by 2009 graduates. The net response rate was 20.10%, of which 31.13% was by 2005 graduates and 17.53% by 2009 graduates. Gross response rate represents the number of responses as compared to the target group, whereas the net response rate represents the number of responses invited to participate in the study.

3. RESULTS
The survey results to be discussed were structured in 5 distinct areas: 1) Socio-biographic characteristics of graduates (input indicators); 2) Studies, conditions and course of studies (indicators on system entries); 3) Teaching-learning indicators; 4) Graduates’ insertion on labor market, including central aspects of the job search, competences upon graduation, professional requirements and employment situation approx. 1.5 and 5.5 years after graduation; and 5) Professional success indicators (output results).

1. The input indicators show the general profile of the LBUS students, with 13.11% of 2005 graduates and 25.53% of 2009 graduates coming from scientific-oriented high schools. (In general, university candidates have abandoned the tendency to enrol in general liberal arts studies, showing preference for applied Bachelor’s degree programs, which trains them for the labour market and business professions and which ensure relatively immediate professional opportunities, employability and financial rewards.) Candidates’ option for LBUS confirms the existence of a certain socio-professional trajectory and a still relatively stable demand for higher education in Sibiu. In terms of social-structure reproduction, the maximum level of education of the graduates’ parents indicates a graduate parent for a large segment of the student population and bottom-up education mobility for the rest. The geographical distribution breakdown of graduates on the other hand, shows, within the same group of indicators, that most students are residents of Sibiu (14.58% for the cohort of 2005 and 33.01% for the cohort of 2009), and that a good many of them come from the neighbouring counties of Valcea (6.85%), Mures (4.83%), Brasov (4.63%) and Harghita (3.96%).

2. System entry indicators describe the studies, conditions and course of studies and are mainly relevant for graduates’ study conditions and facilities and, for the purpose of this paper, the retrospective assessment of LBUS management. Between the two reference years, the survey responses show a significant change in graduates’ study conditions and facilities, mainly due to the large investments in resources made by LBUS in the last years: thus, the increase of facilities, equipment and instruments for labs, seminars is reportedly on a significant upward trend (from 21.09% in 2005 to 49.64% in 2009), on-campus accommodation facilities show a spectacular rise (from 20.80% in 2005 to 48.41% in 2009), food and catering services have more than doubled (from 20.90% in 2005 to 46.93% in 2009), building modernization, upkeep and maintenance have registered a significant increase (from 25.00% in 2005 to 61.92% in 2009), students’ access to technical equipment (measuring instruments, PC, etc) has also indicated a significant upward trend (from 20.05% in 2005 to 49.36% in 2009), and last but not least, the quality of instruments and equipment for student practical laboratories and seminar work has also increased (from 20.05% in 2005 to 52.29% in 2009).

3. Teaching-learning indicators show significant differences between the two reference points and indicate the degree of graduates’ satisfaction regarding the educational processes and their quality, indicated on a “very good”, “good” and “average” scale. Thus: organization and structure of study programs (from 26.43% in 2005 to 61.43% in 2009); possibility to interact with academic staff in extra-curricular time (from 21.07% in 2005 to 54.38% in 2009), which shows in LBUS a more significant trend towards a student-oriented university; the testing-evaluation system is perceived as spectacularly better (from 24.55% in 2005 to 60.59% in 2009); as is the general counselling and guidance provided by academic staff (from 25.03% in 2005 to 62.28% in 2009); exam preparation counselling and guidance provided by academic staff, particularly for graduation exam preparation shows marked improvement (from 25.81% in 2005 to 60.69% in 2009); provision of courses, manuals and textbooks (from 22.05% in 2005 to 58.22% in 2009), quality of teaching practice (from 26.02% in 2005 to 61.03% in 2009) and quality of teaching-scientific content of courses, manuals and textbooks are on a rising mode (from 27.09% in 2005 to 63.22% in 2009). It would have been interesting to go longitudinal rather than transversal in such an institutional study and see whether the opinions of students and those of the teaching staff tend to “converge” with respect to the quality of the educational process, as they are reported to do so in the national Quality Barometer Report 2010, issued by ARACIS [1]. The report shows (at a national level) divergent opinions of students and academic staff regarding quality indicators of study programs and takes stock of the fundamental attribution error (fundamental attribution error is a term in social psychology referring to individuals’ tendency to explain personal successes by their own qualities and to attribute personal failures to external causes.) of surveyed students who, towards the end of their academic experience, may get progressively estranged from the university, feeling less and less a part of it, and, under the pressure of their future insertion on the labor market, tend to become more critical. Such a tendency has an added value; we tend to think, in the context of our institutional survey, given the results obtained. Nonetheless, aspects relating to graduates’ opportunities to participate in internship during studies at national and international levels have been indicated by respondents as problematic and insufficiently coordinated and/or provided by the university, rendered in the questionnaire as very weak, (see Chart 1 and 2 below. Internship participation at national and international levels).
As for the teaching methods and strategies utilized in the teaching process (question D5) the dominant opinions point to the fact that too much emphasis is placed on memorizing and theory, while the practical side is neglected, leading to graduates’ lack of capacity to contextualize knowledge and apply it to specific social or technical situations. Consequently, a shift in the teaching methods between 2005 and 2009 has become progressively significant (see Chart 3), indicating a focus on lectures, student-teacher conversations during lectures and seminars, debates, drills, problem-solving and practical applications of theoretical concepts, learning through individual and group projects (other than research projects).

The non/low involvement of students in research projects and internship placement remains problematic, which indicates a management direction to be pursued in the next policymaking period. Question K1 “To what extent was the study program you have chosen useful”? complements the general picture of the LBUS study programs and respondents appreciated the usefulness of pursued study programs for personal development and long-term career attainment.

4) Indicators on graduates’ competences upon graduation from the retrospective view of graduates’ competences and their professional requirements have shown little variation between 2005 and 2009, the level of competences being almost the same. The E2 Question (“How do you evaluate your own competence level upon graduation?”) reveals the fact that LBUS has developed the graduates’ work time-management, learning, performing well under stressful work conditions, team work and solution finding skills, with a focus on ‘transferable’ or ‘generic skills’. As for graduates’ intention to pursue the same study program if they were to choose again, retrospectively they indicate, interestingly enough, a downward trend in the desire to pursue higher education at all, probably as a result of depressive economic conditions (14.7% in 2005 as compared to 13.68% in 2009), but nonetheless registered an upward trend of their desire to choose: same faculty (12.10% of 2005 graduates and 12.76% of 2009 graduates), same university (12.10% in 2005 as compared to 12.76% in 2009) and pursue LBUS M.A. and Ph.D. study degrees, irrespective of gender and seat status (whether fee-paying or state-budgeted) (11.56% for 2005 graduates as compared to 12.55% for 2009 graduates) (see Chart 5).

Graduates’ insertion on labor market, including central aspects of job search and transition to work are revealed in Chart 3 with relatively similar percentages for both years.

5) Professional success indicators (output results) are relevant indicators for LBUS. Undoubtedly, transition from the university to the labour force remains a difficult problem for our graduates, particularly at times of a deteriorating economic situation. The opportunities of securing a job by graduates declined over the years and the period of seeking employment had increased 18.73% of the 2005 graduates looked for a job upon graduation, whereas 25.93% of the 2009 graduates cohort started looking for a job before graduation, which indicates an
increased desire to secure work and income. Development of competences after graduation by means of professional training and education (Question E4) is equally rendered by graduates as “very important” (see Chart 6).

Figure 5. Chart 6. Question E4

Other relevant data show job search means employed by graduates (recruiting agencies, direct application to work place, job fairs) to find work. The small percentages for both cohorts that resorted to traditional job fairs, particularly those organized by the university, show the need for a new avenue to be explored by LBUS in the next years. More workshops and roundtable sessions could provide more information regarding top-paying jobs, skills graduates need to find a job, fastest-growing occupations, jobs with the most openings, how to explore career options, what to expect in the interview, tips on appearance and attitude in an interview, job tools and outlook, etc.

4. CONCLUSIONS

In the light of the graduate-tracer survey, the role of LBUS seems to be increasing in manpower demand and supply, returns on educational investments, and patterns of occupational mobility. The fact that there is a significant desire on the part of the LBUS BA graduates to pursue M.A. and Ph.D. study degrees indicates more room for the diversification of our M.A. study programs and yet another possibility to improve our graduates’ competences and help them in their career choices, professional trajectories and ability to cope with various assignments at the working place. The university management has been confirmed successful to the degree to which most indicators have registered an upward trend, the tracer survey being thus a useful tool of maintaining curriculum relevance, providing targeted benefits to our graduates and enhancing the marketability of our graduates. However, there is a lot more to be done in the direction of to increase the number of our multi-competent graduates and their employment-related capability, particularly the graduate employability indicators [3]; as well, the challenges ahead LBUS needs to overcome in the formation of subject-specific knowledge and skills and the promotion of other valued skills and qualities need more concerted effort. The institution also needs to pursue a more vigorous program for job placement of its graduates, and should seriously consider institutionalizing a Job Placement Unit under the Guidance Office or a separate Student Affairs Office. Likewise, strengthening the OJT component of its curricular offers to offset the “lack of experience” and shifting drastically from the traditional modes of teaching to the more progressive and modern strategies are the core short-term goals to be achieved in the next period.

5. REFERENCES

ABSTRACT: European funds are a development opportunity for the Romanian organizations. The research in the article aims to identify the main risk categories that the beneficiaries from Centre Region have faced, and also the effects of not considering certain risk categories in the stage of filling out the application form and also in the implementation stage of the projects have had on the development of these projects. Identifying how the organisations have managed projects during the development projects 2003-2013 finds its usefulness in the following period that is knocking on our doors: 2014-2020 that should find us better prepared and more capable of proving seriousness and professionalism. Therefore, training in projects should not end once the structural funds have been attracted, but it should be regarded as destined to modernize our way of thinking and actions in helping organisations develop their businesses.

Key words: risk analysis, European funds, project

1. INTRODUCTION

European funds are a current topic of the world we live in, in terms of the contribution they have to our country’s economic growth and stability. Romania, as a member state of the European Union should work towards stimulating the economic growth potential, maintaining and getting higher growth rates. To achieve the real convergence with the average development level in the European Union, the Romanian strategy should focus on the necessary investments to enhance long-term competitiveness, promote job creation and sustainable development. [5]

Ensuring a dynamic, sustainable economic and social development level of growth, similar to the European countries is practically an impossible task without the strategic, institutional and financial support of the European Union. [4]

An efficient use of European funds and an active participation to the European development policy require a wide change: professionalism of project management, creation of a genuine project culture, in explicit terms of programs and projects, using specific methodologies of program management and project management. These changes meet a fairly low rate of implementation in our country.

In order for the society we live in to reach maturity in terms of project management, program management and project portfolios, the problems affecting the absorption of European funds, the main causes generating them and identifying ways to remove them need to be identified and understood.

The way potential beneficiaries of European funds know to prevent the risks of European projects is reflected in the successes and failures they have in running European projects. The fact that beneficiaries of European funds have faced a great number of problems in writing and implementing the projects reflect a poor risk analysis of the projects undertaken. [6]

Since institutions deal with several projects in the same time, innovative work methods must be identified to facilitate the transition from one stage to another, with much easier risk prevention, such as the management tool – the stage-gate model. [7]

2. METHODOLOGY OF THE RESEARCH

This article begins with the identified issue, namely a low rate of absorption of European funds in Romania. Currently Romania is placed last in terms of absorption rate of European funds, not exceeding 20%. This reflects a poor practice of the project management in our country, an immaturity in this field of our society.

The article contains a questionnaire-based quantitative research aiming to identify the risks faced by the social actors in the initial project design and in the implementation stage of the projects. The research aimed at testing the hypothesis according to which implementation teams face risks even in the design stage, continuing with the implementation stage, where “financial risks and human resources risks” prevail.

The population of interest for the study, namely the population that has been selected for the sample, is composed of public institutions (town halls, county councils, foundations, government, prefectures) or NGOs from Centre Region (the counties of Alba, Brasov, Covasna, Harghita, Mures and Sibiu), most of which have accessed European funds. A number of other 95 questionnaires have been collected, 73 of which have been processed, the remaining 22 respondents being institutions that have not accessed any type of funds (European, governmental) and the processing of which would have vitiated the results.
3. ANALYSIS OF RISKS ARISING FROM THE INITIAL CONCEPT OF THE PROJECT

Beyond the issues raised previously encountered in starting and carrying out projects funded by the surveyed public institutions in Centre Region, a special importance should be given to the categories of risk that they may face, both in the initial design of the project and in its implementation. The categories of risk arising from the initial conception of the project, usually generating rejection of funding [1]:

- non-harmonization of the project’s objectives with those of the financing program;
- wrongly chosen target groups;
- erroneous construction of the budget;
- inappropriately quantifiable benefits;
- project team without the skills or experience required by the sponsor.

According to the respondents’ answers, we can notice that for them, identifying the main risk categories has not been an issue (68%). This may also reflect the importance given to this stage of preparing a project.

Figure 1. Situation of the institutions for which the identification of risks was an issue.

Figure 2. Frequency of risk categories at the initial conception of projects.

Figure 3. Frequency of risk categories at the initial conception of projects.

Figure 2 and figure 3 show the incidence of two categories of risks, the non-harmonization of the project’s objectives with those of the financing program and wrongly chosen target groups. The first one is a risk that institutions have encountered in a percentage of 24 and sometimes 27. The second risk is less common, only 5% have faced it, 9% sometimes and the rest rarely and very rarely.

The construction of the budget is a more frequently encountered risk by the respondents’ institutions, 19% encountered often and very often and 34% from time to time. With regard to the construction of the budget, respondents have identified several issues, both in filling out the application form and in the implementation of projects.

Figure 4. Frequency of risk categories of the initial conception of projects.

Figure 5. Frequency of risk categories at the initial conception of projects.

The inappropriate quantification of results is not a risk that has raised serious problems, only 12% of the respondents have often encountered this risk and 31% stated they have sometimes encountered it.

Figure 6. Frequency of risk categories at the initial conception of projects.

Regarding the risk that the project team does not have the skills and experience required by the lender, those responsible for the development and implementation of projects have experienced in a rate of 53% this category of risk.

Figure 7. The risks faced by project beneficiaries in Centre Region.
The employees’ lack of training and lack of experience were the causes of certain problems encountered during the technical and financial reporting stage.

Respondents also claimed that they have faced other categories of risks in the projects’ development, such as: lack of interest and lack of competence of participants and the identification of financial resources for ineligible costs (VAT). The first risk fits the project team’s risk, and the second fits the construction of the budget’s risk.

Figure 7 shows the scores for every category of risks that might occur during the initial conception of the project. Except the category of risks “other” mentioned by the respondents, the harmonization of the projects’ objectives with those of the funding program has the highest score, although not very high, 2.53. This risk is followed by the risks regarding the construction of the budget and the project team.

Figure 8. Effects of not quantifying risks on the development of projects

Another category of risks faced by beneficiaries of projects are those that occur during the implementation stage of the projects. These are: [2]

- **Financial risks.** This category of risks does not mean the establishment of budgets, but a bad financial forecast of the projects, in which necessary resources are undervalued, leading either to the impossibility of running the project, or to a negative balance.

- **Risks of the human resources.** This risk occurs due to a wrong analysis of the human resource involved in the project or of the needs required by each activity (external consultants, partner organizations, etc.), which sometimes does not have sufficient skills to manage properly all stages of the project.

- **Technical risks.** The risk refers to the quality of the project’s final results. It is often common for those technical conditions established in the project, such as those related to the purchase of materials or equipment, to not be met due to various reasons, which implicitly changes the project’s overall quality.

- **External risks.** This category includes currency risks, fiscal policy changes or administrative procedures. Delays in reimbursements have seriously hampered the Romanian projects funded through European funds and have very little considered by beneficiaries in preparing the initial documentation.

Again, the financial risks affect in a relatively high degree institutions during the implementation stage of the projects. Therefore, institutions have faced these risks in a 37% often and very often and 43% from time to time. The risks regarding human resources should also not be neglected, institutions facing them often and very often in 19% and a relatively high percentage (57%) sometimes.

With regard to the technical risks, half of the respondents sometimes face them and a quarter of the respondents say that they encounter this category often and very often. The consequences of this category of risks were often sources of problems for the respondents’ institutions. Thus, respondents reported various problems regarding the procurement processes: from their cumbersome development to their poor organisation.

The external risks category, although from the respondents’ answers it results that it interferes with the implementation of projects in their institutions only in a 20% often and very often, they have been less considered by the beneficiaries of projects, but have caused them the most problems: changes in the
funding guide during the development of the project, bureaucracy, poor legislation, long evaluation periods of the documents submitted, sometimes of even a year.

Figure 13. Comparison of risks arising at the implementation of projects.

Figure 13 shows the scores for the risks faced by the institutions during the implementation period. Financial risks are placed first among the risks faced by the institutions, with a score above the average score, followed by the technical risks and the risks with the human resources. External risks already have the lowest score calculated from the scores given by the respondents.

The effects of not considering certain risk categories during the implementation stage are outlined in the figure below.

Figure 14. Effects of not considering certain risks in the implementation of projects.

4. CONCLUSIONS AND RECOMMENDATIONS

This analysis on the risks that occur in projects outlines the frequency of certain risk categories that occur in the initial conception of the project and also of another category of risks that occur in the implementation of the projects. Their analysis shows that the non-quantification of certain risks from the two categories made the institutions meet some problems in project implementation. With regard to the risks that occur in the implementation of projects, the category with the highest frequency of occurrence is represented by financial risks, followed by technical and human resources risks.

The results partially confirm the hypothesis according to which implementation teams encounter risks from the conception stage, continuing with the implementation stage, where “financial risks and human resources risks” prevail. For the risks in the initial conception of the project, respondents encountered great difficulties in formulating the project’s objectives and also in the construction of the budget.

Non-quantifying the risk on the construction of the budget increases the financial risks that occur in the implementation stage of the project. The only difference from the formulated hypothesis is represented by the technical risks, following the financial risks in the hierarchy of risks occurring in the implementation of European projects.

The article has an important contribution to all potential beneficiaries of European funds (business environment, public institutions, NGOs, etc.) by identifying how the projects’ risk prevention may reduce the number of problems they may face in accessing and implementing European projects.

Therefore, one recommendation for the project development institutions is to consider the risk categories that occur in carrying out the projects, whose failure to be taken into account may result in facing certain problems during the project’s development.

A series of recommendations for the institutions dealing with European funds in Romania:

- Elaboration of Financing Guides that would provide detailed and explicit information to potential applicants on projects to make the filling out of the application form much easier;
- Early approval of certain changes that occur in the Financing Guides;
- Correlation of information in the Financing Guides to the active legislation;
- Shortening the projects’ evaluation period which reached even one year.

Accessing European money should become a priority for the entire Romanian society and the experience of 2007–2013 funding period should be used so that the next period – 2014–2020 finds us better prepared to develop and implement projects more professionally and with a greater support from the institutions dealing with these funds.

5. REFERENCES

ABSTRACT: There are several key external challenges to be mastered in the transition from the traditional university towards entrepreneurial university which are transformed into internal challenges. Unlike the business schools the management structures and environment of an university of technology may be often very cautious about implementation of the entrepreneurial elements in the technology and science study and research programmes. Often they have to be confronted by the requirements of students and businesses for more entrepreneurship education and skills in the university graduate profiles to accept this. This paper examines fundamental challenges of implementation of the concept of entrepreneurial university in two European universities of technology with direct central public funding which gradually covers less and less its future development needs. The current status of transformation towards an entrepreneurial university at the Slovak University of Technology in Bratislava compared to the University of Technology Ilmenau is described, analyzed and the next steps put forward.

Key words: entrepreneurial university, entrepreneurship education, entrepreneurship

1. INTRODUCTION

The European universities appear to be in the process of transition from teaching institutions to research and entrepreneurial organisations. This move is caused mostly by external factors, e.g. growing number of students, gradual reduction of central public funding of university operation and development, university search for complementary/alternative financing, issues of employability of university graduates vs. massification of university education, demand for development of entrepreneurial skills of graduates on the part of their employers or by the student society, internationalization of universities vs. their regional/local engagement. These external pressures turn into the internal challenges to university management and staff [1], e.g. changes in university vision, mission and strategy, leadership and organizational changes within university, new/changed study programmes and curricula up to the reaching/learning methods and outreach activities, pressure upon vs. motivation of academics in favour of efficient industry-academia collaboration, changes in qualification and skills profiles of university teachers and researchers, pressure to obtain complementary external financing through commercialization of knowledge and technology transfer, etc.

2. ENTREPRENEURIAL UNIVERSITY

The concept of entrepreneurial university was first introduced in 1998 Burton R. Clark, who used the term as a characteristic of social systems [2]. In the period from 1998 to 2008 a lot of scientists have tried to explain the phenomenon of entrepreneurial universities in theoretical models [3],[4],[5] or in empirical studies [6],[7],[8],[9],[10]. Today this type of university is a place where knowledge-based entrepreneurship has emerged as a driving force for economic growth, employment creation and competitiveness [5]. An entrepreneurial university could be defined as a survivor of competitive environments with a common strategy oriented to being the best in all its activities, and to creative in establishing links between education and research [6]. Based on the experience from USA, Asia and Europe [11] universities are considered to be entrepreneurial when:

a) their strategy
   • considers the diminishing public funding by the state in time and active search for complementary income generation;
   • accepts the combination of the scholarship of relevance and integration of knowledge and a sharing with, and learning from, the wider community;
   • counts with maximum potential for commercialisation of their ideas to create value in society without considering this as a significant threat to academic values;

b) their organization culture and structure
   • provides a stronger central steer to entrepreneurial endeavour while building on the natural autonomy of individual academics;
   • part of an ‘organisational learning’ strategy is an active engagement with the wider stakeholder community;
   • promotes the creation of, incubators, technology transfer offices and patent protection arrangements, science parks powerful means to opening up and integrating into the university activity-based relationships with the relevant stakeholders in both a formal and informal institutional manner;
   • encourages a wide range of interdisciplinary activities with the creation of interdisciplinary departments and R&D centres;

c) their human resources policies
   • accept wider responsibility for the personal development of students and staff, particularly with respect to future, social, career and lifelong learning experiences;
   • consider recruitment of entrepreneurial staff and appoint entrepreneurial leaders as change agents and academic post swill be opened up to a wider constituency via adjunct and visiting appointments;
   • build rewards systems well beyond those relating to research, publication and teaching criteria;
   • ensure that the concept of entrepreneurship education is embedded in all the faculties, owned by key staff and integrated into the curricula.
All in all an entrepreneurial university keeps to the purpose of training future entrepreneurs who will build their own business and developing the entrepreneurship of students and conducting their activities in an entrepreneurial manner (organizing business incubators, technology parks, etc.). For the analysis of the universities of technology we followed the Resource-Based View Theory as a theoretical framework. According to this theory organizations are considered as unique sets of resources and capabilities of different nature enabling them to achieve a competitive advantage compared to their present or future competitors. Capability is regarded as a firm-specific, organizationally embedded and non-transferable resource whose purpose is to improve the productivity of the other resources possessed by the firm.

3. ENTREPRENEURSHIP EDUCATION AT THE SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA

3.1. Mission and strategy of the Slovak University of Technology and its faculties

STU founded in 1937 has been the biggest university of technology in Slovakia with about 18,000 students studying every year. At present, the university consists of seven faculties offering 329 accredited BSc., MSc. and PhD study programmes compatible with the European Credit Transfer System (ECTS), enabling mutual mobility of students within the EU as well as within the larger European Economic Area. As stated in its mission the STU has maintained the profile of research-oriented university and ranks among the three best Slovak universities. The current STU mission does not contain any specific objectives in the field of entrepreneurship education and skills. However, it does contain development of system of valorization of results of creative activities at the STU using protection and utilization of intellectual property rights as tools of the STU policy, and setting-up and developing incubator companies with the technology focus. Set off of new start-up companies will be further supported through recruitment and promotion activities of the University Technology Incubator.

3.2. Organisational units within the STU supporting entrepreneurship

The University Technology Incubator has supported set-up of some 30 technology start-ups up till now, entrepreneurship trainings and contests since 2005. It has collaborated closely with some STU faculties and the STU Institute of Management and functioning as an Information and Contact Point (Inno Info) of the Slovak Institute of Industrial Property as well. Since March 2008 the STU Institute of Management integrates teaching and research resources in economics and management disciplines for the STU faculties; guarantees study programmes in management, especially the interdisciplinary programmes and university-wide programmes, and creates better conditions for entrepreneurship education on an interdisciplinary basis within the current and future STU study programmes. It takes on some educational and promotional functions of prospective Centre for Entrepreneurship and Innovation. The STU Scientific a daughter company of the STU has been operating since 2008. Its aim is valorisation of the STU research results in industry, e.g. by supporting creation of spinout companies (4 sofars), rendering of business, financial and ICT consulting and educational services. The Institute of Space Planning and Architecture is also functioning within this company transferring its research results in the urban planning practice. Since 2010 the TRANSFERTECH centre has been operating within the STU in order to support transfer of knowledge and R&D results of faculties to industry. It also provides know-how in the field of IPR protection, administers the database of STU research facilities and helps searching for partners / investors from industry and enterprise. It collaborates with the Technology Transfer Centre of the University of Oxford – ISIS Innovation Ltd. in implementation of its know-how in technology transfer, licencing and spin-off creation in the relations of STU to Slovak industry.

3.3. Entrepreneurship education and outreach activities at the STU

Analysis of the business education at STU with respect to degrees, curricula, courses, teaching methods and extra-curricula activities confirms that in the education of Economics & Management courses prevails the traditional approach to teaching business courses and programmes. Business education in an integral manner from a general entrepreneurial point of view is still not prevailing at STU. However, some entrepreneurial elements may be observed in the content, focus and teaching methods used in some courses on SME Entrepreneurship, IT Entrepreneurship and Economics and Management of Construction Businesses. Also, currently there is a limited offer of entrepreneurship related extracurricular activities by departments/institutes of the STU faculties except for the annual organization of contests for “student scientific papers” with some limited participation regarding entrepreneurship related topics. Student associations in the faculties however usually support some entrepreneurship related events organized by external bodies (banks or companies) during the year, e.g. with regard to programming contests, robot construction contests and business plan contests. The most appealing entrepreneurial elements may be found in the study programmes of Institute of Management and Faculty of Materials Science and Technology. This faculty has also its own Centre for Technology Transfer. Outreach activities on entrepreneurship mainly consist of relations to alumni and other stakeholders. Since 2007 STU as well as its individual faculties have established Industrial Councils as advisory bodies to the rector and deans on collaboration of the STU and businesses. Members of council are prominent faculty representatives and representatives of companies close to the industrial focus of the specific faculty. They meet on a quarterly or a semiannual basis and discuss the strategic issues of faculty education and R&D. The STU faculties have been maintaining their specific alumni associations following similar goals extended by student traineeships since the year 2000. An external outreach impulse for change into the “entrepreneurial direction” might stem from organizational interface between the STU and regional and municipal authorities: However, they should focus more on entrepreneurship support in the Bratislava and Trnava Regions and assign sufficient funds for this purpose. The Institute of Management has been acting as a host and coordinator of events fostering entrepreneurial mindset of the young within the worldwide initiative Global Entrepreneurship Week since its inception in 2009. In cooperation with partners in Slovakia and abroad there were organized many events, contests of business ideas, business plan contests, inspiring meetings with entrepreneurs, business angels and investors, lectures and seminars on efficient entrepreneurship methods and tools.

3.4. Types and sources of entrepreneurship education funding and budget allocation

The operation of STU faculties and their educational activities fully depend on government funding allocated to universities
via the Slovak Ministry of Education by criteria considering student numbers in study programmes, faculty qualification structure and volume and quality of publication outputs. This funding covers some 70% of the STU needs and therefore STU has to use its own sources (about 8%) and the rest has to be covered from business contracts, foreign and domestic grants. Therefore the STU clearly states in its strategy that all its faculties, institutes and their units should take best efforts to acquire further funding from national and international contests for grant programmes and from contractual educational or R&D work for third parties to secure the sufficient financial coverage of their educational and R&D activities. Building of Centres of Excellence is based on the EU structural funding. The current legislation does not allow for any specific funding criterion dedicated to entrepreneurship education. However, § 18 of this Act allows for entrepreneurial activity of the HEI if it is related to its statutory activities and does not end up with loss.

4. ENTREPRENEURSHIP EDUCATION AT ILMENAU UNIVERSITY OF TECHNOLOGY

4.1. Mission and strategy of the University of Technology Ilmenau

The history of the education in science and technology in Ilmenau dates back to the year of 1893 (Thuringisches Technikum founded by Eduard Jentzen) focusing on electrical engineering and later also mechanical engineering as Engineering School Ilmenau. The current Ilmenau University of Technology (TUI) has been functioning since 1992. It has five faculties, four university-wide institutes (e.g. Institute of Car Manufacturing and Production Technology or Institute for Media and Mobile Communication), TU Ilmenau International School and several university support institutions (e.g. university library, computing centre or patent centre PATON), Ilmenau University of Technology is a leading entity in selected competence areas of basic and applied research on a national as well as an international scale. Strategic appointment of university chairs and targeted development of the scientific infrastructure as well as the technological environment have established high competences in broad activities in its teaching and research activities. The main research areas are “Microsystems and Nanosystems” and “Intelligent Systems Engineering and IT” with six research clusters. There are six research-training groups with about 110 early stage researchers in structured PhD programmes working at the University. There are currently more than 300 co-operation contracts with the industry ranging from the services and sponsored industrial research to basic or application-specific joint collaboration projects with enterprises. Several German enterprises are currently involved in 12 cross-university projects sponsored by the EU, in which the university creates a basis for these enterprises in order to participate in research competencies and find new business contacts on the European as well as an international scale.

4.2. Organisational units within the TUI supporting entrepreneurship

The Faculty of Economic Sciences (WiWi) at the Ilmenau University of Technology (TUI) comprises 4 institutes out of which Institute for Business Management (BWL, especially Dept. of Business Management and Organization) and Institute of Business Informatics (WI) offer in their courses educational content related to entrepreneurship. Their course Business Start Up and Management offering the basic entrepreneurial knowledge and competences open to all TUI students and employees. Passing this course is linked with Certificate on Business Start Up and Management for those considering the entrepreneurship career. The entrepreneurial mindset among students is also supported by the Dept. of Research Services and Technology Transfer being together with the Dept. of Business Management and Organization and other organizations the founders of the Entrepreneurship Initiative auftakt. It is supported by the Association Grunderforum Ilmenau e.V. (started in February 2011) and by the Dept. of Research Services and Technology Transfer. Members of the auftakt. are the TUI students and professors as well as external persons interested in creation of positive entrepreneurial climate at the TUI and in the region. The main activities of the auftakt. are: (a) make the TUI students sensitive in favour of entrepreneurship, (b) counselling and support of the startups in their pre-seed, seed and development stage and (c) start up networking support (with partners, investors, potential customers). The promotion of the activities of auftakt. and Grunderforum Ilmenau is carried out via the website www.auftakt.org. The University Branch of the Steinbeis Technology Transfer Network financed by the Steinbeis Foundation has been focusing on research in quality assurance, image processing and mechatronics. The Branch of the State Patent Centre of Free State of Thuringia (PATON) provides access to patent and other IPR databases, patent searches and consulting and patent registration services. It participates in the SIGNO-KMU Project aiming at support of SMEs in protecting their IPR and know-how transfer. The Head of PATON gives lectures on IPR, patents and patent search open for any interested public each semester. Besides the TUI makes optimal use of the proximity of some regional institutions for entrepreneurship support: Technology and Start Up Centre Ilmenau (TGZ Ilmenau) situated at the borders of the university campus, and the Thuringian Start Up Network EXIST. The Technology and Start Up Centre Ilmenau (TGZ Ilmenau) has been functioning as a venue for innovative technology start up companies in the region Ilmenau – Arnstadt since 1991. It is a regional tool of business and technology support in the TECHNOLOGY REGION ILMENAU ARNSTADT. Its proximity to the TUI should draw from the R&D competencies, human capital and interdisciplinary work at the university, know-how and technology transfer. The TGZ Ilmenau has no specific technology focus but offers besides office space also premises of industrial operation. The Thuringian Start Up Network EXIST is a partnership between the high education institutions (HEI) in Ilmenau, Jena, Schmalkalden and Weimar, Technology and StartUp Centres and Industry and Commerce Chambers (IHK) in the Free State of Thuringia led by the IHK East Thuringia in Gera. The EXIST provides education for starting up businesses, stipends for startups at HEIs and universities (EXIST-Grunderstipendium), counselling and consulting on business ideas, support in business financing, networking with German and foreign business partners, organization of contests of business ideas and business plans.

4.3. Entrepreneurship education and outreach activities at the TUI

The entrepreneurship education at the TUI is not concentrated in a study programme but rather dispersed in several study programmes, courses and their elements, e.g. Dept. of Media Management provides to the students of Media Management lecture „The Art of Entrepreneurship and Communication“ and media projects related to entrepreneurial issues in PR and media business. The Dept. of Business Management provides
students of WiWi Faculty lecture on Strategic Management & Entrepreneurship, and proseminar on the Development of Company Business Plan. Students may also opt for bachelor or master theses in the field of entrepreneurship. This department also offers a course Business Start Up and Management open to all TUI students and employees interested in entrepreneurship and potential entrepreneurial career. They can learn the fundamental competences required for starting up a business successfully and gain a specific certificate on passing this course. Every year 20 to 30 students are awarded these entrepreneurship certificates.

4.4. Types and sources of entrepreneurship funding and resource allocation

Entrepreneurship funding may rely on grants for projects related to research and entrepreneurship. One of them is a grant VIP (Validation of Innovation Potential of Scientific Research) supported by the Federal Ministry for Education and Research (BMBF) as a part of the Hightech-Strategy of the federal government. It should be a bridge between academic research and industry practice in assisting the scientists and researches from universities and R&D institutions to validate the applicability of their research results, innovative products, processes and services. The EXIST- Gruenderstipendium (Startup stipend) cofinanced by the European Social Fund is aimed to assist university students, graduates and scientists to turn their business idea into a business plan of a potential new company, especially if it will be a technology or science-oriented company. The project IP - SIGNO (Protection of ideas for business application) is financed via the branch of PATON (Federal Ministry of Economy and Technology - BMWi) supporting the inventors in universities and SMEs in legal protection of their intellectual property rights. Within the Thurinia there are offered several financing concepts based on combination of equity and debt (banks, VC, business angels).

5. CONCLUSION

- The key challenge to overcome is the work inertia and doubts on entrepreneurship among the university management and staff predominantly involved in the teaching and research activities of the faculties/institutes that should spread and support the entrepreneurship mindset leading to intrapreneurship or entrepreneurship activities of students, graduates and staff.
- The next challenge is lack of clear-cut university-wide strategy for entrepreneurship education within an university supported by a central organization unit steering the university education and outreach activities focused on entrepreneurship.
- For both the STU and TUI there is an urgent need to restructure the current teaching of dispersed courses of economy and management at STU into an “Entrepreneurship Education Module”, especially within the MSc. study programmes utilizing experience of study programmes of universities of technology abroad as benchmarks. Optimal conditions for realization of such an intention may be created by an efficient transformation of the STU Institute of Management into a Faculty of Entrepreneurship and Interdisciplinary Studies teaching Engineering, Economics and Management courses relevant for students developing innovative technologically –oriented entrepreneurship. Reinforcement of this the faculty with university teachers with sufficient business experience, and managers experienced in technology transfer and venture capital appear to be important prerequisites for viability of the proposed schemes and structures.
- In order to motivate university teachers, researchers and students in favour of commercialization of their work results, a transparent IPR policy and clear rules on division of commercialization revenues of should be implemented and promoted within the university faculties and and accepted by their organizational units.
- The experience of the TUI shows that a well organized collaboration with regional and municipal authorities and industrial partners based on state or regional entrepreneurship support programmes and infrastructure can substantially accelerate the development of entrepreneurial mindset and action among the university students and in the region. This comprehensive pattern of collaboration may assist in alleviating some financing issues related to this collaboration.
- The experience of the STU proves the catalyzing effect of the outreach activities in favour of entrepreneurship upon students, especially via university participation in the world-wide initiative Global Entrepreneurship Week. It also improves the image of the university towards the interested public and its partners in these activities.

6. REFERENCES


HUMAN COMPUTER INTERACTION
E-LEARNING COURSES IN ENGINEERING EDUCATION WITH SCORM STANDARDS

Sorin, Borza
University "Lucian Blaga" of Sibiu, sorin.borza@ulbsibiu.ro

ABSTRACT: Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for computer-assisted learning (e-learning). This collection of standards was defined by the Advanced Distributed Learning (ADL), an organization within the U.S. Defense Department. SCORM is a set of technical standards for e-learning software. SCORM says programmers how to write their code so that it was “fit” with several-learning software. This paper reflects the author’s research, on how to set up an e-learning course using a SCORM-compliant software. The paper shows how can the software CourseLab achieve in any field of engineering courses, courses that contain in addition to presenting information, in a static and dynamic field and quizzes to check students’ knowledge.

Key words: e-learning, engineering education, SCORM standards, CourseLab, Udutu

1. INTRODUCTION
In the technical literature, there are many definitions of the term “E-learning”, all of which are associated with distance learning via the Internet.

In a broader sense, "E-learning" means "all educational situations in which ICT (Information and Communication Technology) resources are significantly used ".

In the narrow sense, the term "E-learning" is "a type of distance education, organised by an institution that provides online materials to be assimilated by the students in their own way." Currently, there are a number of E-learning models (Butz, 2006) developed and used worldwide in distance education. Each university, or other institution provides such programs by adopting an appropriate model - a model that it deems to be the most effective for its intended type of training.

2. E-LEARNING MODELS AND ARCHITECTURE
The first model is the self-directed E-learning. This model is the simplest with respect to the number of functionalities, and is aimed at experienced learners in the process of continuous professional development, who wish to deepen specific topics. The information content consists of web pages, multimedia presentations, audio-video presentations and other materials. The content is made available to users via a hosting Web server[3].

The second model is called facilitated E-learning. This system combines the self-directed e-learning architecture model with a range of communication facilities, such as the email or the discussion forums. Documents are often transferred through the forum, where all users have access.

The third model is the advanced E-learning, which uses advanced Web technologies for the management of the entire educational process. Such a model uses audio-video real time transmission techniques via video telephony or video conferencing applications, chat or smart boards. These facilities are added on top of the previous model. Also, the educational process follows a timetable that all the students are required to meet. Such a model is built on the LMS system (Learning Management System). The information content is covered gradually, allowing the student to deepen all aspects of a topic. Increasing pressure faced by organizations (universities included) compel them to be organized in a better performing manner. High flexibility is another requirement, so as to enable them to quickly implement continuous improvement processes. A few reference architectures were created in order to assist the organizations in this work. They provide frameworks (templates) for certain fields. These templates typically consist of a list of modules, domains and specific functions and interactions between them. They also contain elements and features located outside the studied architecture.

Figure 1 shows an example of a reference architecture specific to E-learning educational systems. The product life cycle stages (of system development and use) specific to E-learning system are presented on an axis and the main entities and actors interacting with it, on the other. At the intersection points of these modules the main activities that characterize an E learning system are described[8].

![Figure 1 E-learning Architecture](image-url)
3. E-LEARNING COURSE STRUCTURE

An E-Learning Course consists of structured sets of Learning Modules. Depending on the structure of the learning content, modules can be grouped into Chapters. Chapters are arranged using a Chapter Hierarchy structure.

3.1. Learning Modules

The Learning Module is the fundamental building block of the course hierarchy and represents a set of author-structured Slides. During the learning process, the learner, by default, is led from one Slide to another sequentially. If desired, the author of the learning Module can define a different order for the Slides to appear (for example: depending on the result of the test). A Learning Module can be used for educational purposes if it only contains learning material. The Learning Module can also be employed for assessment of the learned lessons if it also contains tests and exercises. It is a common practice to combine learning material and tests into one single Learning Module – when a user has completed the learning material, they are tested within that same Learning Module.

In a Learning Management System the Learning Module is one of the components of a Learning Course and the only dynamic structural unit. The LMS collects information from the Learning Module about progress and testing. When processing information about status of all Learning Modules, the LMS registers the completion state of sections of the Course and also of the Learning Course itself, according to the rules defined by that particular Learning Management System. From an educational Methodology point of view, a Learning Module corresponds to a lesson or lecture – meaning it should contain thematically coherent and complete learning material.

3.1.1. Folders

Learning Modules created in CourseLab can be thematically combined in Folders. Folders can be grouped inside other folders - resulting in a complex course hierarchy structure. Although there is no limitation on the number of folders OR number of sub-folders within a folder, it is strongly recommended that you avoid using an overly complex hierarchy structure. You do not want to discourage students from pursuing your course just because the structure is too hard to comprehend. A folder usually contains Learning Modules and/or other folders. The folder in a distance Learning System is a structural entity, or unit. No information about the state of the folder is transmitted to the Learning Management System from the Learning Modules. The LMS makes changes to the state of folders based on information received from its Learning Modules and other Folders.

4. SCORM STANDARD

Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for computer-assisted learning (e-learning). This collection of standards was defined by the Advanced Distributed Learning (ADL), an organization within the U.S. Department of Defense. SCORM is a model for multiple use and its goal is standardizing content and content technology for education and online education, such training. More specifically SCORM is a set of technical standards for e-learning software. SCORM says programmers how to write their code so that it was "fit" with several e-learning software. Specifically, SCORM eLearning and regulate the content of LSM (Learning Management Systems). Take, for example, DVDs. When buying a new DVD movie, it works on all brands of DVD players, as they are made according to certain standards.

SCORM defines the communication between the content on the client system and a host system called the run-time environment (commonly a function of learning management system). SCORM 2004 introduces a complex idea called sequencing, which establishes a set of rules that specify the order in which the user can access training topics can experiment and use different teaching materials. The standard uses XML, and is based on results obtained by AICC (CBT) Training IMS Global Consortium and IEEE.

4.1. SCORM components

SCORM specifications are defined in three main documents:

- SCORM Content Aggregation Model (SCORM aggregation model content) defines the requirements for assembly and packaging of content, requirements for content editors, so any package that complies with these requirements can be loaded on any platform and run e-learning in it.
- SCORM Run-Time Environment (SCORM runtime environment) defines requirements for running the content, applicable to both an LMS (software learning management) and content objects.
- SCORM Sequencing and Navigation (SCORM Sequencing and Navigation) defines requirements for the order in which various items of content are delivered on students and how this order can be controlled by a series of events generated by the student navigation or content.

From a structural, SCORM consists of 4 sequences, respectively:

- sequence overview at the conceptual level (refer to SCORM version)
- sequence describing the unit components
- sequence showing learning management (learning progress)
- Navigation and production sequence of events

SCORM Sequencing defines the requirements on the order in which various items of content are delivered on students and how this order can be controlled by a series of events generated by the student navigation or content.

Sequencing rules allow the author to do the following:

- to determine what Moodle LMS should provide student (buttons previous / next).
- specify the order of activities.
- to do so some parts of the course to be more important than others.

In terms of information, a SCORM object is a zipped file containing the definition of a file name extension with IMS manifest, XML, ml files showing all the other components of the object specification use.

4.2. SCORM Versions

The SCORM’s versions are presented in figure 2. They are:

- SCORM 1.1 - is the first version, little used because of its rigidity.
- SCORM 1.2 base version for most platforms.
- SCORM 2004 - current version to resolve some ambiguities found in version 1.2 and adding new specifications for learning management [2].

SCORM 2004 editions:
that this term covers a wide range of development functions. The term "authoring tool" can be misleading. In e-learning, meaning of the word "Authoring", which also refers to e-learning authoring tools, e-learning authoring software, e-learning content development tools and software development e-learning course, means much more than writing and word processing. E-Learning authoring tools allow instructors to integrate a series of media training courses to create an interactive training content. With an authoring tool, you can reuse learning objects and digital elements of the existing interactive training content. Producing SCORM objects is the result of a conversion with a module attached to an editor (eg Microsoft Word) or as a result of interaction with a specialized editor (UDUTU, CourseLab, exe, etc.).

Product eXe (eLearning XHTML editor) is an editor available at http://www.exelarning.org, offered free. Udutu is an online editor that can be used freely by creating a user account on the site located at http://www.myudutu.com. Pedagogical support to create courses. Can be imported created using other text editors.

5. EDITORS FOR ACHIEVING E-LEARNING COURSES IN SCORM FORMAT

The current and most spectacular way distance education is the so-called "e-Learning" (electronic learning) or through distance education electronic media and especially the Internet. However, e-Learning is not just an electronic way to transfer knowledge. E-Learning solutions have quickly evolved from the simple to use download (download-and-play) to model complex online courses including live tests and full monitoring of all educational activities (over-the-Web-fair-in-time). The term "authoring tool" can be misleading. In e-learning, meaning of the word "Authoring", which also refers to e-learning authoring tools, e-learning authoring software, e-learning content development tools and software development e-learning course, means much more than writing and word processing. E-Learning authoring tools allow instructors to integrate a series of media training courses to create an interactive training content. With an authoring tool, you can reuse learning objects and digital elements of the existing course. In this way you can achieve a return on investment for components that have been developed using various graphic design programs or resources. In fact, "e-learning course creation tool" is a correct term for the popular "Authoring tool". As you begin to look for an authoring tool you will find that this term covers a wide range of development functions. A wide range of utilities can be used for courses in the format SCORM (Sharable Content Object Reference Model). For example:

- eXe OPEN SOURCE SCORM Development Package (http://exelarning.org/)
- Xerte OPEN SOURCE SCORM development Package (http://www.nottingham.ac.uk/xerte/)
- ScenariChain Opale / OpaleSup (http://scenariplatform.org/projects/scenari/en/pres/co/)

5.1. CourseLab software

CourseLab is an application to create courses, easy to use. Provides an environment for creating high quality interactive training courses that can be accessed online or in a system LMS (Learning Management Systems).

CourseLab essential features are:
- Environment WYSIWYG (What You See Is What You Get) for interactive content creation and management of e-learning;
- No required knowledge of HTML or other programming skills;
- The object oriented design allows complex e-Learning content;
- Scenario feature enables building complex interaction between objects, with a single mouse click;
- Interface is based on an Open Object Model and allows you to easily expand and improve existing object libraries and templates, including those created by user;
- Has built-in for creating tests;
- It has an integrated mechanism for animating objects;
- Ability to insert rich media content such as Macromedia Flash, Shockwave, Java, and video formats;
- Inserting synchronized light and sound;
- Import PowerPoint presentations into learning material (optional PowerPoint Import Pack);
- Mechanism for screen capture (screenshot optional Pack);
- Access to additional functionality for Course Player through JavaScript;
- Does not require Java for Course Player.

5.1.1. Slide

The Slide (interactive webpage) is the main building block of the Learning Module. Slides are used by the author to contain the learning material, tests, and exercises. The sequence and navigation of Slides is predefined by the author. A Slide consists of Frames. Depending on complexity, the number of frames can vary (e.g. using animations or software simulations can significantly increase the number of frames). Every Slide has at least one frame. Slides are not individually accessible by the Learning Management System. The Learning Module is the smallest system-managed unit. From an educational Methodology perspective, a Slide is employed to express a single point of view, thought, or idea inside of the Learning Module. In figure 3 we presents the slide of CourseLab. Every Module contains Special Slides: Title-Slide and Master-Slide (one or several).

The Title-Slide (figure 4) is the introductory page of the Learning Module and appears on the computer screen as the Learning Module launches. The system preloads the main part of the Module and loads the introductory page in the background, which makes it faster for the user. All Slides in the Learning Module are created on top of the Master-Slide (figure 5). The Master Slide is a Slide that contains various elements that are common to all, or several,
Slides. The Master Slide could contain logos, navigation Objects (Next / Previous), Help buttons, etc. There is no limit to the number of Master-Slides and, hypothetically, each Slide with assessment or content could have a Master-Slide. That would be rather inefficient and should be avoided. In practice, one Master-Slide should be enough. Note that the Master Slide is a background Slide (Slide content will be placed on top of it) but it also can contain interactive components such as navigation buttons.

![Figure 3 The Slide](image)

![Figure 4 Title side](image)

![Figure 5 Master Slide](image)

5.1.2. **Frame**

A Frame is a component of a Slide. Every piece of content is placed inside its own Frame – so the Frames on a Slide could contain graphics, a button, text or a video. The Frame is the smallest structural unit of a Learning Module. Even though there is no limitation to the number of Frames within a Slide, we recommend no more than 30-40 Frames per Slide; otherwise the Slide will load up extremely slow. As with Slides, Frames are not accessible by the Learning Management System individually. The Learning Module is the smallest system managed unit.

![Figure 6 Frame](image)

5.2. **eXe Editor**

The eLearning XHTML editor (eXe) is an authoring environment to assist teachers and academics in the design, development and publishing of web-based learning and teaching materials without the need to become proficient in HTML or complicated web-publishing applications.

![Figure 7 eXe Page Editor](image)

The Web is a revolutionary educational tool because it presents teachers and learners with a technology that simultaneously provides something to talk about (content) and the means to hold the conversation (interaction). Unfortunately, the power of this hypertext medium is constrained in educational settings because the vast majority of teachers and academics do not have the technical skills to build their own web pages, and must therefore rely on the availability of web developers to generate professional looking online content. eXe has been developed to overcome a number of identified limitations:

- Much web-authoring software entails a fairly steep learning curve, is not intuitive or designed for publishing learning content. Consequently teachers and academics have not adopted these technologies for publishing online learning content. eXe aims to provide an intuitive, easy-to-use tool that will enable teachers to publish professional looking web pages for learning;
- Currently, learning management systems do not offer sophisticated authoring tools for web content (when compared to the capabilities of web-authoring
software or the skills of an experienced web developer), eXe is a tool that provides professional web-publishing capabilities that can be easily referenced or imported by learning management systems;

- Most content management and learning management systems utilize a centralized web server model thus requiring connectivity for authoring. This is limiting for authors with low bandwidth connectivity or no connectivity at all. eXe has been developed as an offline authoring tool without the requirement for connectivity.

- Many content management and learning management systems do not provide an intuitive WYSIWYG environment where authors can see what their content will look like in a browser when published, especially when working offline. eXe's WYSIWYG functionality enables users to see what the content will look like when published online [6].

5.3. myUdutu Editor

Udutu is not a software company, it is a service company. We recognized that budgets, personnel resources and shifting priorities can stall a worthwhile online course project for months or even years. Licensed Desktop tools get limited to a few "technical" experts, and leave subject matter experts, project managers, and other stakeholders out of the loop. So we make the authoring tool available to anyone and everyone, and because it is online, stakeholders can collaborate from anywhere, on any platform or operating system, so long as they have a browser.

Whether you are a large corporation offering constant learning and training opportunities for managers and employees or you are a small business, you will find that Udutu’s WSIWYG (What You See Is What You Get) online learning software makes it easy to produce media rich, engaging online courseware at minimal cost and without having to rely on programmers or multimedia experts.

Every time you sign into the myUdutu tool you will start on the welcome page of myUdutu where there are 3 tabs at the top of the screen: Workspace, Library and Administration.

You will automatically have the workspace tab open for you. This is where you will likely get started in creating a course or modifying, copying or publishing an existing course (figure 8).

![Figure 8 myUDUTU start page](image)

”A” is where you create a brand new course. „B” is where your existing courses will be listed and accessed from and „C” is where you might choose to import an existing SCORM compliant course [7].

The system is perfect for corporate trainers, software trainers, human resource managers, curriculum designers, sales professionals, account managers and small businesses. You are able to easily import existing curriculums and PowerPoint presentations.

Flexible templates allow users to effortlessly present material to learners, engaging them with interactions, and immersing them in branching scenarios. All major types of graphic, sound, and video formats optimize automatically for web delivery. A robust multimedia corporate training and development program can be up and running in 3 to 4 weeks. The authoring tool also extracts a .zip file that integrates seamlessly with any SCORM compliant LMS. All this can be done with no technical knowledge. You could be up and running within hours or days depending on the size of your offering.

6. CONCLUSIONS

Research conducted in the elaboration of e-learning courses have generated the following conclusions:

- Course topics should be very clear and very consistent;

- Stay focused. The e-learning course should refer strictly to the theme developed without unnecessary discussion on alternative topics;

- Do not provide too many alternatives. A tree-like Course structure is not as good as a linear type course. It sends learners different directions and some parallel paths of the tree-like structure may end up not being covered at all. The only exception for using a more complex structure is when you need to provide an example which is relevant to the main Objective;

- Pieces of the Learning Material should be reasonably sized. Break down the Learning Material into chunks of learning content. Build a clear hierarchy structure. If learning material is extensive, break it down into coherent thematic Modules – clear and consistent story lines and content. It is not recommended to group more than one learning subject into one Module; better to use more Modules in the course than overload the Modules with different subjects;

- One Topic per Slide. Overloading a Slide with several related topics is not recommended. Most likely the student will remember none of those concurrent topics. This does not mean that the entire learning material within a larger topic should be placed on one Slide; in most cases that will be impossible;

- Use Interactive Multimedia features. Use multimedia and graphics. E-Learning has a huge advantage over conventional learning because it can incorporate multimedia content;

- Animations and Flash-movies are often more easily understood than lengthy text descriptions and should be used as much as possible when exploring topics;

- Learn as you practice. Allow audience to interact with the material as it significantly improves the process of memorizing the material. Where appropriate, enable onscreen Actions to demonstrate different results by the manipulation of their parameters. Use quizzes as knowledge checks along the way.

7. REFERENCES


2. Kiyoshi Nakabayashi, Youseke Morimoto, Yoshiaki Hada, Design and Implementation of an Extensible Learner-


An Automatic Speech Recognition (ASR) converts the speech signals into words. The recognized words can be the final output or it can be an input for a natural language processing. In this paper, vowel recognizer using Continuous density HMM and Mel-Frequency Cepstral Coefficient (MFCC) were used for feature extraction for its development, and phonetically balanced words (PBW) in Filipino were developed. Thus, this study is a preparation for Filipino Language ASR using HMM. For vowel recognizer, forty speakers were trained (20 male and 20 female speakers). An average accuracy rate of 94.5% was achieved for speaker-dependent test and 90.8% for speaker independent test. For PBW, 2 word lists were developed consisting of 257 words for the 2-syllable Filipino PBW word list and 212 words for the 3-syllable Filipino PBW word list.

Key words: Continuous Density Hidden Markov Model, Filipino Vowels and Phonemes, Phonetically Balanced Words.

1. INTRODUCTION

Speech is one of the most effective means of communication that is acquired as one of the first skill a human acquires through interaction with its environment. In the past decades, computer scientists as well as linguists have been researching effective means of recognizing speech through automated machines.

Automatic speech recognition is the process of decoding speech into its corresponding sequence of words. It has been an effort of Filipino researchers to provide an accurate speech recognizer throughout the past years [1][2]. However, not one provides an efficient solution for the Filipino Language.

The Hidden Markov Model (HMM) is a doubly stochastic process with one that is not directly observable [3]. This hidden process can be observed only through another set of stochastic process that can produce the observation sequence.

HMMs are so far the widely used acoustic model for speech recognition [4]. This model is used from previous studies relating to an Automatic Speech recognizer for the Filipino Language [1][2].

In 2003, an ASR for Filipino phonemes was developed [1]. This study reported to have achieved a recognition accuracy of 85.5%. However, this recognizer was incorporated for phoneme utterances using discrete HMM rather than continuous word recognition.

Dela Roca G., et.al (2003) attempted to recognize continuous speech using a developed Filipino Speech Corpus by Guevara R., et. al (2002) that reported to achieve only a 32% recognition accuracy. In an attempt to increase this accuracy, as study in 2010 was held where in an Indonesian speech corpus was incorporated for the recognizer as training sets to recognize Filipino utterances [5]. The Indonesian speech corpus contains 80 hours of recording compared while the developed Filipino speech corpus in 2003 contains 4 hours of recording. This cross-lingual approach achieved 79.50% recognition accuracy.

In this effort, the researchers’ objective is to (1) prove the efficiency of HMM for recognizing Filipino words using a Mel-frequency Cepstral Coefficient approach, (2) and create a phonetically balanced word list of commonly used words in the Filipino Language.

2. FILIPINO LANGUAGE

Filipino is the language used largely in the Philippines with 22 million native speakers [6].

Between the 1930s and mid-1970’s, a system of syllabication for the alphabet called abakada was developed by Lope K. Santos to represent the native sounds[7]:

\[ a \ ba \ ka \ da \ e \ ga \ ha \ I \ la \ ma \ na \ nga \ o \ pa \ ra \ sa \ ta \ u \ wa \ ya \]

to represent the Filipino alphabet, consisting of 5 (a, e, I, o, u) vowels and 15 (b, k, d, g, h, l, m, n, ng, p, r, s, t, w, y) consonants. The Filipino alphabet, though in a sense, considered as phonetic, does not reflect exactly the correct sound in written form [8]. There are words present in the Filipino Language that are spelled the same but are pronounced with slight differences, which produce difference in meaning.

\[ \text{bata} /\text{b}:a-\text{ta}/ - \text{“a child”} \]
\[ \text{bata} /\text{b}:a-\text{ta}/ - \text{“to bear or endure”} \]

The word bata with the phonetic representation of /b:a – ta/ denotes a long sound which is produced by a short pause after
the affected syllable, while the other phonetic representation /ba-ta/ is produced continuously without breaks.

Thus, the Filipino phonemes can be broken down to the following phones:

**Vowels**
/a/ /e/ /i/ /o/ /u/

**Consonants**
/b/ /k/ /d/ /g/ /h/ /l/ /m/ /n/ /ŋ/ /p/ /r/ /s/ /t/ /w/ /y/

Table 1: The Filipino Vowel System

<table>
<thead>
<tr>
<th></th>
<th>front</th>
<th>central</th>
<th>back</th>
</tr>
</thead>
<tbody>
<tr>
<td>upper</td>
<td>/i/</td>
<td></td>
<td>/a/</td>
</tr>
<tr>
<td>high</td>
<td>/e/</td>
<td>/o/</td>
<td></td>
</tr>
<tr>
<td>lower</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Filipino vowel phonemes can be described as /a/ low central unrounded, /e/ mid front unrounded, /i/ high front unrounded, /o/ mid back rounded, and /u/ high back rounded. According to tongue height, we have two front vowel phonemes /i e/, and two back vowel phoneme /o u/, and one central vowel phoneme /a/.

Table 2: The Filipino Consonant System

<table>
<thead>
<tr>
<th></th>
<th>labial</th>
<th>dental</th>
<th>alveolar</th>
<th>palatal</th>
<th>velar</th>
<th>glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>stops</td>
<td>voiced</td>
<td>/p/</td>
<td>/t/</td>
<td>/k/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasals</td>
<td>voiced</td>
<td>/b/</td>
<td>/d/</td>
<td>/g/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricatives</td>
<td>voiced</td>
<td></td>
<td>/h/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>affricatives</td>
<td>voiced</td>
<td>/f/</td>
<td></td>
<td>/v/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lateral</td>
<td>voiced</td>
<td>/l/</td>
<td></td>
<td>/r/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flap</td>
<td>voiced</td>
<td>/w/</td>
<td></td>
<td>/y/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glide</td>
<td>voiced</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Filipino consonants are produced through the help of the lips (labial), teeth (dental), alveolar ridge (alveolar), palate (palatal), velum (velar), and glottis (glottal).

3. **TEST OF VOWEL RECOGNITION**

Filipino native speakers were selected for voice recording sessions. 50 speakers were asked to record their voices, 25 of which are female and 25 male. These speakers are gathered from the undergraduate students, and faculty members of the School of Information Technology at La Consolacion College Manila, Philippines.

The speakers have Filipino as their first language and are able to read and speak Filipino. The speakers are fluent with the language, and has no speaking ailment and at their proper dispositions.

3.1. Recording Specifications

The recordings were done in an isolated room using a uni-directional microphone connected to a computer with input speech sampled at 16 kHz at mono. A distance of approximately 5-10 centimetres is used between the mouth of the speakers and the microphone used.

3.2. Recorded Speech

The speakers were asked to utter Filipino phonemes: /a/, /e/, /i/, /o/, and /u/. The speeches collected were used as training data, and test data.

The training data are gathered from 20 female and 20 male speakers, which recorded 4 sets of vowel utterances. The test data were grouped as ‘speaker dependent’ and ‘speaker independent’. The speaker dependent speech were taken from the same speakers from the training data (20 female and 20 male), which recorded another set of vowel utterances while the speaker independent speech were taken from 5 female and 5 male speakers not included in the training data which recorded a set of vowel utterances.

The recordings conventionally named with the format “A1 001.wav” where:

A – phoneme (a/e/i/o/u)
1 – speaker’s gender (1 male, 0 female)
001 – number of recorded set

3.3. Hidden Markov Model Toolkit (HTK)

The recorded speech data were converted into a Mel-frequency Cepstral Coefficient (MFCC) that is used to train a prototype HMM using HTK tools.

A percentage were taken from the recognized vowel utterance by HTK and shown as follows to define the accuracy of recognition:

Table 3: Accuracy rate taken from the test data of dependent speakers.

<table>
<thead>
<tr>
<th>Vowels</th>
<th>Male (Dependent) 20 speakers</th>
<th>Female (Dependent) 20 speakers</th>
<th>Average Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accuracy rate (%)</td>
<td>Accuracy rate (%)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>E</td>
<td>100</td>
<td>85</td>
<td>92.5</td>
</tr>
<tr>
<td>I</td>
<td>100</td>
<td>95</td>
<td>97.5</td>
</tr>
<tr>
<td>O</td>
<td>95</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>U</td>
<td>95</td>
<td>90</td>
<td>92.5</td>
</tr>
<tr>
<td>Results</td>
<td>98</td>
<td>91</td>
<td>94.5</td>
</tr>
</tbody>
</table>

Table 4: Accuracy rate taken from the test data of independent speakers.

<table>
<thead>
<tr>
<th>Vowels</th>
<th>Male (Independent) 5 speakers</th>
<th>Female (Independent) 5 speakers</th>
<th>Average Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accuracy rate (%)</td>
<td>Accuracy rate (%)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>E</td>
<td>100</td>
<td>76</td>
<td>88</td>
</tr>
<tr>
<td>I</td>
<td>100</td>
<td>64</td>
<td>82</td>
</tr>
<tr>
<td>O</td>
<td>96</td>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td>U</td>
<td>72</td>
<td>100</td>
<td>86</td>
</tr>
<tr>
<td>Results</td>
<td>93.6</td>
<td>88</td>
<td>90.8</td>
</tr>
</tbody>
</table>
The accuracy rate of recognition of the Filipino phonemes had a slight decrease from the dependent speakers with a mean of 94.5, compared to the accuracy rate from the independent speakers with a mean of 90.8. This is anticipated since the dependent speakers were not common to the training data.

4. PHONETICALLY BALANCED WORDS

In lieu with the results of the conducted test of recognition vowels from the Filipino Language, a phonetically balanced word list could be used with the same methodology in testing vowel recognition of Filipino words using continuous density HMM for larger vocabulary word recognition.

In the construction of large-vocabulary word recognition, a set of recording must be obtained from a spoken corpus gained from a written corpora or a phonetically balanced word list. A Filipino Speech corpus was developed by Guevara, et. al [2] that includes both an open-ended and close-ended spoken words. This methodology in training data is not phonetically balanced. A phonetically balanced speech text used for English, German, Swedish, Danish, Hebrew, Italian, Finish, and Portuguese often taken into the following criteria [9][10]: Syllable structure, equal phonetic structure, phonetic balance, equal average difficulty and equal range of difficulty, common words, and speaker intelligibility.

An Ilocano Phonetically Balanced Word based on the Ilocano language – the third largest dialect spoken in the Philippines [11] list was produced in 2003 from the following criteria [12]: Syllable structure, equal phonetic structure, phonetic balance, equal average difficulty and equal range of difficulty, common words, and speaker intelligibility.

This 2-syllable Ilocano word list was gathered from a locally published articles, and 2-syllable words from an Ilocano dictionary.

4.1. Development of PBW

The Filipino phonetically balanced words were evaluated from 16 articles found from a Filipino based textbook written for senior public school students, “Bagwis”. This textbook is approved by the Department of Education and Sports Commission of the Philippine Government, thus be considered reliable with a minimal chance of error. All the articles extracted from the textbook are written in Filipino, which consists of a total of 9768 words.

<table>
<thead>
<tr>
<th>Title</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ang Gilingang Bato</td>
<td>2905</td>
</tr>
<tr>
<td>Sa Yapak ng Pambansang bayani sa Heidelberg</td>
<td>1154</td>
</tr>
<tr>
<td>Ang Wika Ng Pilipino At Ang Banta Ng Globalisasyon</td>
<td>1150</td>
</tr>
<tr>
<td>Ang Kulturan Pilipino Ng Mga Wikang Filipino</td>
<td>1006</td>
</tr>
<tr>
<td>Walang Panginooon</td>
<td>607</td>
</tr>
<tr>
<td>Sandaling Repleksyon</td>
<td>550</td>
</tr>
<tr>
<td>Ang Sex Education Ni Inay Ukol Sa Origin Ng Mga Bata</td>
<td>548</td>
</tr>
<tr>
<td>Ang Alibuhang Anak</td>
<td>436</td>
</tr>
<tr>
<td>Ang Mangmang at ang Pari</td>
<td>317</td>
</tr>
<tr>
<td>Ang Mga Kagitgitala Na Pakikipagsapalaran Ni Juan dela Cruz</td>
<td>248</td>
</tr>
</tbody>
</table>

Table 6: Frequency of Syllable Counts from the extracted unique words

<table>
<thead>
<tr>
<th>Syllable Count</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-syllable</td>
<td>101</td>
</tr>
<tr>
<td>2-syllable</td>
<td>780</td>
</tr>
<tr>
<td>3-syllable</td>
<td>912</td>
</tr>
<tr>
<td>4-syllable</td>
<td>740</td>
</tr>
<tr>
<td>5-syllable</td>
<td>299</td>
</tr>
<tr>
<td>6-syllable</td>
<td>72</td>
</tr>
<tr>
<td>7-syllable</td>
<td>23</td>
</tr>
<tr>
<td>8-syllable</td>
<td>7</td>
</tr>
<tr>
<td>9-syllable</td>
<td>2</td>
</tr>
<tr>
<td>10-syllable</td>
<td>1</td>
</tr>
<tr>
<td>13-syllable</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>2938</td>
</tr>
</tbody>
</table>

A tabulation of the frequency of number of syllabifications were extracted from the excel spreadsheet as a basis of selecting the best syllabically homogeneous words from the 2938 unique words.

Table 7: 2-syllable words and 3-syllable words and its frequency of occurrences.

<table>
<thead>
<tr>
<th>Syllable Count</th>
<th>1 occurrence</th>
<th>&gt;1 occurrences</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-syllable</td>
<td>457</td>
<td>323</td>
<td>780</td>
</tr>
<tr>
<td>3-syllable</td>
<td>663</td>
<td>249</td>
<td>912</td>
</tr>
</tbody>
</table>

From the 780 and 912 2-syllable and 3-syllable words found in the list, A total of 323 2-syllable and 249 3-syllable words were extracted of which have more than 1 frequency of occurrence in the list to ensure commonality of words. These words are grouped according to their phonetic structure, constituting at least 80% of the total numbers of the 3-syllable and 2-syllable words.
Table 8: Phonetic Structure of 2-Syllable unique word list

<table>
<thead>
<tr>
<th>Phonetic Structure</th>
<th>Frequency</th>
<th>Vowel</th>
<th>Consonants</th>
</tr>
</thead>
<tbody>
<tr>
<td>cv-cvc</td>
<td>130</td>
<td>260</td>
<td>390</td>
</tr>
<tr>
<td>cv-cv</td>
<td>61</td>
<td>122</td>
<td>122</td>
</tr>
<tr>
<td>v-cvc</td>
<td>43</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>cvc-cv</td>
<td>27</td>
<td>54</td>
<td>81</td>
</tr>
<tr>
<td>cvc-cvc</td>
<td>25</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>cv-vc</td>
<td>13</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>v-cv</td>
<td>12</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>v-cvc-cvc</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>ccv-cv</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>cv-cv</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>cv-vc</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>v-v</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>cve-ccv</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>cve-cv-cvc</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>cv-v</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>323</strong></td>
<td><strong>646</strong></td>
<td><strong>849</strong></td>
</tr>
</tbody>
</table>

Table 9: Phonetic Structure of 3-Syllable unique word list

<table>
<thead>
<tr>
<th>Phonetic Structure</th>
<th>Frequency</th>
<th>Vowel</th>
<th>Consonant</th>
</tr>
</thead>
<tbody>
<tr>
<td>cv-cvc-cvc</td>
<td>100</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>cv-cv-cv</td>
<td>38</td>
<td>114</td>
<td>114</td>
</tr>
<tr>
<td>cv-cvc-cvc</td>
<td>15</td>
<td>45</td>
<td>75</td>
</tr>
<tr>
<td>cve-cv-cvc</td>
<td>14</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>v-cv-cvc-cvc</td>
<td>11</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>cve-cvc-cv</td>
<td>11</td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td>cv-cv-cv-cvc</td>
<td>9</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>cv-cv-cv</td>
<td>8</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>cv-cvc-cvc</td>
<td>8</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>cv-cv-cvc-cvc</td>
<td>6</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>cv-cv</td>
<td>3</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>cv-vc-cvc-cvc</td>
<td>3</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>cv-v-cv</td>
<td>3</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>cve-cvc-cvc-cvc</td>
<td>3</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>cve-cve-cv-cvc</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>cve-cv-vc</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>cve-v-cvc</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>v-cve-cvc-cvc</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>v-cve-cvc-cvc</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>ve-cvc-cvc</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>ve-cv-cv-cvc</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>v-v-cvc</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

| 2-cvc-cv-cvc       | 1         | 3     | 4         |
| cv-cv-cv-cv        | 1         | 3     | 5         |
| cve-cv-cv-cv       | 1         | 3     | 4         |
| cv-cv-cv-cv        | 1         | 3     | 4         |
| cv-cv-cvc-cv       | 1         | 3     | 5         |
| cv-vc-cvc-cvc      | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cvc-cvc      | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cvc-cvc      | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |
| cv-cv-cv-cvc       | 1         | 3     | 5         |

214 of the 3-syllable words are represented with the following phonetic structures: cv-cv-cvc, cv-cv-cv, cv-cvc-cvc, cve-cv-cv, cve-cvc-cvc, v-cv-cvc, cv-cv-cv, cv-cv-cv, cv-cvc-cvc, and v-cv-cv with the frequencies of 0.416, 0.1526, 0.0602, 0.0441, 0.0562, 0.0441, 0.0361, 0.0321, and 0.0321 respectively. While 261 of the 2-syllable words are represented with the following phonetic structures: cv-cvc, cv-cv, v-cvc, and cve-cvc with the frequencies of 0.4024, 0.1889, 0.1331, and 0.0836 respectively.

A frequency of each phoneme is calculated with the formula:

\[ F = \frac{(pfw \times wf)}{n} \]

Where:
- \( F \) frequency of phonemes represented in the list
- \( pfw \) frequency of phonemes in a word
- \( wf \) frequency of word occurrence
- \( n \) total number of phonemes

This value is compared to the acceptance value with the formula:

\[ aV = \frac{1}{(x \times n)} \]

Where:
- \( aV \) acceptance value
- \( x \) average of the vowels/consonants in a phonetic structure
- \( n \) total number of words

Table 10: Acceptance values of phonemes for the 2-syllable and 3-syllable words

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Consonants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-syllable words</td>
<td>0.0023</td>
</tr>
<tr>
<td>3-syllable words</td>
<td>0.0015</td>
</tr>
</tbody>
</table>

The acceptance value for the frequency of vowels from the 2-syllable word list is 0.0023 and 0.0018 for the consonants based on the 261 2-syllable words while the acceptance value for the vowels from the 3-syllable word list is 0.0015 and 0.0012 for consonants based on 214 words in list. These values are compared from the frequency of each phoneme in the list to validate if the phoneme is well represented. Phonemes lower than the acceptance values would not be represented, thus the words including the phonemes will be removed from the accumulated list while frequencies higher or equal to the acceptance values well represented by the list.
Table 11: Frequency of Phonemes represented by the developed 2-syllable phonetically balanced word list

<table>
<thead>
<tr>
<th>Consonants</th>
<th>Remark(s)</th>
<th>Vowel</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>0.0196</td>
<td>ACCEPT</td>
<td>A</td>
</tr>
<tr>
<td>K</td>
<td>0.0311</td>
<td>ACCEPT</td>
<td>E</td>
</tr>
<tr>
<td>D</td>
<td>0.0184</td>
<td>ACCEPT</td>
<td>I</td>
</tr>
<tr>
<td>G</td>
<td>0.0175</td>
<td>ACCEPT</td>
<td>O</td>
</tr>
<tr>
<td>H</td>
<td>0.0247</td>
<td>ACCEPT</td>
<td>U</td>
</tr>
<tr>
<td>L</td>
<td>0.0308</td>
<td>ACCEPT</td>
<td>IW</td>
</tr>
<tr>
<td>M</td>
<td>0.0454</td>
<td>ACCEPT</td>
<td>AY</td>
</tr>
<tr>
<td>N</td>
<td>0.0642</td>
<td>ACCEPT</td>
<td>AW</td>
</tr>
<tr>
<td>ŋ</td>
<td>0.0779</td>
<td>ACCEPT</td>
<td>OY</td>
</tr>
<tr>
<td>P</td>
<td>0.0122</td>
<td>ACCEPT</td>
<td>EY</td>
</tr>
<tr>
<td>R</td>
<td>0.0128</td>
<td>ACCEPT</td>
<td>UY</td>
</tr>
<tr>
<td>S</td>
<td>0.0348</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.0357</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>0.0135</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.0367</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>η</td>
<td>0.0779</td>
<td>ACCEPT</td>
<td>OY</td>
</tr>
<tr>
<td>P</td>
<td>0.0122</td>
<td>ACCEPT</td>
<td>EY</td>
</tr>
<tr>
<td>R</td>
<td>0.0128</td>
<td>ACCEPT</td>
<td>UY</td>
</tr>
<tr>
<td>S</td>
<td>0.0348</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.0357</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>0.0135</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.0367</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>η</td>
<td>0.0779</td>
<td>ACCEPT</td>
<td>OY</td>
</tr>
<tr>
<td>P</td>
<td>0.0122</td>
<td>ACCEPT</td>
<td>EY</td>
</tr>
<tr>
<td>R</td>
<td>0.0128</td>
<td>ACCEPT</td>
<td>UY</td>
</tr>
<tr>
<td>S</td>
<td>0.0348</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.0357</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>0.0135</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.0367</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>η</td>
<td>0.0779</td>
<td>ACCEPT</td>
<td>OY</td>
</tr>
<tr>
<td>P</td>
<td>0.0122</td>
<td>ACCEPT</td>
<td>EY</td>
</tr>
<tr>
<td>R</td>
<td>0.0128</td>
<td>ACCEPT</td>
<td>UY</td>
</tr>
<tr>
<td>S</td>
<td>0.0348</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.0357</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>0.0135</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.0367</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>η</td>
<td>0.0779</td>
<td>ACCEPT</td>
<td>OY</td>
</tr>
<tr>
<td>P</td>
<td>0.0122</td>
<td>ACCEPT</td>
<td>EY</td>
</tr>
<tr>
<td>R</td>
<td>0.0128</td>
<td>ACCEPT</td>
<td>UY</td>
</tr>
<tr>
<td>S</td>
<td>0.0348</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.0357</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>0.0135</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.0367</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>η</td>
<td>0.0779</td>
<td>ACCEPT</td>
<td>OY</td>
</tr>
<tr>
<td>P</td>
<td>0.0122</td>
<td>ACCEPT</td>
<td>EY</td>
</tr>
<tr>
<td>R</td>
<td>0.0128</td>
<td>ACCEPT</td>
<td>UY</td>
</tr>
<tr>
<td>S</td>
<td>0.0348</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.0357</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>0.0135</td>
<td>ACCEPT</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>0.0367</td>
<td>ACCEPT</td>
<td></td>
</tr>
</tbody>
</table>

The table 11 shows the distribution of the 31 phonemes (23 consonants, and 8 vowels) of which the developed list represents. From the 261 tentative 2-syllable word list, a final 257 2-syllable word list resulted by removing the words in the list that are not represented by the list. Table 12 shows the distribution of the 32 phonemes (25 consonants, and 7 vowels) of which the developed list represents. From the 214 tentative 3-syllable word list, a final 212 3-syllable word list resulted by removing the words in the list that are not represented by the list.

Table 12: Frequency of Phonemes represented by the developed 3-syllable phonetically balanced word list

<table>
<thead>
<tr>
<th>Consonants</th>
<th>Remarks</th>
<th>Vowel</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>0.0137</td>
<td>ACCEPT</td>
<td>A</td>
</tr>
<tr>
<td>K</td>
<td>0.0316</td>
<td>ACCEPT</td>
<td>E</td>
</tr>
<tr>
<td>D</td>
<td>0.0210</td>
<td>ACCEPT</td>
<td>I</td>
</tr>
<tr>
<td>G</td>
<td>0.0440</td>
<td>ACCEPT</td>
<td>O</td>
</tr>
<tr>
<td>H</td>
<td>0.0183</td>
<td>ACCEPT</td>
<td>U</td>
</tr>
<tr>
<td>L</td>
<td>0.0575</td>
<td>ACCEPT</td>
<td>IW</td>
</tr>
<tr>
<td>M</td>
<td>0.0501</td>
<td>ACCEPT</td>
<td>AY</td>
</tr>
</tbody>
</table>

The frequency gathered from each calculated phoneme is compared with the acceptance value of 0.0023 for consonants in the 2-syllable word list, and 0.0015 for vowels and 0.0012 for consonants in the 3-syllable word list. With this criterion, the phonemes would be well represented by the concluded 3-syllable and 2-syllable Filipino Phonetically Balanced Word list.

Based on the frequency gathered, phonemes /m:, g:/, /iw/, /ey/, /uy/ were not well represented from the 2-syllable word list; while phonemes /iw/, /ey/, /oy/, and /uy/ from the 3-syllable word list.

4.2. Results of Filipino PBW

From the 20 basic phonemes of the Filipino language, 16 phonemes were added (10 long consonants, and 6 diphthongs). 5 phonemes were not represented in the 2-syllable word list (/m:, g:/, /iw/, /ey/, /uy/) since the frequencies of these phonemes are less than the acceptable value of 0.0023 for vowels, and 0.0018 for consonants. 4 phonemes were not represented in the 3-syllable word list (/m:, g:/, /iw/, /ey/, /uy/) which are less than the acceptable values of 0.0015 for vowels and 0.0012 for consonants. The total number of phonemes represented by the 3-syllable word list is 214, and 261 for the 2-syllable word list. Since the words with the unrepresented phonemes were removed, four (4) words from the 2-syllable word list, and two (2) words from the 3-syllable words were removed. Thus, the final list for the phonetically balanced word list for the Filipino Language will be 257 for 2-syllable words, and 212 for 3-syllable words.
Table 13: Word count for the 3-syllable and 2-syllable list with the number of represented phonemes

<table>
<thead>
<tr>
<th></th>
<th>List 1 3-syllable word list</th>
<th>List 2 2-syllable word list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemes represented</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>Number of words per list</td>
<td>212</td>
<td>257</td>
</tr>
</tbody>
</table>

5. CONCLUSION

Filipino vowel phonemes were tested using continuous density HMM and MFCC for feature extraction, having a result of 94.5 accuracy rate for dependent speakers and 90.8 accuracy rate for independent speakers. The results obtained from the independent speakers were less than the results obtained from the dependent speakers since these were not common to the training data.

The development of Filipino Phonetically Balanced Words produced 257 words for the 2-syllable Filipino PBW List, and 212 words for the 3-syllable Filipino PBW List. These words are to be used for the future development of a large vocabulary speech recognizer of Filipino words using the Continuous Density Speech Recognition. Further development of the phonetically balanced word list would be applied after including 3 additional textbooks from the Bagwis series used in the 1st to 3rd year of Public High Schools.

6. REFERENCES

ABSTRACT: Smart antenna networks are receiving a lot of interest in these days, as new advanced and fast processors are being developed. Capable of pointing the main beam in a certain desired direction and create nulls in the radiation pattern in the direction of interference, smart antenna networks are a good solution in a bandwidth limited environment as the number of users continuously grow. This technique is called beamforming. For many years smart antennas were not practical as they involve the use of a processor that runs an adaptive algorithm. Slow processors meant low speed of convergence and a slow adaptation. There are a lot of adaptive algorithms that can fulfill the job that a smart antenna system has to accomplish. The main purpose of this paper is however to present the main advantages of creating a MATLAB GUI (Graphical User Interface) in order to study these algorithms. The GUI described studies 62 adaptive algorithms, some described in literature, some propose by the authors. We will make a short description of the LMS (Least Mean Squares Algorithm), the APA (Affine Projection Algorithm) and the GASSAPA (Gradient Adaptive Scalar Step Size Affine Projection Algorithm) and compare them with the use of the graphical interface.

Key words: smart antenna networks, adaptive algorithms, beamforming, MATLAB GUI, LMS< GUI, GASSAPA

1. INTRODUCTION

Beamforming is not a new field of research. There is a lot of theory and also some implementations but real, useful practical applications are just starting to make their way into the communications environment. With the help of this technology, the adaptive antenna system increases the cell-edge and the link budget, increases overall network capacity and of course manages interference. An adaptive antenna system performs best however in a low-density, highly-scattered application scenario as is the case of rural areas. Here it helps reduce the number of cell-sites required. This is a gain for the operators as they can reduce the infrastructure costs.

Many adaptive algorithms have been developed and studied and there is a large amount of literature that details their performance. In this paper we took the mathematical theory behind some of these algorithms and transpose it to MATLAB.

There are two main classes of adaptive algorithms. There are the blind equalization algorithms that use a training sequence in order to reach convergence and there are the no blind equalization algorithms that reach convergence without the need of a training sequence.

We are interested in a few but vital things when it comes to using such an algorithm. First we look at the precision with which it reaches the adaptation stage and its stability once this stage is reached. Also another important property is the speed with which it reaches convergence. Another essential characteristic of such an algorithm that has to be taken into consideration is its behaviour in a noisy environment [1].

The algorithms described in literature have advantages and disadvantages depending on the references taken when decided to compare them with each other. Some of them behave better in some situations, other behave better in other situations. All of them have pluses and minuses. By simulating these algorithms and plotting the results we can compare them and decide which is best suited for a certain situation.

The GUI is a useful tool with the help of which a student can evaluate the performance of his work in an organized matter and can present the results obtained in a fast and elegant way. A teacher can also present to the student the practical aspect of mathematics by giving complex formulas a visual representation. By creating a friendly GUI the teacher can make theory more interesting to the student as he sees the results and the importance of mathematics.

MATLAB has the possibility to create such interfaces with a certain degree of ease. This MATLAB feature comes in handy especially when a mathematician needs to evaluate the performance of different algorithms designed to fulfill a certain purpose.

1.1. The principles of Beamforming

Adaptive filtering is more and more present in communications systems nowadays. It helps to improve the performance of these systems by using complex signal processing techniques. The idea of adaptive filtering also became interesting to the antenna design field. The tap weights update filter is in this case represented by an antenna array with multiple elements. The basic idea is that in an environment with multiple signal sources some of these signals interfere with others. Much of the engineers’ interest in communications is to differ between.

In our simulations we consider a linear antenna array and a signal source in the far field. The wave front that arrives at the antenna array will be planar in this case. We also take into consideration the presumption that the propagation medium is homogeneous. The array is made up of Omni-directional elements. In the ideal case of non-dispersive propagation and distortion less elements, the propagation from the source to the element is a matter of time delay [3].
The delay translates into phase difference, and this phase difference can be manipulated in order to point the main lobe of the radiation pattern toward the signal source. It is also possible to create nulls in the radiation pattern in the direction of interfering signals. This is done with the help of an adaptive algorithm.

As we can see in figure 1, the origin of the coordinate system is the time reference. The time in which a signal from source $k$ in direction $(\phi_k, \theta_k)$, measured from element $l$ to the origin, arrives at the antenna array is given by the equation:

$$\tau_l(\phi_k, \theta_k) = \frac{\hat{v}(\phi_k, \theta_k) \cdot \mathbf{e}}{c}$$

where $\tau_l$ is the position vector for element $l$, $\hat{v}(\phi_k, \theta_k)$ is the unit vector in direction $(\phi_k, \theta_k)$ and $c$ is the propagation speed for the wave front. For a linear array with equally spaced elements along x axis, and $d$ the distance between them, the time is:

$$\tau_l(\theta_k) = \frac{d}{c} (l - 1) \cos \theta_k$$

When the signal source is situated somewhere perpendicular to the array’s axis, at an angle $\theta_k = 90^\circ$ from (2) it can be seen that $\tau_l(\theta_k) = 0$ for any of the elements $l$. We can conclude that the wave front reaches all the elements at the same time and the signals induced by source $k$ at all the elements of the array are equal. For $\theta_k = 0^\circ$, the wave front reaches element $l$ before it reaches the element in the origin of the coordinate system. The delay can be expressed as in the following equation:

$$\tau_l(\theta_k) = \frac{d}{c} (l - 1)$$

On the other hand, for $\theta_k = 180^\circ$, the delay becomes:

$$\tau_l(\theta_k) = -\frac{d}{c} (l - 1)$$

The minus sign in front of the equation is due to $\tau_l$. This quantity represents the propagation time in which the wave front travels the distance between element $l$ and the origin. The negative sign indicates the fact that the wave front gets to the origin before it gets to element $l$, and the signal induced at element $l$ reaches this element later than the one induced at the element in the origin.

2. ADAPTIVE ALGORITHMS

In order to understand how an adaptive algorithm works it is necessary to point out some of the equations that describe probably the simplest one of them, the LMS (Least Mean Square) algorithm. After that the basics of the APA (Affine Projection Algorithm) and the GASAPA (Gradient Adaptive Step Size Algorithm) will be described in order to make a comparison between them with the use of our GUI.

2.1. The LMS Algorithm

A signal source in a certain desired direction, a couple of interfering sources in other directions and the background noise are considered. For mathematical simplicity we consider a linear antenna array. The most commonly used way to distinguish the desired signal source from the other signal sources is to evaluate the mean square error [2]. As already said the main lobe of the radiation pattern can be pointed in a certain direction and nulls can be created in the direction of interfering signal sources. The study is considered for the reception case, but the same principles are true for emission. Small letters will be used to represent scalars and large letters to represent vectors. Consider the signals induced at the array elements:

$$x(0), x(1), x(2), ...$$

The LMS is a non blind adaptive algorithm so it uses a reference signal:

$$d(0), d(1), d(2), ...$$

The input signal vector is:

$$X(k) = [x(k), x(k-1), ..., x(k-N+1)]^T$$

The difference between the received signal and the reference signal represents the error:

$$e(k) = d(k) - y(k)$$

A set of weights is computed. The weights are multiplied with the input signal in order to better approximate the desired signal. The weights vector is:

$$W(k) = [w_0, w_1, ..., w_{N-1}]^T$$

The output signal is in this case:

$$y(k) = WH[k]X(k)$$

where $H$ is the Hermitian operator meaning the conjugate transpose.

The weights update equation is:

$$W(k + 1) = W(k) + \mu X(k)e^*(k)$$

where $\mu$ is the step size. It controls the speed of convergence and the stability of the algorithm. A higher value chosen for $\mu$ will make the algorithm converge faster but with poor stability at adaptations stage. Choosing a smaller value for $\mu$ a better stability is obtained, but the time necessary to reach convergence is higher.

2.2. The APA Algorithm

A better algorithm is the Affine Projection Algorithm. It is based on affine subspace projections [2]. It behaves better than LMS on noisy channels. If the error computed in case of the LMS is scalar, the error computed by the APA is a vector giving it a better evaluation perspective. The APA algorithm doesn’t operate with only one sequence of the input signal that arrives at the array. It operates with a matrix that consists of $P$ of this input vectors. The matrix containing the input signal vectors is:

$$X_P(k) = [X(k - 1), ..., X(k - P)]$$

The error vector is:

$$E(k) = D(k) - X_P^T(k)W(k)$$

The autocorrelation matrix of the input signal vectors is:
Finally, the weights update equation is:
\[ W(k+1) = W(k) + \mu X_p \phi^{-1}(k)E(k) \]  
(13)

There are many similarities with the LMS algorithm. The backbone of this algorithm is actually the LMS algorithm.

2.3. The GASSAPA Algorithm

An improved APA algorithm is the GASSAPA (Gradient Adaptive Scalar Step Size Algorithm). Like in the case of the VSSLMS (Variable Step Size Least Mean Squares) algorithm that improves the LMS algorithm by using a variable step size, the GASSAPA improves the APA algorithm by using a variable step size [2]. All the equations remain the same as for the APA algorithm. The only difference is that in the weights update equation the step size is not a constant any longer, it changes its value at every loop and it is computed recursively.

The weights update equation for the GASSAPA is:
\[ W(k+1) = W(k) + \mu(k)g(k) \]  
(14)

with:
\[ g(k) = H(k)E(k) \] and \[ H(k) = X_p \phi^{-1}(k) \]  
(15)

The recursive equations for the adaptive step size computation are:
\[ \mu(k+1) = \mu(k) + \delta \text{Re}[[\Phi^H(k)X(k)e^*(k)]H_{\text{max}}] \]  
(16)
\[ \Phi(k+1) = \Phi(k) + \mu(k)h(k)X^H(k)\Phi^H(k) + \mu(k) \]  
(17)

where \( h(k) \) is the first column of the matrix \( H(k) \).

In the equations describing the variable step size of the GASSAPA, the scalar error and also the signal input vector are used. The error vector and the input signal matrix is used in the weights update equation.

The step size is bounded to a minimum and also a maximum limit in order not to diverge. It is a good trade-off between speed of convergence and stability.

3. THE GUI AND SIMULATION RESULTS

3.1. Main features of the graphical user interface

As we can see in figure 2, on the left side of the GUI window we have a panel from where we can choose the algorithms we want to test. Regarding the dynamics of the simulation, we can choose between the case of a fixed signal source or a moving signal source.

![Figure 2. GUI used to simulate the Affine Projection Algorithm](image)

Each algorithm has different parameters. Just on the right hand side of the panel that contains the algorithms, as we choose an algorithm, the parameters that describe this algorithm will appear, parameters like numbers of iterations, step size, sliding window length and others.

We can choose the desired signal source’s direction, the Signal to Noise Ratio and the number of interference sources in case of the non-blind adaptive algorithms.

At the bottom of the GUI there are 2 panels. The first describes the antenna array’s structure like the number of elements, the frequency at which the system operates and the length between the elements of the array. In the second panel, the interference sources can be defined.

We use a figure in which the user can plot the radiation pattern either in Cartesian coordinates or polar coordinates, the adaptation error and the power level in dB.

The running time is also displayed. The running time is the time in which MATLAB does all the computations and plots the results.

The actual time is much less if we were to simulate the algorithms without the graphical representation which would happen in real applications. But for comparison purposes it provides a good reference.
Simulations and results

We chose to compare the APA with the GASSAPA. For simulations we chose a number of 50 iterations. For the APA we chose a step size \( \mu = 0.001 \) and for the GASSAPA we constrained the step size to the interval \( 0.001 < \mu < 0.01 \). The input signal matrix is made of a number of signal vectors which translates in our GUI as the sliding window. We chose a number of 20 input vectors in our simulations. The antenna array has 8 elements. The desired signal source is at 120 degrees. We considered three sources of interference, at 30 degrees, 80 degrees and 160 degrees.

The operating frequency is 5.8GHz, commonly used in wireless communications. The signal to noise ratio is low. We considered a 0dB value for it. As we can see the GUI is intuitive and easy to use.

Of course first of all, when you want to see the performance of an algorithm you need to study the mathematical equations that describe it in order to see what all the parameters represent. Some of the algorithms use many such kind of parameters. By comprehending their purpose and see the results obtained for the values chosen for them, one can even maybe find ways to improve on some.
As we can see from figures 2 and 3, the GASSAPA has a better performance. It is faster and more precise. Compared to the APA, the GASSAPA places the nulls better in the radiation pattern. The time in which the GASSAPA runs through the 50 iterations is smaller than the time it takes the APA although the first has slightly more computations to make. If we were to run the algorithms a couple of times we would see that this time is almost the same in both cases. Next we will see how the algorithms behave if the signal source is moving. The sources of interference remain in fixed positions.

Figure 5. GUI used to simulate the Affine Projection Algorithm in a dynamic environment

Figure 6. GUI used to simulate the GASS Affine Projection Algorithm in a dynamic environment
The same parameters were used as in the static case for both the algorithms. The principle of the dynamic case involves a signal source that travels from an angle, let’s say zero degrees to an angle of let’s say 180 degrees. As the source travels it is pretty obvious that we need to restart calculating the weights after a certain time window. So we zeroise all the weights and then compute them again.

The window and the number of iterations are chosen the same for both algorithms. From figures 5 and 6 we can denote that the algorithms have slightly similar performances. The GASSAPA is a little slower due to the computational complexity. As the signal source gets close to the direction of the interference source in case of the APA we can see that a secondary lobe is created alongside this direction.

It doesn’t have a high magnitude but it’s interference any way. In the case of the GASSAPA secondary lobes also appear when the desired signal source gets close to the direction of the interference source but in this case the secondary lobes are not in the direction of the interference signal source. So the interference is less than in the case of the APA.

4. ACKNOWLEDGEMENTS

We can conclude that the GUI is indeed useful. With its help we could study the two algorithms described and compare the results. So as to say the GASSAPA has indeed better performance at least when it comes to combat interference. The GASSAPA manages to better place nulls in the radiation pattern, and this is due to the fact that the variable step size parameter controls the speed of convergence.

The GASSAPA works better in the static case. If the signal source is moving however, the APA gives better results at tracking it. This is due to the fact that the GASSAPA is computationally more expensive. The nulls although, are still better placed in the radiation pattern in case of GASSAPA for the dynamic case, only that the algorithm is slower and can lose track of the signal if the source moves very fast.

Having this in mind we propose a future study in which to introduce a new parameter in the GUI to define the performance of the algorithms in the dynamic case. The idea is to convert the number of iterations and the sliding window length into degrees per second and obtain a speed parameter. With its help we can study at which speed the algorithms lose track of the signal in the dynamic case.

Looking at the practicality of such a graphical interface in the case presented, we can say that such a development could improve the learning process. Such an interface is figuratively speaking a teacher-student interface meant to ease the job of the teacher and also raise the student’s interest regarding a certain matter.

5. REFERENCES

NATIONAL CULTURE INNOVATION AND EDUCATION DEVELOPMENT
IS THE ORGANIZATIONAL CULTURE FAVORABLE TO TRAINING IN RESIDENCY FOR MEDICAL STUDENTS?

Carmen Daniela, Domnariu1 and Florentina Ligia, Furtunescu2
1 “Lucian Blaga” University of Sibiu, Faculty of Medicine “Victor Papilian”
2 University of Medicine and Pharmacy “Carol Davila” Bucharest, Faculty of Medicine

ABSTRACT: The long-lasting training in medicine (more than 10 years) is still an attraction for many excellent students. Most of the evaluation forms during this training are based on theoretical and practical skills. However, could we be sure that the organizational climate provides the most appropriate environment for study and career development? We did a survey on 22 young doctors, residents in public health and management and/or epidemiology aiming at evaluating the personal management style and the management style within the organization (Adizes questionnaires: “Personal Test” and “Task Demands”). The management styles described by Adizes - Producer – Administrator – Entrepreneur – Integrator - and their expression as primary or secondary style were analyzed. We found that the young residents generally have a powerful expression of producer and entrepreneur as personal style, but they tend to become administrators within the organization, mostly during their first years of training.

Key words: organizational culture, medical residency, management style, Adizes questionnaire

1. INTRODUCTION

Medicine is a particular profession in which the academic training in medicine has one of the longest durations (six years undergraduate plus three to seven years a postgraduate residency program in a medical specialization. So, nine to thirteen years are needed for ensuring the necessary clinical background for a physician. Most evaluations, during this long period, are focused on gained medical knowledge, both theoretical and practical. However, we often do not think about how appropriate the professional environment and the organizational culture are for stimulating the student creativity and enthusiastic commitment in accomplishing the organization goals.

The aim of this study was to assess the management styles in a group of young doctors as personal and task demand styles, in order to understand the influence of the organization culture on the career motivation for the young professionals.

2. METHODS

We did a cross-sectional survey in young doctors, residents in complementary specialties (public health and management, epidemiology, hygiene and medical ecology) in two medical universities from Romania. We used in parallel two questionnaires of Ichak Adizes : “Personal Test” and “Task Demands” (1). Both questionnaires are based on the PAEI management style defined by dr. Ichak Adizes a few decades ago (2).

The theory of dr. Adizes is based on the assumption that there are four roles of the management process: Producer (P), Administrator (A), Entrepreneur, (E) and Integrator (I). We are able to evaluate our PAEI personal style, but also our PAEI management style in relation to task demands. Knowing those two styles, we are able to better communicate with persons and to allocate the most appropriate tasks for them, in order to maximize their potential and creativity.

The Producer style (P) is characterised by high energy, dynamism and attraction for tangible results. These individuals are task oriented, very effective and always busy; they prefer to work rather than going to meetings and they are highly motivated to accomplish concrete goals. They dislike details, ambiguous or abstract situations. They have the know-how in their field of action, they are impatient, quick to make decisions, they know what is needed and how to do what is needed. They are less preoccupied by the rest of the team, preferring to work alone, because they have no time and patience to train the others. This can be a little unpleasant, but these persons are responsible for driving many organizational achievements (3-5).

The Administrator style (A) is characterised by attraction for rules and procedures. Usually, these individuals are well organised, quiet, and cautious to details. They are less concerned with what should be done and more focused on how the things should be done. They need to understand the processes and procedures before taking action, and they are able to generate new procedures and rules in order to improve the control. They are extremely uncomfortable with ambiguity and uncertainty. In organizational contexts, the administrators bring stability and order. They are systematic, slow, careful in decision-making and conservative (3-5).

The Entrepreneur style (E) is marked by generating ideas, establishing new goals and strategies. These individuals are creative, enthusiastic, willing to change and initiators for actions, often so called “risk takers” and “dreamers”. They have no time to consider the consequences of past actions or decisions, going in full speed ahead and being attracted by bigger potential achievements in the future. They are talkative and charismatic. Entrepreneurs scan permanently the environment for opportunities of developments in new directions.

The Integrator style (I) is focused on the group. Those persons are good listeners; they successfully manage the interpersonal relationships inside the organization and outside it. They are cautious to peoples’ needs, motivators and conflicts, trying to create harmony and consensus and to solve all conflicts. They are less concerned about formal roles and
titles, and more concerned about the people, following always the group.

Usually a person is able to act in all four styles, but we are natively strongest in only one of the four styles (6). We can learn to act in secondary style in adulthood and we can learn with much effort to act in a third style, but weakly. On another hand, an organization needs to combine individuals with all the four styles, being in this purpose very useful to understand primary style of the people.

The Adizes Personal Test questionnaire consists of 27 statements in pairs and responders are asked to choose the statement that is best characterising them. The PAEI profile is calculated from the addition of all responses from the vertical columns, each column representing a role.

The Adizes - Task Demands questionnaire reveals the demands of the job. There are 22 statements and responders are asked to choose a score from 1 to 4, where “1” indicates that the specific statement is really a demand in their job and “4” indicates the statement is not a demand in their job. The chosen score supposes to reflect as better as possible the appropriateness of the statement for each responder. The number of alternatives chosen in each column represents the specific score for the PAEI roles. The roles can be absent or expressed primary (P, A, E, I) or secondary (p, a, e, i), depending on the score obtained by each responder (Table 1).

Table 1. The PAEI styles expression in relation to the scores

<table>
<thead>
<tr>
<th>Score's value</th>
<th>Personal test</th>
<th>Style's expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2</td>
<td>&lt; 10</td>
<td>Absent</td>
</tr>
<tr>
<td>2 to 5</td>
<td>10 - 13</td>
<td>Secondary</td>
</tr>
<tr>
<td>6 +</td>
<td>14+</td>
<td>Primary</td>
</tr>
</tbody>
</table>

We compared the frequency of individuals’ styles expression in both questionnaires, being particularly interested in individual styles. Generally, the PAEI roles can be used for analyzing the organization profile, based on the contingency theory (6). According to this, an organization is expected to have similar stages of development to humans, starting to Courthip (pAEI), Infant stage (Paei), Go-Go (PaEi), Adolescence (pAEI) and Prime (PAEI) and eventually passing in the middle age as Stable organization (PAeI) or going to Aristocracy (pAeI) or Bankrupt Aristocracy (pA-I).

Our target population was represented by resident physicians following their medical stages in departments of public health from two faculties of medicine from Romania. Beside the Adizes questionnaires, we collected also demographic variables (age, gender, specialty, year of study) and variables related to career satisfaction and personal future plans (Are they are happy with the specialty?; Do they intend to finish this specialty?; Do they intend to remain in the country?). For the first question, a Likert scale from 1 to 10 was used (1 represented the lowest level of satisfaction) and for the other two, we collected binary answers (yes/no). Data collection took place during February – April 2012. The study was performed in full respect of informed consent and confidentiality of personal data.

Statistical analysis: scale variables were analysed as means ± SD. Qualitative variables were presented as proportions. We calculated the relative frequency of expression in each style, in both circumstances (as personal style and as task demand style). Comparisons by gender, specialty, year of study and career satisfaction were done using t-student test or one-way ANOVA for scale variables and Chi² or Fischer test, as appropriate, for qualitative variables.

3. RESULTS

We included 22 responders, among which 5 were males. The proportion is similar to male: female ratio in medical students. Mean age was 28.68±2.255 years (very homogenous case series, coefficient of variation less than 10%) (fig. 1). No statistical difference among genders in mean age was found (t-student test, normal distribution for age). Most of them were residents in public health and most were in the first two years of residency (Table 2).

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Public health</th>
<th>Epidemiology</th>
<th>Hygiene</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>15</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>68.2</td>
<td>18.2</td>
<td>13.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year of study</th>
<th>first</th>
<th>second</th>
<th>last (3rd or 4th)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>7</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>%</td>
<td>31.8</td>
<td>40.9</td>
<td>27.2</td>
</tr>
</tbody>
</table>

Figure 1. Age distribution.

Figure 2. Distribution of score of satisfaction in relation to professional career.
18 subjects were in their first residency, but 4 were at the second specialization. The mean level of satisfaction related to professional career reached to 6.50±2.345 (range 2 to 9), with no difference among genders (fig. 2).

Differences in satisfaction were found by specialty and year of study (one-way ANOVA). A significantly higher mean score was found for public health specialty (7.60 compared to 4.00 and 4.33 for epidemiology and hygiene respectively). No difference in scores for the last two specialities (equal variances, Bonferroni test). Also, significant higher scores were found in the last years of study compared to the first two years (not-equal variances, Tamhane T2 test). No difference was found between the first and second year of residency and also between the third and the fourth (public health is four year lasting and epidemiology and hygiene three years).

Generally, among two thirds of residents (15/22) wish to finish the current specialty, especially those from third and fourth year of study. More than half of the subjects wish to practice abroad (12/22), with no difference by year of study.

Most frequent profile related to task demand was pAeI (5/22), followed by pAei (4/22).

Most frequent profile related to personal management style was P0EI (5/22), followed by paeI (4/22).

Majority of subjects had two styles primary expressed both as personal styles and as task demand style (fig. 3).

We noticed so far that people tended to be mostly integrators, producers and entrepreneurs as their personal style, but they become mostly administrators in organizations.

Each style’s expression was assessed in parallel from personal and task demand perspective (fig. 4 – 7)

**Figure 3. Subjects’ distribution according to number of styles primary expressed**

Most frequent style primary expressed in relation to task demand was (A) (16/22), followed by (E) and (I) equally (10/22). The (P) was primary expressed only in three subjects.

**Figure 4. Producer (P) style**

Most frequent style primary expressed in personal test was (I) (15/22), followed by (P) (13/22) and (E) (12/22) and the last was (A) (3/22).

**Figure 5. Administrator style (A)**

**Figure 6. Entrepreneur (E) style**

**Figure 7. Integrator (I) style**

Using the Personal Test, (P) was found expressed primary and secondary in 13, respectively 9 subjects. In relation to task demand, this role remained primary expressed only in three subjects, but in 15 and 4 was secondary expresses and respectively absent (Fig. 4).

The (A) was found primarily expressed as personal style only in 3 subjects, but secondarily expressed or absent in 11 and 8 respectively. In relation to task demand, 16 subjects were found (A) and (6) respectively (Fig. 5).

The (E) was found primarily and secondarily expressed in 12 and 10 subjects as personal style and remained expressed
...primary in 10 subjects (secondary style and absent in 11 and 1 respectively) in relation to task demand (fig. 6).

The (I) was primarily and secondarily expressed in 15 and 7 subjects as personal style and remained primarily expressed in 10 subjects in relation to task demand.

The situation was similar by year of study (due to the restraint number of subjects we grouped the first two years and the last two years) and by intention to leave the country (Table 3, 4).

**Table 3. Style expression by year of study**

<table>
<thead>
<tr>
<th>Year of study/style</th>
<th>Task Demand</th>
<th>Personal Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I, II</td>
<td>III, IV</td>
</tr>
<tr>
<td>P</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>p, 0</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>A</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>a, 0</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>e</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>i, 0</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

**Table 4. Style’s expression by willing to leave the country**

<table>
<thead>
<tr>
<th>Remaining in Romania</th>
<th>Task Demand</th>
<th>Personal Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>P</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>p, 0</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>a, 0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>e, 0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>I</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>i, 0</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Following both criteria (year of study and willingness to practice in Romania), we found decreasing in expression of productivity in relation to task demand, compared to the personal management style.

We also found increasing in administration focus in relation to task demand, maintaining of the entrepreneur role and small decreasing in integrator role.

4. DISCUSSION

Our study is a pilot exploration of the personal management style compared to task demand in a small population of young residents in three medical specialties complementary to the clinical practice. Most of our subjects were females (this is a general structure by gender in physicians’ population in Romania), with a fair level of satisfaction in relation to their professional career (mean satisfaction score of 6.5 on a Likert scale from 1 to 10). Half of them would like to practice abroad.

We were interested only about the persons’ style, and not about the organization style, because the residents usually follow successive practical stages (duration six months - one year) in different organizations. Most frequent profiles found in our study were pAeI and pAei in relation to task demand and pOEI and paeI as personal style.

The producer style was much better expressed primarily in the personal test and tended to become secondarily expressed in relation to task demand. This could mean that the young doctors are natively preoccupied about achieving concrete results, but inside the health organizations they switch to pay attention to rules and procedures.

This hypothesis is sustained by the expression of the administrator style that increased substantially as primary expression in relation to task demand compared to personal test (16 and 3 respectively).

The entrepreneur style was quite constantly represented as primary style both as personal style and in relation to task demand. This could be interpreted as a stimulating professional environment, which keeps the residents active and willing to look for opportunities, to generate ideas and to promote the changing.

The integrative capacity seemed to be well represented as personal role and also adequately maintained within the organization. This is a favourable finding because the medical professions are recognised as very individualistic. So, encouraging the focus on the group is an appropriate way to promote team work, learning from experience and personal exchanges.

Our main goal was to understand the native abilities of the young professional and behaviour in organizations, based on the assumption that a better knowledge of their management style could help us to a more appropriate task-allocation. An additional result was the high focus on administration in relation to task demand. This result needs further exploration in order to understand the environment factors leading to this issue and possible to change them on medium term.

5. REFERENCES

1. European Institute Denmark – Property of Adizes
   Questionnaires Adizes / Task Demands, Adizes/Personal Test
ABSTRACT: Based on the situational leadership theory (Hersey&Blanchard), our study aimed to analyze the leadership style in managers of different health facilities from Romania.

We included 41 persons with key positions (general manager, medical director, chief of section/department, nursing director, chief – nurse). All these persons filled the LEADself questionnaire (Leader Effectiveness and Adaptability Description Instrument, Center for Leadership Studies, Hersey and Blanchard). The tool measures three dimensions: the dominant (and secondary) leadership style, the style range (flexibility) and the style adaptability (the leader effectiveness).

We found a dominance of ”Selling/Coaching” style, followed by the “Telling/directing” style. The managers were found to have a high relationship supportive behavior. Only three cases of low relationship dominance were found. Also almost all the managers were found as mostly group centered (only 5 cases were more leader centered). The flexibility of the managers was high, only one persons having the style range<2; the effectiveness score varied from 12 o 25, most of the responders having a low or moderate level of adaptability.

Key words: leadership style, health organizations, LEADself questionnaire

1. INTRODUCTION

The health system from Romania is facing different stages of reform since more than two decades, without visible increasing in satisfaction for patients and medical staff. During these multiple interventions for reforming the health system, the managers of the public providers of medical services are often replaced upon variable criteria of performance, that usually measure processes. The new managers need to rapidly adapt to the organizations’ culture and to the staff values. In this context our study aimed to describe the leadership style in managers from different public providers of health services from Romania.

2. METHODS

A cross-sectional survey was performed, based on the Hersey – Blanchard Situational Leadership (HBSL) model. This model was developed in relation to Theory of Situational Leadership, of Paul Hersey and Ken Blanchard, according to which a manager can vary his leadership style depending on the employees’ needs (1-3). The employees can have variable level of commitment and motivation and also variable level of professional experience. The manager will choose his leadership style in relation to two parameters: the task behaviour (extent to which he is likely to define roles for the staff) and relationship behaviour (extent to which he is likely to maintain relationship with the staff members). The task behaviour is influenced by staff’s level of competence. More task-oriented is the manager, more detailed and specific instruction he will give to the staff. A high level of communication with the staff characterises a more relationship oriented manager; that will provide emotional and psychological support to the employees.

Four leadership styles were described – Directing, Coaching, Supporting and Delegating (fig. 1) (1-3).
The **delegating style** (S4) is characterised by less focus both on relationship and tasks, because the leaders passed most of the responsibility to the team.

The leadership style is influenced by the maturity of the team, each style corresponding to a specific level of readiness to fulfill the task. S1 is more appropriate to immature teams, with lack of knowledge and confidence and S2 is appropriate for teams with lack of knowledge and skills, but willing to fulfill the task. S3 is appropriate for skilled teams, but not confident in their potential and S4 is appropriate for teams strongly skilled and highly committed to achieve their goal. There is no good or wrong style and there is no one style optimal to be used all the time. Usually the leaders must adapt their style according to the situation and to the team.

In our study we used the LEAD self questionnaire (Leader Effectiveness and Adaptability Description), developed by the Center for Leadership Studies (4).

The questionnaire exposes twelve situations, each with four alternatives. The responders are asked to choose the alternative which they consider more closed to their personality (no the correct or desirable alternative). The instrument is able to evaluate the following dimensions:

a. The leadership profile of the leader, upon his own perception. The respondent can find his primary (most used) and/or secondary (back-up) leadership style.

b. the style range or flexibility – referring to how flexible the leader is in varying the types of behaviour when attempting to influence others. Three or more responses in a quadrant indicate a high degree of flexibility, two responses a moderate one and only one response in a quadrant is not statistically significant (difficult to predict flexibility).

c. the leadership style adaptability score (leader effectiveness) - degree to which they are able to use the appropriate style in various situations.

**Target population**

We included in our study physicians with managerial responsibilities in public medical units (hospitals, ambulatory units or family practices). Sample selection was done using snow-ball method. Responders were asked to fill the LEADSelf questionnaire. Additional demographic data were collected (age, gender, specialty, academic involvement, type of medical provider)

Selected variables: we followed the leader profile, the adaptability and flexibility. The leadership styles were analysed by gender, age-group (young, middle-aged and seniors), type of unit and academic involvement.

**Statistical analysis**

Scale variables were presented as mean ± standard deviation. Nominal variables were presented as proportions. Comparisons were done using T-student test or nonparametric tests.

Data were analysed using SPSS v. 17.0 software.

**3. RESULTS**

We found 41 responders willing to be involved in our study, 58.5% among them being males. The mean age was of 44.78±6.814 years (median 44 years). Mean age tempted to be higher in females (46.06, compared to 43.88 years in males), but no statistical significance was found (fig. 2).

![Figure 2. Age distribution by gender](image)

Almost half of the responders worked in hospitals (48.8%), but some worked as family doctors (31.7%) or in ambulatory units (19.5%).

The responders working in family practices were specialised in family medicine, but the responders working in ambulatory or hospital units had other clinical specialties, most of them from the “medical” group (we had only 5 surgeons). Around a quarter from the responders (10) had academic involvement at the medical university.

![Figure 3. Frequency of primary style](image)
Table 1. Relative frequency of primary styles by study criteria

<table>
<thead>
<tr>
<th></th>
<th>S1 (%)</th>
<th>S2 (%)</th>
<th>S3 (%)</th>
<th>S2+S3 (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>20.8</td>
<td>66.7</td>
<td>4.2</td>
<td>8.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Females</td>
<td>17.6</td>
<td>58.8</td>
<td>11.8</td>
<td>11.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Age category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>27.3</td>
<td>63.6</td>
<td>0.0</td>
<td>9.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Middle-aged</td>
<td>13.6</td>
<td>68.2</td>
<td>9.1</td>
<td>9.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Seniors</td>
<td>25.0</td>
<td>50.0</td>
<td>12.5</td>
<td>12.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Type of unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family practice</td>
<td>7.7</td>
<td>76.9</td>
<td>7.7</td>
<td>7.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Ambulatory</td>
<td>37.5</td>
<td>50.0</td>
<td>0.0</td>
<td>12.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Hospital</td>
<td>20.0</td>
<td>60.0</td>
<td>10.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Academic involvement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>12.9</td>
<td>67.7</td>
<td>9.7</td>
<td>9.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Yes</td>
<td>40.0</td>
<td>50.0</td>
<td>0.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The most frequent secondary style was S3, followed by S1 (fig. 4).

Most frequent profiles (primary – secondary style) were S2 – S3 (13 subjects) and S2 – S1 (11 subjects).

The style’s range varies from 1 to 4, half of the responders having moderate flexibility (n=20 subjects) and half a high one (fig. 5). Only one responder had the style range <2. No difference was found by gender, age-category, type of unit or academic involvement.

Table 2. Relative frequency of secondary styles by study criteria

<table>
<thead>
<tr>
<th></th>
<th>S1 (%)</th>
<th>S2 (%)</th>
<th>S3 (%)</th>
<th>S4 (%)</th>
<th>Combined (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>33.3</td>
<td>20.8</td>
<td>25.0</td>
<td>4.2</td>
<td>16.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Females</td>
<td>17.6</td>
<td>17.6</td>
<td>52.9</td>
<td>0.0</td>
<td>11.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Age category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>27.3</td>
<td>27.3</td>
<td>27.3</td>
<td>0.0</td>
<td>18.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Middle-aged</td>
<td>27.3</td>
<td>9.1</td>
<td>40.9</td>
<td>4.6</td>
<td>18.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Seniors</td>
<td>25.0</td>
<td>37.5</td>
<td>37.5</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Type of unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family practice</td>
<td>30.8</td>
<td>0.0</td>
<td>46.2</td>
<td>0.0</td>
<td>23.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Ambulatory</td>
<td>0.0</td>
<td>37.5</td>
<td>50.0</td>
<td>12.5</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Hospital</td>
<td>35.0</td>
<td>25.0</td>
<td>25.0</td>
<td>0.0</td>
<td>15.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Academic involvement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>29.0</td>
<td>16.1</td>
<td>35.5</td>
<td>3.2</td>
<td>16.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Yes</td>
<td>20.0</td>
<td>30.0</td>
<td>40.0</td>
<td>0.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

This distribution was somehow similar by study variables (Table 2). However, the limited number of subjects didn’t allow us to conclude on the statistical significance.
4. DISCUSSION

Our study aimed to evaluate the leadership profile for managers of public providers of health services. We included managers from family practices, ambulatories, and hospitals. Most frequent primary style was S2 (Coaching/selling), which is highly task oriented and also supportive and appropriate for teams that are not very well prepared professionally, but willing to accomplish the tasks. This style was the most common in more than a half of the responders. It was found as most frequent in all types of medical providers and didn’t vary by gender, age category, and academic involvement. Second most common was S1 (Directing/telling). No cases with S4 style primary expressed were found, possibly because the managers didn’t meet apparently very experienced teams. This is, however, the self perception of the managers, but all of them had the managerial position since less than two years (except the family doctors) so it is also possible for them not to understand completely the level of commitment for the team.

The secondary style was S3, followed by S1 approximately with the same frequency. So basically we found two categories of managers. The S2 - S3 managers are able to work well with people with appropriate level of readiness, but the face problems in working with people with low level of task maturity. The S2 - S1 managers are able to work with teams with low level of readiness, but they may be less-performing in the supportive behaviour.

The moderate or high level of flexibility showed that the managers are able to adapt to the team which is some-how

The low or moderate level of adaptability (leaders’ effectiveness) showed a reduced capacity to adapt to situations. More effort is needed more effort being needed to vary use of alternate leadership styles. Leaders with high adaptability are more likely to be successful compared to those with a low adaptability score (6). So additional training in situational leadership may be needed in order to improve the adaptability scores.

Our results are consistent to other studies, showing the predominance of S2 in different managers and low levels of adaptability (6-8).

The leadership profile in our study seemed not to vary by gender, age category, type of unit or academic involvement. However, one major limitation of our study was the small number of subjects, and consequently the limited generalizability. Another limitation is the translation of the questionnaire, which was done in the frame of a project, but the Romanian form was not assessed for content validity. The similarity of our results to other international studies allows us to conclude that LEAD Self questionnaire - Romanian version is an appropriate tool to evaluate the leadership profile.

This study was just a research attempt to evaluate the managers form health units upon other criteria than quantitative performance (eg. resources, processes and outputs of the health unit). It may be useful in identifying the most appropriate manager to the team characteristics. However, high skills are required in interpreting the leadership profile, and this may be a limitation of use in practice of such tools.

5. REFERENCES

7. Leadership Development for Program Directors
INTEGRATION THROUGH QUALIFICATION

Grünwald, Norbert¹ and Postler, Gregor M.A.²
1 Wismar University, norbert.gruenwald@hs-wismar.de
2 Wismar University, gregor.postler@hs-wismar.de

ABSTRACT: Foreign students are an asset to our university and our society. They bring a wealth of experience and resources such as openness to foreign cultures, great motivation to acquire a successful degree in Germany, language skills and creativity. The 1957 in Newark born and not uncontroversial economist and Professor Richard Florida speaks in this context of the "creative class" and sees a connection between the economic strength of a region and the diversity of its population.

Key words: creative class, interculturality, labour market, foreign students

1. THE NATIONWIDE NETWORK OF “INTEGRATION THROUGH QUALIFICATION”

Germany is home to approx. 16 million people with an immigrant background - about 20% of the total population [1]. Migrants are affected twice as much by unemployment as locals.

It is no wonder that more and more immigrants take the plunge into self-employment.

While in the traditional immigration countries, the U.S. and Canada "Immigrant Business" has always attracted great interest in politics and science, the subject is gradually gaining attention in Germany.

Consequently, there is a lack of research - at least in some areas - and the following statistics should be treated with caution.

The number of companies has increased since the 70s from about 70 000 to more than 620 000 in 2010 [2].

The proportion of the self-employed among the immigrants was, in 2009, according to the KfW Start-up Monitor - for the first time higher than among the Germans.

In 2009, of 870 000 start-ups, 170 000 were made by people with foreign passports [3].

That is, companies run by people with an immigrant background have become an important economic factor.

According to a study by the Institute for Turkish Studies in Essen, the Turkish self-employed alone generate sales of approximately 30 billion euros per year [4].

Self-employed persons with an immigrant background have created according to a report by the Federal Government, two million jobs in this country, this means: every twentieth place.

Behind the self-employment rate lies a heterogeneous mix - not only kebab stands and greengrocers!

However, they are also, through various obstacles, threatened by failure in the market.

To improve labour market integration of these people, the federal government has launched the nationwide network "Integration through Qualification", which is funded by the Federal Ministry of Labour and Social Affairs, the Federal Ministry of Education and Research and the Federal Employment Agency.

The network operates in the following 5 areas of action:
1. Recognition of professional qualifications obtained abroad.
2. Vocationally oriented German.
3. Diversity Management - Strategies for dealing with diversity of Germany's society, for greater diversity in public administration and business.
4. Entrepreneurship - particularly accompanying of start-ups.
5. Qualification - especially improving access to training opportunities.

2. REGIONAL CONDITIONS IN MECKLENBURG-VORPOMMERN

Approximately 1.64 Mio. people live in Mecklenburg-Vorpommern according to statistical State Office [5].
Mecklenburg-Vorpommern is in terms of the number of inhabitants the third smallest state, but in terms of the surface area the sixth largest! Foreigners make up about 1.8%, the proportion of people with an immigrant background is about 4.6%. Unemployment of people with immigrant backgrounds in MV is sometimes more than twice as high as that of the locals.

In addition, Mecklenburg-Vorpommern is strongly affected by demographic change. To combat the shortage of professionals, it is imperative to utilize the potential of all effectively.


3. OUR PROJECT “SCIENCE MEETS INTERCULTURALITY”

Foreign students are an asset to our university and our society. They bring a wealth of experience and resources such as openness to foreign cultures, great motivation to acquire a successful degree in Germany, language skills and creativity. The 1957 in Newark born and not uncontroversial economist and Professor Richard Florida speaks in this context of the “creative class” and sees a connection between the economic strength of a region and the diversity of its population. Through foreign students we have the opportunity to come into contact with other cultures, learn about different approaches to problems, but also the possibility to work internationally and to remain competitive.

The University of Wismar is connected as an international university in a particular way to their region and the state of Mecklenburg-Vorpommern, and is characterized by its useful orientation and proximity to businesses, associations and regional chambers of various actors in the labor market. In the winter semester 2011/12 - 535 foreign students from more than 70 countries studied at the HSW [6].

But now let’s talk about the tasks of our sub project “Science meets Interculturality”.

The tasks are:

1. Firstiy, public and specifically company awareness of the theme: “Labour market integration of people with MB”
2. Implementation of intercultural trainings
3. Accompanying research:
4. For example the survey of international students at the HSW

Below I will briefly introduce some examples of how the project objectives will be implemented.

To 1:
For example, the issue of "raising awareness of labor market integration of people with a migration background" was successfully aired at the 5th Business-Contact-Fair of Wismar University on 26/04/2012. The Integration Commissioner of Wismar reproached interested foreign students with a paper on labour law regulations for students and graduates. Exhibiting companies held individual meetings to discuss the grant program and its goals, as well as recent developments. Furthermore, the topic is being aired at high-profile events, for example through a stall at the MVpreneurDay on 23.05.2012 and on university networks, in person by the economic transfer officer and through research projects with industry, it is conveyed to companies.

Figure 2. 5th Business-Contact-Fair of Wismar University on 26/04/2012

To 2:
In the summer term 2012 2 intercultural training courses for university staff and students have already been designed, organized and implemented. The first, very successful exercise, took place on April 13 at the Department of Maritime with 10 participants. The second aimed exclusively at employees on the university campus in Wismar, where the access to the employees turned out to be more difficult and the offer has yet to be established. In the winter term 2012/2013, two further intercultural training courses are already scheduled.

Figure 3. Intercultural Training on 13/04/2012

To 3:
In the winter semester 2011/2012, a survey of foreign students was conducted, which was evaluated in February. The analysis was supplemented with solutions to specific problems and concrete recommendations. Of 535 foreign students 54 took part in the survey.

The survey with a total of 32 questions was divided into five sections:

1. Personal information (for example: origin, semester, language skills, and so on);
2. Preparation for study (for example: Why did you apply to the University of Wismar? Were you assisted in the search for accommodation? and so on)
3. While studying (for example: What content and organisational information have you received from the University of Wismar? Did you attend an orientation session? How do you cover your living expenses while studying? and so on)
4. Personal plan for the time after graduation (for example: Can you imagine, after studying in Germany, working here? If yes, what obstacles do you see? and so on);
5. Own comments and suggestions

For the project "Science meets interculturality" we were interested mainly in the questions of section four. 46 of 54 participants responded to the question: Can you imagine, after studying in Germany, working here? 80% of them answered yes and 20% no. The free text question: If yes, what obstacles do you see? Was answered as follows:

- 12 Months is not enough time to find a job in Germany.
- Language problems
- Discrimination,
- Problems with the formalities

To the question: For what topics you would like to have further information before taking up a job in Germany? The Participants responded mainly with: “questions on labor law” and “careers service” (such as “application folders coaching”, and so on)

In Section five ‘own comments and suggestions’ the foreign students desired more learning groups and project work with German students. These are just a few examples from the survey.

If somebody is interested in individual results, I am ready to follow up discussions.

4. CONCLUSION

As demonstrated above, people with a migration background are an asset to our society and therefore our economy due to their wealth of experience and resources. The University of Wismar, therefore, will be heavily involved internationally in future. In addition, the Robert Schmidt Institute of the University of Wismar is expected from January 2013 to offer a special care and counseling service for foreign graduates. Furthermore, a contact platform for local and foreign students is being planned. Native Students and university staff will be
working as a kind of mentor to the foreign students to facilitate orientation on the university campus and in their host country.

5. REFERENCES

2. „selbstständig, Interkulturell, erfolgreich.“ – Institut für Sozialpädagogische Forschung Mainz e.V., Mainz 2011
6. http://www.hs-wismar.de/was/hochschule/profil/zahlen-fakten/, Stand: 02.05.2012
8. Hochschule Wismar: http://www.hs-wismar.de/was/hochschule/profil/zahlen-fakten/, (02/05/2012)
9. Institut für sozialpädagogische Forschung Mainz e.V., Selbstständig, Interkulturell, Erfolgreich, Mainz, (2011)
10. IQ-Netzwerk: http://www.netzwerk-iq.de, (02/05/2012)
16. Light, Ivan Hubert, Ethnic Enterprise in America, University of California Press, (1972)
THE ROLE OF THE WORK FORCE SKILLS IN INNOVATION PROCESS IN A FLEXICURITY CULTURE – THE ROMANIAN CASE STUDY

Daniela, Pasnicu¹ and Gabriela, Tudose²
1 Spiru Haret University and National Scientific Research Institute for Labour and Social Protection, Bucharest, daniela.pasnicu@spiruharet.ro, danielpasnicu@incsmps.ro
2 National Scientific Research Institute for Labour and Social Protection, Bucharest, gabriela_tudose@yahoo.com, tudose@incsmps.ro

ABSTRACT: In the context of flexicurity, lifelong learning is essential in keeping people in employment. It is important because it ensures initial good quality education, key skills and a good as possible correspondence between new skills and better jobs. The increased flexibility of labour market, due to the need of its adaptability to the new challenges and increased competitiveness, must be balanced by instant flexible lifelong learning programs, which promote innovation and creativity (learning by doing and learning by using). The article defines innovation and skills, investigates the role of labor market skills in the innovation process, describes and quantifies the diversity of skills and occupations involved in specific types of innovation activity. Having in mind Romanian’s low public funding compared to the EU States, the principles of the innovation policy and main directions of action are established in order to promote innovation.

Key words: work force skills, innovation, flexicurity, lifelong learning

1. INTRODUCTION

We consider the study useful and timely, given the need for further adaptation of the Romanian labour market to the "permanent white water" [1], more exactly: increased competitiveness, dynamic of markets, the use of new technologies, increased volume of information, job insecurity, labour market volatility etc. These processes, that are difficult to control, appeared in the context of the intensification of globalization, rising unemployment and the occurrence of prolonged economic crisis. Adapting the labour market to this challenges requires flexible labor market and employment security, in which lifelong learning has a primary role. The next period will be characterized by the growth of the dynamic of markets and companies’ quest for innovative, well trained staff who will contribute to the timely completion of projects, which are also adapted to fluctuating market: sharp increase in production, orders and circumstantial contingencies. In the new context, competitiveness is not something optional, it’s the admission price on the playing field. In order to balance these challenges, we must look for another answer that will lead to the growth of adaptability of the labour market, especially Romania’s labour market.

The solution found by academics and scientists to this challenge was the concept of flexicurity. The idea of this strategy is based on the fundamental idea that the two dimensions of flexibility and security are not contradictory, but support each other. The concept has been widely debated and interpreted differently by social partners. There are several definitions, among which, as a political strategy [8] or as a multidimensional concept [9]. Therefore, adapting to new changes, requires a more flexible labour market combined with levels of security, addressing to the new needs of employees and employers. People's confidence in future employment opportunities, human capital, decent work and labor market development needs urgently to be strengthened. At the same time, companies require an appropriate business climate and a transparent, legal framework, in order to increase business potential and create new jobs. Security relates to modern security systems, as well as training opportunities for all workers, especially those with low skills and older workers, to help them enhance skills and achieve upward mobility. In conclusion, the new interaction between flexibility and security ought to focus on obtaining results such as “win-win” (advantageous for both employers and employees). Moreover, it should not be perceived traditionally as a conflict of interest, or a monopole of the labour market, but rather as a benefit for both employers and employees [4].

2. ROLE OF SKILLS IN INNOVATION

Innovation has now become a decisive factor in economic development. As a consequence, the innovative skills of the labour force have become a key factor. In order for companies to adapt quickly and successfully to the new challenges, innovative employees need to be united for the same purpose.

In general, there is a strong bond between the increasing demand for high levels of education (training and skills) and the supply of technical and organizational innovation. Technical reviews have shown that the investments in equipment, innovation and human capital are generally complementary and mutually reinforcing. The demand for higher and higher skills is also determined by the increasing intensity of competition, which has changed the strategy of many companies across the diversified production of quality.

On the other hand, in developing and disseminating technical and organizational innovations, an important role is played by non-S&T workforce (non-science and technology workforce).

In specialized literature there are many definitions of the concept of "skill", but there is no generally accepted definition "the notion of "skill" has been one of the most elusive and hardest to define concepts in labor economics” [3]. In general, this concept refers to productive assets of the workforce, which...
are acquired through learning activities. In Business Dictionary, the concept of "skills" is defined as "An ability and capacity acquired through deliberate, systematically and sustained effort to smoothly and adaptively carryout complex activities or job functions involving ideas (cognitive skills), things (technical skills), and/or people (interpersonal skills)". The main indicators, used in specialized literature, that reflect the impact of technological changes on qualifications are: distribution of employment by level of occupation and education, gap in wages established by education and occupation, measurements of changes in job tasks and characteristic attributes needed to succeed at work, studies of employers or employees to determine skill levels needed to succeed at work and others.

Intensity of investment in innovation is not homogeneous on the economy, but varies considerably depending on industry and company size. Investment generates a variety of workforce skills needed to implement activities. Innovation is defined as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method or a new organizational method in business practices, workplace organization or external relations" [5]. Research and development is a key part of innovation activity, defined in the literature as "creative work undertaken systematically on the systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications [6]. Research development includes three activities: basic research, applied research and experimental development.

Figure 1. Employment structure by sex and educational level, in 2010

The analysis of distribution of employment with long-term education may notice certain changes in analysed period (Table 1). Thus, given the growth of 69% in persons with long term education, respectively from 775679 to 1314661 persons, the percentage of the people with higher education occupied in "specialist with higher education and scientific" category varied a little between 68,75% and 71,5%. reaching in 2010, 69,06% of total value.

Category of occupation "Farmers and workers skilled in agriculture, forestry and fishing" posted a significant drop in the share of workers with higher long-term education, indicating a low tech of the field and, therefore, the innovation in this basic economic activity.

Also there is an increase in the share of people with higher education in the categories of occupations: "Technicians foremen and assimilated", "Administrative officials", "Operative workers in services, trade and assimilated", "Unskilled workers", indicating an inefficient resources spent to prepare at high level the individuals and a whole society also. The following table illustrated a complete picture of these proportions for the employed population by level of education and training.

To understand the role of labour, its preparation and skill-sized and fitted in the research and development activity, we must be able to assess the proportion of innovative processes of all Romanian companies.

The latest Romanian statistics indicate that about 333% of all companies are undertaking innovative activities distributed such as: 34,7% of enterprises are considered innovative in industry, while in services sector are 31,3% of the them.

3. THE DIVERSITY OF SKILLS INVOLVED IN INNOVATION ACTIVITY

The study presented below has in view the Romanian case. Analysing the distribution of the labour by sex and educational level, Figure 1, we can see that the share of woman with tertiary levels of education, specialty post high school or technical foremen education and high school in the total employed woman is higher than among men. At the same time, the largest share of women is observed in the low level of education too, respectively “secondary” and “primary or no education”, respectively 24,4% and 6,4% compared to 21,4% and 4,6%. The men hold the largest share of education level “vocational” 28,5% compared to 14,6% of woman, indicating that men leave early the educational process and start the economic activity. Although the educational level of women is higher than men, it seems that further professional development, career advancement of women is much slower, requiring implementation of specific measures to accelerate it.
Innovators typology on the Romanian market indicates that companies are using, particularly, technological innovation (19.5% of all innovative enterprises) others non-technological innovation (40.8% of all innovative enterprises) and others making use of both types of innovation (39.6% of all innovative enterprises), while the rest remain non-innovative enterprises (66.7% of the total enterprises). Romanian statistics indicate the levels of staff training in research and development of the national economy by occupation group and by performance sector:

From 2005 until 2010, was a sharp drop in the total number of employees in research and development, statistics showing a decrease as number of employees and also as number of persons in full-time equivalent (Table 2). Starting with 1993, the staff from research-development activity has been also  calculated in “fulltime equivalent” converting the number of part time workers in equivalent of full-time workers, corresponding to the working time devoted to this activity [10].

Between 2005 and 2010 the total number of employees allocated to research and development of the economy declined in absolute terms by 7051 persons or 22% decrease in per cent of people and the whole research-development activity posted a decrease also in number of higher education level researchers by 19.28%.

Noteworthy the most significant increase of researchers occurred in the higher education (less in business sector), meanwhile the number of researchers decreases from other sectors of performance (government and private non-profit sector - sector performance classification is made by European standards –Table 2).

Higher education sector included, in 2010, the largest share in total workers employed in research and development, 35.2% in total employees from whole sectors (and around 34.5% of number of persons in full-time equivalent from all research-development sectors), persons with higher education are around 95.8% of total employees from higher education sector, respectively 91.1% of number of persons in full-time equivalent ). At the opposite site, the smaller share of total employees in staff assigned research and development is located in private non-profit sector and its weight is 0.5% of total employees (as number), but with a very high percentage of staff with higher education, 94.7% of total employees (respectively 64.8% of number of persons in full-time equivalent).

Characterizing the business sector we found in 2010, a significant percentage of researchers 74.6% (respectively 70.8% of number of persons in full-time equivalent) and other employees having education other than higher employees, 20% (respectively 29.2% in number of persons in full-time equivalent).

In 2010, the government sector employees represent 23.0% of total employees working in research-development activity from economy (respectively 33.2% in number of persons in full-time equivalent), but with the highest percentage of staff belonging to other employees categories (technicians and assimilated and others, staff excluding tertiary education), representing 29.7% of total research-development sector’s employment (respectively 35.8% in number of persons in full-time equivalent).

Regarding the representation of women in research and development staff, a significant percentage of women represents 45.2% in total employees allocated to this activity in national economy and 84.5% of total having a high level of training and education, meaning they are doctorates holders or postgraduates or providing long-term or short term tertiary education; these weights are relatively balanced between men and women, the only sector where these reports are illustrated as discrepancies is the business sector, where female employees with training other than tertiary education represent 33.3% of all research-development activity and only 25.4% of total sector employment as research and development female employees. We also notice a higher prevalence of women in government sector 51.1% and private non-profit, 51.9% and less significant in enterprise and higher education, respectively 37.8% and 45.6 % compared to men. As a conclusion resulting is the women polarization in public institutions, government and private non-profit sectors and an important share of men in business and in higher education sector [10]. Dynamic evolution of the employment structure by performance sector between 2005 and 2010 is captured in Table 2, as in the following graphs:

Table 1. Employment structure by occupation group and long-term education level between 2000 – 2010 (%)

<table>
<thead>
<tr>
<th>Year/Occupation groups</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members of legislative body, executive, leaders of public administration, leaders and clerks of socio-economic and political units</td>
<td>12,19</td>
<td>12,60</td>
<td>13,50</td>
<td>12,24</td>
<td>12,84</td>
<td>12,69</td>
<td>11,99</td>
<td>11,27</td>
<td>10,00</td>
<td>8,62</td>
<td>7,91</td>
</tr>
<tr>
<td>Specialists with intellectual and scientific occupations</td>
<td>70,63</td>
<td>69,68</td>
<td>69,96</td>
<td>71,50</td>
<td>69,86</td>
<td>69,44</td>
<td>70,32</td>
<td>70,45</td>
<td>70,89</td>
<td>68,75</td>
<td>69,06</td>
</tr>
<tr>
<td>Technicians, foremen and assimilated</td>
<td>7,67</td>
<td>8,28</td>
<td>7,91</td>
<td>7,28</td>
<td>7,88</td>
<td>8,09</td>
<td>8,10</td>
<td>9,22</td>
<td>9,36</td>
<td>10,78</td>
<td>10,89</td>
</tr>
<tr>
<td>Civil servants</td>
<td>1,93</td>
<td>2,07</td>
<td>2,18</td>
<td>2,22</td>
<td>2,78</td>
<td>2,91</td>
<td>3,05</td>
<td>3,27</td>
<td>3,43</td>
<td>3,65</td>
<td>3,56</td>
</tr>
<tr>
<td>Operative workers in services, trade and assimilated</td>
<td>1,12</td>
<td>1,17</td>
<td>1,64</td>
<td>2,20</td>
<td>2,22</td>
<td>2,38</td>
<td>2,55</td>
<td>2,28</td>
<td>2,30</td>
<td>4,17</td>
<td>4,46</td>
</tr>
<tr>
<td>Farmers and skilled workers in agriculture, forestry and fishery</td>
<td>1,54</td>
<td>1,64</td>
<td>0,89</td>
<td>0,94</td>
<td>0,86</td>
<td>0,78</td>
<td>0,74</td>
<td>0,81</td>
<td>0,81</td>
<td>0,78</td>
<td>0,65</td>
</tr>
<tr>
<td>Artisans and handicraftsmen in machinery and installations, maintenance and adjustment</td>
<td>0,63</td>
<td>0,62</td>
<td>0,78</td>
<td>0,59</td>
<td>0,60</td>
<td>0,68</td>
<td>0,36</td>
<td>0,50</td>
<td>0,64</td>
<td>0,42</td>
<td>0,38</td>
</tr>
<tr>
<td>Other categories of occupations of which:</td>
<td>4.29</td>
<td>3.94</td>
<td>3.14</td>
<td>3.03</td>
<td>2.95</td>
<td>3.06</td>
<td>2.91</td>
<td>2.21</td>
<td>2.57</td>
<td>2.83</td>
<td>3.10</td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>0.19</td>
<td>0.23</td>
<td>0.12</td>
<td>0.28</td>
<td>0.30</td>
<td>0.24</td>
<td>0.33</td>
<td>0.32</td>
<td>0.25</td>
<td>0.18</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Source: National Institute of Statistics: data base TEMPO on-line
Table 2. The dynamic of employees from research-development activity by occupation group and by sector of performance between 2005 - 2010 – absolute and relative values

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees (total number)</td>
<td>33222</td>
<td>29340</td>
<td>28977</td>
<td>30390</td>
<td>28398</td>
<td>26171</td>
</tr>
<tr>
<td>Researchers (%)</td>
<td>69.1</td>
<td>64.8</td>
<td>64.9</td>
<td>63.8</td>
<td>67.9</td>
<td>70.8</td>
</tr>
<tr>
<td>Technicians and assimilated (%)</td>
<td>15</td>
<td>15.3</td>
<td>15</td>
<td>15.2</td>
<td>14.1</td>
<td>12.4</td>
</tr>
<tr>
<td>Others employees categories (%)</td>
<td>15.9</td>
<td>19.8</td>
<td>20</td>
<td>21</td>
<td>18.1</td>
<td>16.9</td>
</tr>
<tr>
<td>Business (number)</td>
<td>10055</td>
<td>8381</td>
<td>8786</td>
<td>10312</td>
<td>8708</td>
<td>8704</td>
</tr>
<tr>
<td>Researchers (%)</td>
<td>63.9</td>
<td>56</td>
<td>59.2</td>
<td>54.7</td>
<td>57</td>
<td>70.8</td>
</tr>
<tr>
<td>Technicians and assimilated (%)</td>
<td>15.8</td>
<td>16.6</td>
<td>16.8</td>
<td>18.2</td>
<td>13.9</td>
<td>12.4</td>
</tr>
<tr>
<td>Others employees categories (%)</td>
<td>20.4</td>
<td>27.4</td>
<td>24</td>
<td>2.0</td>
<td>29.2</td>
<td>16.9</td>
</tr>
<tr>
<td>Government (number)</td>
<td>10055</td>
<td>8381</td>
<td>8786</td>
<td>10312</td>
<td>8708</td>
<td>8704</td>
</tr>
<tr>
<td>Researchers (%)</td>
<td>70.4</td>
<td>66.6</td>
<td>66.2</td>
<td>59.8</td>
<td>66</td>
<td>64.2</td>
</tr>
<tr>
<td>Technicians and assimilated (%)</td>
<td>18.6</td>
<td>20.3</td>
<td>20</td>
<td>19.6</td>
<td>19.2</td>
<td>19.1</td>
</tr>
<tr>
<td>Others employees categories (%)</td>
<td>11</td>
<td>13</td>
<td>13.8</td>
<td>20.5</td>
<td>14.9</td>
<td>16.7</td>
</tr>
<tr>
<td>Higher education (number)</td>
<td>6803</td>
<td>7101</td>
<td>6931</td>
<td>8433</td>
<td>8824</td>
<td>9054</td>
</tr>
<tr>
<td>Researchers (%)</td>
<td>79.2</td>
<td>79.6</td>
<td>73.6</td>
<td>81.1</td>
<td>82.8</td>
<td>91.1</td>
</tr>
<tr>
<td>Technicians and assimilated (%)</td>
<td>8.1</td>
<td>6.9</td>
<td>5.7</td>
<td>5.6</td>
<td>9.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Others employees categories (%)</td>
<td>12.8</td>
<td>13.5</td>
<td>20.7</td>
<td>13.3</td>
<td>7.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Private non-profit (number)</td>
<td>207</td>
<td>97</td>
<td>153</td>
<td>120</td>
<td>108</td>
<td>142</td>
</tr>
<tr>
<td>Researchers (%)</td>
<td>82.6</td>
<td>78.4</td>
<td>86.3</td>
<td>64.2</td>
<td>83.3</td>
<td>64.8</td>
</tr>
<tr>
<td>Technicians and assimilated (%)</td>
<td>15</td>
<td>11.3</td>
<td>8.5</td>
<td>15</td>
<td>2.8</td>
<td>31</td>
</tr>
<tr>
<td>Others employees categories (%)</td>
<td>2.4</td>
<td>10.3</td>
<td>5.2</td>
<td>20.8</td>
<td>13.9</td>
<td>4.2</td>
</tr>
</tbody>
</table>


In general, there is an inverse relationship between the research expenditure evolving and the share of technicians and other similar categories of staff in research and development as development activity, in our country was at a lower level, at 30, 9% as supporting and technician staff.

This allocation was based on operational needs of the productive units. Although the share of technicians, similar categories and other categories of employees in the EU was in 2005, approximately 44% in total employees of research and a whole.

Figure 2. Relationship between type of research and development expenditure and composition of research and development workforce in 2005
Between 2005-2010 there was a decrease in number of total technicians and related workers from research activity belonging to the business sector, but increasing in relative terms in the governmental and private non-profit sector. These "losses" were caused by compression of economic activities due to the prolonged financial and economic crisis. Thus, in 2010, only 16.1% of expenditures were allocated for basic research in business sector, while 29.2% of all employees representing technicians research share in this sector. In contrast, in the higher education sector basic research expenditure reached 68.2% of total research expenditures and technicians are working in this sector at a rate of 8.9% of all employees from research and development activity.

In 2010, due to the effect of financial and economic crisis, research and development activity belonging to business, government and private non-profit sectors drop to 20294 employees (respectively 17550 as number of persons of full-time equivalent), both data representing a severe reduction of employees recorded in 2005. It may be noted, however, a small increase of number of researchers in business and an important one in education sector by 53% compared to 2005. Another relevant data shows an important decrease/increase of technicians from diverse sectors simultaneously to the evolution of basic research expenditure. We can notice the significant decrease of technicians from business sector, meaning 32% compared to same data from 2005 (Figure 3).

These results demonstrate the rationality of research and development in our country, as well as in EU, meaning that this category of technicians and related workers are involved, in particular, in incremental growth processes of research in applied research related breaks, experimental development e.g., the introduction of new products, services and innovative processes oriented to market.

These weights should, however, be seen in the big picture, the general context of evolution of the total number of employees in research, by sector of performance; according to Romanian Statistical Yearbook 2011 data that already has been presented in our analysis.

In term of irrationality, it is noticed the maintaining of a significant weight of technicians and others related to them in government sector simultaneously to a larger share of basic research expenditure in government sector (see Table 2).

In terms of measuring changes in task characteristics and attributes needed to succeed at work, the study "Evolution of the occupations on the labour market in Romania in the perspective of 2010," revealed the existence of three categories of occupations in manufacturing (the most important industry): occupations dominating, occupations as breakdown and occupations changing their contents [2].

In this sense we can say that innovation has to be seen not only technological perspective, but also as a non-technological. Other study results indicate that skills required especially in professional activities are predominantly intellectual competencies, ability to relate with others, social skills, claiming that the whole industry has increased demand for highly skilled labour.

A study to directly address skills in research and innovation has not yet been achieved in Romanian economic activity.

4. CONCLUSIONS

Research and development activity is organized as mainly "management by project" and the workforce allocation is estimated accordingly the "needs" of the projects. In this sense can be assess the differences between the number of people employed in this activity and the number of persons in full-time equivalent.

These results are taken to prove the development of the flexicurity concept, adopting flexible forms of labour and securing workers in this field.

There is no model "one size fits all" to get innovation or the type of skills required for successful innovation.

Statistics show the research and development activity involution in business sectors due to a prolonged economic and financial crisis (sharp decrease in the number of employees...
especially for technicians and related workers); it demonstrates the effects of economic crisis, the experimental development activities, new product implementation, new technologies, new services have diminished by restricting the number of technicians and assimilate categories providing operational and logistical support.

An important share of technicians we found in government labour sector, while the basic research spending increased and the weight of researchers decreased in 2010 compared to 2005 as an inefficient labour allocation in research-development activity.

In a later stage of this research we try to emphasize the correlations between specific skills and the enterprise propensity for innovation.

5. REFERENCES

TALENT CULTIVATION MODE OF NEO-CONFUCIAN BUSINESSMAN AND ITS PRACTICE

Miao, Zehua¹ and Li, Jinying²
1 Business School, Shijiazhuang University of Economics, miaozh1964@126.com
2 School of Foreign Languages, Shijiazhuang University of Economics, cathylbd@sina.com

ABSTRACT: Business talent cultivation is related to the international competitiveness of an enterprise. How to inherit and develop the traditional ethics and culture based on confucianism deserves serious study. The paper focuses on the cultivation mode and concepts of business talent, and points out that confucianism is playing more and more important role in quality development of business talent and improvement of international competitiveness. Therefore, a quality development mode is advocated, that is, “ethics + innovation + knowledge + ability + mental and physical health”, and equal weight should be given to the all-round education on good morality and top talents. In theoretical reform, studies are closely related to the talent education in Business School of Shijiazhuang University of Economics, and focus on the methods of and measures to talent cultivation. In practice, the cultivation mode is executed, that is, “benevolence education to freshmen, honesty education to sophomores, entrepreneurship education to juniors, and gratefulness education to seniors”; and besides, nine annual knowledge contests have been held, which bring about good results and great social effects.

Keywords: neo-Confucian businessman, business management, talent cultivation, good morality, top talent

1. THE MEANING OF TALENT CULTIVATION MODE

1.1. The definition of "mode"

The definitions of "mode" vary in the international and domestic literature. Some of them are as follows:

(1) "Mode" is the standard form of a thing, or a standard pattern according to which people take actions (Modern Chinese Dictionary, Supplement, 2002).

(2) "Mode" is the theoretic and simplified form that represents the realities. (Bill & Hardgrave, scholars of American Comparative Politics).

(3) "Mode" is a scientific method (Youliang Cha & Qingguang Guo, Chinese Scholars).

Generally speaking, "mode" is the "way", that is, "method" and "pattern". The reasons are as follows, ① the meanings of "mode" in English. In English, "mode" and "pattern" are synonyms. "Mode" originates from the Latin word "modus", a "way", and it is more representing than "pattern". ② The studies on "mode". Mode is a way for the nature to exist and present—the objective mode; in addition, "mode" is a way for human to understand and change the world—the subjective mode.

From the perspective of definition, "mode" consists of form and method formed by structure and process, including mode structure, mode process, and mode method.

1.2. The meaning of talent cultivation mode

Talent cultivation mode is a term with various meanings and broad sense. Generally speaking, it is the way of cultivating the talents (that is, methods and form).

In college teaching reform and specialty construction, the focus is always the studies on talent cultivation mode, and many modes are put forward, such as, general education + specialty education, solid basics + wide knowledge, basics + specialty, knowledge + ability + quality, and liberal arts and science, so on so forth. College talent cultivation mode can be explained as: Guided by certain educational ideology, theory and policy, the colleges, according to their own tasks, adopt different organization forms and operation mechanisms to realize the training purposes. It contains two aspects:

(1) It reflects the educational ideology and theory of the nature of talent cultivation. Its nature concerns two problems: what kind of students will be trained, and how they can be trained. The first problem refers to the training purposes determined by educational ideology and theory; the second problem involves the organization forms and operation mechanisms. College education is restricted by social economy, politics, and culture, at the same time, it is independent and dynamic. It should adjust to the social reform and development, and in return, it also makes an overall and pioneer influences. It is such role of college education that motivates the reform of talent cultivation mode.

(2) The training objective, standard, process, and education appraisal are the basic elements of cultivation mode. Talent cultivation mode is a complex system in which the elements are not only different in functions and characteristics, but also interrelated. The training purpose determines the direction and tiers, thus it is the guidance. In addition, it is the basis of standard design, process, and educational appraisal. Whether the training standard can reflect objective directly concerns the realization of the objective. The process is the practical activities to carry out the objective and realize the standard, and it is arranged according to the objective and standard. The different objective and standard lead to different process.
2. THE ROLE OF CONFUCIAN ETHICS IN THE BUSINESS AND MANAGEMENT TALENT CULTIVATION

2.1. The role of Confucian ethics in quality development education

In 1988, 75 Nobel Prize winners said in their declaration after a gathering, if the human beings will continue to survive in the 21st century, and avoid the world confusion, they must reconsider Confucian wisdom existing about 2500 years ago. In 1996, International 21st Century Educational Committee, in a report to the UNESCO completed in 3 years by the education experts from 15 countries, elaborated the "four mainstays" of modern education: learn to cognize, learn to do things, learn to survive, and learn to live common life. The report, regarded as the milestone of modern quality education, proposed the basic measures from the education perspective to solve the various global problems and crises. The measures resort to the Confucian ethics, which is a system of the educational thought with the core of ethic education so as to resolve the relationships between human body and soul, between human beings, between human and society, between human and nature, and between human and universe. See figure 1

![Figure 1. The four mainstays of quality education](image)

Confucian educational ideology provides rich thought for modern talent cultivation mode. The four mainstays mentioned above can be considered to cultivate the morality of a person. According to Confucianism, only if the survival is resolved, and morality is cultivated, the quality of a person can be improved on the basis of the natural endowment, that is, guided by one's conscience to exceed the innate desires, improving oneself with morality to live an integral and happy life, being devoted to one's duty, being diligent and perseverant to make accomplishment. Confucianism pays attention to moral education and quality improvement, emphasizes a kind of spirit: in success, trying to make all people virtuous; in poverty, attending to their virtue in solitude, advocates devotion of struggling hard, striving hard and sacrificing one's life for a cause, makes emphasis on quality of broad learning and constantly examining oneself to improve the awareness and make fewer mistakes, and advocates the moral education on persistence to improve oneself.

2.2. The role of Confucian ethics in educational internationalization

Educational internationalization is to apply international education resources to cultivate internationalized talents. As for the students, going through internationalized education, and having an internationalized vision and thinking way help them to become an independent learner of sustainable development. Internationalized education develops students' abilities to completely understand different cultures, to communicate with people from different countries, and understand international laws and regulations.

With the development of further reform in China's economy, culture and politics, as well as international communication, it is urgent to improve citizens' quality. However, the improvement of the quality should be in all aspects. That is to say, not only the knowledge of modern technology, but also the knowledge of liberal arts and moral qualities should be improved. The improvement of moral qualities should rely on education (social education, family education and school education) and self-improvement. The practice of ethics is restrained by laws and regulations, and more importantly, by self-disciplines. Self-improvement is the way to develop correct ethics and improve character, and execute ethic liability and moral standards. Thus the reasonable factors of Confucian ethics begin to be confirmed in theory and practice of self-improvement. The basic concepts of Confucianism are "benevolence" and "propriety", and the aim is to adjust social relationships, harmonize interpersonal relationships so as to realize policy integrity, social stabilities. "Loyalty, piety, chastity, righteousness, sincerity", representing benevolence and propriety, are Confucian thought applied in certain social relationships. Confucianism emphasizes the political aim of "great unity" of the nation, people-based thought, morality-governing principles, self-improved moral quality, family ethics, ways of handling people, the spirit of happiness and sorrow for humanity, learning attitude, and education ideology etc. which are very practical and significant in modern society.

As for education of business and management talents, it is necessary to learn the talent cultivation mode and experiences from the developed countries in order to further the basic transformation of the educational modes from traditional knowledge mode to quality mode, and more importantly, to form the characteristics of their own. Therefore, it is not enough to learn the advanced mode of talent cultivation from developed countries. It requires to exploit, inherit, and develop excellent Chinese culture. Confucianism and Chinese culture play an important role in China's talent cultivation, determine the value orientation of the management talents in the integration of localization and internationalization, and the moral, quality and value standards of talent training.

3. BUSINESS AND MANAGEMENT TALENT CULTIVATION MODE BASED ON THE IDEOLOGY OF NEO-CONFUCIAN BUSINESSMAN

3.1. The basic qualities of neo-Confucian businessman

Cultivation of neo-Confucian businessman is the responsibilities of both the school and society. With the construction and development of marketing economy, the internationalization of college education, and the development of knowledge economy, to cultivate neo-Confucian businessman, it is necessary for college education to transform from knowledge mode to quality mode. Quality mode is the way to cultivate neo-Confucian businessman, and it is comprehensive system of six factors: morality+innovation+knowledge+ability+physical & mental health (See figure 2). In cultivation of the neo-Confucian businessman, such factors should be paid attention to:
combination of traditional culture and modern management, utilization of advanced teaching technology, structure of knowledge and abilities, process and specific method, etc. Cultivation of neo-Confucian businessman not only requires knowledge and abilities, but also morality and innovation. If a nation wants to be one of the members of the strong countries in the world, it depends on the innovative abilities and level of the nation's knowledge and technology, and the culture with its own characteristics. China, with the history of about five-thousand-year civilization, has created excellent culture, which is the treasure and witness of Chinese history, and still guides the development of China's market economy. Therefore, the current problem facing college education is to inherit the excellent culture and cultivate the neo-Confucian businessman that can meet the needs of modern market economy.

3.2. Paying attention to both excellent morality and excellent abilities in cultivation of neo-Confucian businessman

Neo-Confucian businessman represents traditional Chinese culture, and is demanded by the development of market economy. The neo-Confucian businessman should not only have benevolence, high quality of morality, but also profound business knowledge, proper knowledge structure, broad vision, sharp thinking and the sense of innovation. Briefly speaking, a neo-Confucian businessman should be physically and mentally healthy, and have high moral and knowledge levels (See figure 3). Physical and mental health is basic, otherwise, morality and abilities are meaningless. Excellent morality is the base of excellent abilities, because if a person is dishonest, uncooperative, irresponsible, even if he is very capable, he is not expected to devote much to the society. Of course, excellent abilities are also necessary. In fact, a person with excellent morality and excellent abilities is best, and a person with excellent morality and abilities is good, while a person with ordinary morality and less abilities is useless, and a person without morality but more abilities is dangerous.

4. THE PRACTICE AND PROCESS OF CULTIVATION OF NEO-CONFUCIAN BUSINESSMAN

4.1. Setting up ideology of cultivation of neo-Confucian businessman

In China's college education, the ideology of running school and education is the guidance which directs cultivation of students in college. College education should be based on physical and mental health of the students, and moral education to cultivate neo-Confucian businessmen so that they can meet the needs of a society, have excellent morality and excellent abilities; they are competent, broad-minded, and they are men of integrity.

4.2. Paying attention to PE, psychological education and extracurricular activities

The facilities should be constructed to improve students' physical and mental health. The basis in cultivation of neo-Confucian businessman is to enhance their physical and mental health, because a person without a physical or (and) mental health is not a real competent talent. It should cause the attention in college education. That is, being more strict in the examination of PE can help students improve their physical health and do more physical exercises; at the same time, colleges should play the role of mental consultative center on campus, create files for students' psychological state, make investigation and analysis on their psychological health, help them to resolve their psychological problems, and create a good environment for their well-round development.

4.3. Enhancing moral education on business students

Moral education should be carried out all through the ability training. The key of cultivating neo-Confucian businessman is that the students should have excellent morality and excellent abilities, and integrity. In future, they should benefit both themselves and others to realize win-win. They should be humanity-based, and kind to others. They should put themselves in others' places, and get benefit with integrity. Business School in my university advocates such training and applies it to practice as "benevolence education on freshmen, honesty education on sophomores, entrepreneurship education on juniors, and gratefulness education on seniors", which played very important role in enhancing moral qualities of business and management majors. In addition, the Business School has held many contests of Neo-Confucian Cup to spread the knowledge, improve the students’ activities, and create positive influences.

4.4. Enhancing teaching reform and curriculum construction

In the cultivation of neo-Confucian businessman, colleges are required to further reform in teaching content, methods and ways, and lay stress on students' innovative thinking. In practice, the Business School of Shijiazhuang University of Economics gives emphasis on the reform of training plan, brings traditional Confucian ethics and culture into training, offers the course of Enterprise Ethics. At the same time, Business School adopts various teaching methods, such as, example analytic teaching, practice-oriented teaching, simulation teaching, discussion, and role playing etc, and advocates innovation, entrepreneurship, and creation so as to train the business and management talents capable in innovative thinking, administration, profession, and life.
4.5. Laying stress on integrity and constructing integrity archives

Colleges and universities should construct integrity archives for students which can be linked with other personal archives. Cultivation of neo-Confucian businessman requires colleges and universities to improve themselves in all the aspects, and demands the active participation of the students. Constructing the system of integrity archives for students is beneficial for students to increasingly understand civic virtues, pay attention to their behavior, meet the high demands, enhance self-discipline, and pay for their immoral behaviors, such as cheat in exams and dishonest. Business School enhances education on students as for the problem of cheat in examinations, besides, non-cheat project has been executed, and the reputation system has been set up. By taking such measures, an encouraging result is anticipating.

5. REFERENCES


LIFELONG LEARNING
THE POWERFUL IMPACT OF THE SOCIAL MEDIA OVER THE FIELD OF LIFELONG LEARNING

Anca-Elena, Neață (David)
“Lucian Blaga” University of Sibiu, anca.david@yahoo.com

ABSTRACT: „Globalisation, new technologies and demographic developments constitute an enormous challenge; one of the answers to this problem is the access to lifelong learning”[1] (Jan Figel – Commissioner for Education, Training, Culture and Multilingualism). This paper is intended to be a plea in favour of faculty using and engaging social networks in the act of teaching and learning. This of course will imply a permanent effort of self-teaching for the teachers themselves. Similarly to the notorious brands that are already making use of the social media in an intense and prolific way, academic institutions ought as well to articulate a coherent and viable strategy, based on the new online communication channels, if they want to obtain and maintain their credibility and reputation for the public.

Key words: social media, lifelong learning, online communication channels

1. SOCIAL MEDIA REVOLUTION

An effort of redefining the act of communication is required, a reshuffling of roles between the participants in communication. Indeed, the environment is not quite comfortable and well-known for today’s adults who are educating the digital natives, a generation upon which advertising and publicity have lost their impact. What matters most now is opinions expressed online about your brand.

Few people are indeed aware of the fact that we are today eye-witnessing a social media revolution (“user-generated content”), in which “human relations are entering a new era of multidimensional communication, and social interactions are being performed inside a virtual world which is overlapping with the reality and is occulting it.”[2]

We are talking here “about online communication channels, social interaction and propagation, delineation, syndicating or search for easily accessible information, by which action large communities of participants can cooperate through production and exchange of texts, photographs, audio and video materials; these are repeatedly sent around between users, in a way that is dictated by the will of individuals, similarly to the children’s game called <cordless phone>. (…) The purpose of interactions between users is to create connections for personal or business use.”[3]

The expression “social media generation” has become unanimously adopted. It depicts the generation that prefers the computer mouse instead of the pen, and whose opinions have a significant weight on the labor market.

Statistics determining the preferences of this segment of public have revealed, for example, that 93% of the social network users believe that a company’s profile in the social media ought to be represented by a famous personality, rather than in the classical way having been employed so far.[4]

From a pragmatic perspective, the PR department of each organization (including that of universities) must take seriously into consideration the segment of the online audience, and to create products that are easy to sell, since they are tailored to fit the psychological and intellectual profile of this target group.

Of the existing online communication channels, Facebook is by far the top. According to information released by Google Trends for Websites in February 2011, Facebook has 310 million visitors per day, being followed at a greater distance by the social network called Orkut (51 million individual visitors per day), Qzone (37 million), Twitter (22 million) etc.

In the Romanian online space, the situation in the social media is the following: Facebook (3,206,440 Romanian users aged between 18 and 34, 64,5%), Twitter, with over 64,000 Romanian accounts, preferred by youngsters (currently on Twitter there are 1,200 accounts of companies among which: Vodafone, BMW, LG, Orange), Hi5 (with 3,661,648 individual visitors in March 2011), LinkedIn (with 350,000 Romanian visitors in March 2011), Second Life (with 70,000 accounts opened in November 2009), YouTube (with approximately 2,000,000 individual Romanian visitors per month from), Trilulilu.ro, the Romanian version of YouTube (with 3,000,029, in 2010) and Neogen (with 2,242,285 accounts and 1,109,294 individual visitors).[5]

The figures above show that young people are easier approachable online in/from an institution through promotional campaigns for products, causes or ideas. This is where I want to touch the possibility of promoting the image of the Lucian Blaga University from Sibiu (ULBS) in the virtual world.

Specialists in communication consider that the successful social media are envisaging the mobilization of communities in the desire to attract their contribution to the production and sharing of information: Wikipedia, YouTube, FileSharing, Twitter, Blogging, Social Networking, forums and photo systems, Media and FilesSharing.

On zeroing in, we could take it that Facebook, Twitter, YouTube, Blogger could become the social media platforms to use in the promotion campaign of ULBS, since these social networks would succeed in mobilizing the academic community from Sibiu, on the one hand, and the local and national pre-university community on the other hand, provided
that the publishers, the owners and people in charge with each platform be PR professionals.

For this study we recommend the professors and students of the Faculty for Journalism within ULBS.

Blogger, which is a blog edited through a web browser (Chrome, Internet Explorer, Firefox or Opera), is constructed on a free platform easy to load with information, opinions and multimedia elements, in a continuous flow, usually displayed in a reverse chronological order.[6]

Whether individual or corporate, blogs can host audio files (podcasts) and video files (vodcast), to which the users can subscribe. The two ingredients that ensure the success of a blog are, according to the same Horea Bădău, a good content and interactivity.

Among the landmark traits of quality are to be mentioned a good legibility (easy to read and to scan), and grammar (obviously, a blog content displaying grammar mistakes will not be taken seriously).

Interactivity, defined by Bădău as “a condition of communication containing simultaneous and continuous instances of exchange that implies social force”, has been admitted to be a fundamental aspect of computer-mediated communication.

The stimulation of interactivity is an indispensable condition for the very existence of the blog. It becomes “an extremely precious purpose, with inferred financial connotations, that is being pursued from the choice of subjects up to the choice of title, approach and type of écriture.” [7]

Of the microblogging platforms, Twitter occupies a special place, being preferred by users who wish to stay tuned to the latest developments in their profession and to communicate on various issues.

This is the place where friendship and business connections are being established: 85% of the respondents are using the microblogging platform to announce news, 68% to learn about news and 58% are using them to observe interesting persons.

Jack Dorsey, the founder of Twitter, is explaining the raison d’être of this platform: “Many people’s brilliant ideas are lost because they are not transmitted to others in due time. Twitter gives you the possibility to share your ideas with others, so that they can make use of them in real time.” [8]

The role of Twitter in influencing the public thinking is overwhelming: for example, it has influenced the election of Barack Obama, and has also contributed to the outburst of street protests in Kishinev.

Of the advantages of Twitter, Horea Bădău is mentioning the following:

- It is the most accessible social media platform;
- The Twitter is extremely open, anybody being able to access Twitter from any other social media platform, and even from the platforms of the competition;
- Twitter is useful in building up consensual opinions in a community of supporters;
- According to empirical observations, it seems that postings on Twitter display more honest than those in blogs, due to the more restricted space for messages;
- This site is very helpful in planning events (tweet meet), often spontaneous;
- Twitter brings about more stability in relations emerging from communication;
- Information posted on Twitter is educational;
- You can find a job on Twitter;
- It is a very speedy means of communication, with short and extremely concentrated information;
- It is a suitable place to announce sales, offers, it provides good conditions for the launching of new products;
- It can used to expand your personal or corporate brand: even if the online medium does not belong to your professional objectives, Twitter can help you expand your business;
- In spite of exposing you to critics, Twitter still offers you the possibility to study your competitors;
- Twitter is a social media hub, it functions very well in an integrated system with the other online platforms. Twitter allows you to build functional relations in all social media;
- On Twitter you can find out about all important occurring in the blogosphere. Bloggers post on Twitter the titles of articles, with links to the blogs. The working principle here is: he who finds out first, announces first;
- Twitter is, according to Jeremiah Owyang [9], an instrument through which companies can reach their customers directly, in real time, and people can voice their opinions to the leaders of opinion; at the same time, it is an opportunity to invite bloggers to write, and also to write on other people’s blogs.

Among the disadvantages of Twitter, Horea Bădău is mentioning:

- Too time-consuming;
- Can estrange you from real life;
- Does not produce visible effects in communication;
- There are other more efficient means of communication;
- It is only for the connoisseurs of the online medium;
- Facebook has had more success in România than Twitter;
- It exposes your company to criticism.

The most powerful social network in the world still remains Facebook, due to its considerable number of accessible possibilities of socialization that are available to each user (over 40,000 applications).

Of all these, Horea Mihai Bădău is mentioning the “wall” (where public messages can be posted, that are seen by everybody); “Pokes” (a method of alerting another user); “Notes” (online text editor, allowing photos to be posted); “Photos”; “Videos”; “News Feeds”, “Chat”, “Events”, “Games”; “Marketplace” (containing ads).

Capturing the “wisdom of masses” represents an aim of the social media. The first step in the project would be to attract the targeted segment of audience, high-schoolers ad their parents, into discussion. “Mass cooperation of users, through their participation, means power. The individual must be convinced to participate actively in the community that represents him and of which he is a representative.” [10]

It is possible to catch the audience’s attention not only through online means, but also by using the classical means of promotion, like brochures, audio and video advertising, face-to-face discussions with high-schoolers etc.

The very next step envisages creation of products by which the academic community of Sibiu is introducing herself, in turns asking for opinions, preferences and recommendations.

An indispensable requirement of online communication on its way to being successful is, of course, the slight adaptation of traditional written and verbal expression language to the online medium.
It is desirable to relinquish the formal, monotonous language sometimes used in marketing brochures, to the benefit of a natural, honest, direct, occasionally even colloquial language.

The PR specialist has to reposition him/herself, by focusing on the dialog with the customers in a bilateral communication. Yet, there is a possibility for the publisher to lose control of the information, and instead to merely moderate it through participation in conversations. In the social media, interactivity and perseverance are becoming values.[11]

The social media consultant Mark Brooks, founder of Online Personals Watch, believes that “the most important elements of online community are constructed through interpersonal communication, thus the person becomes a brand”. [12]

Horea Mihai Bădău considers that the current tendency in the social networks is the shifting of power from brand to individuals, and the PR are committing the fatal mistake of continuing to embody an institution and not the person in communication. A user or reader (eager to communicate from colloquial positions) would much easier address the real person behind the brand, rather than an impersonal institution. It is therefore recommendable to appoint a person to represent the company, for example the Vodafone person, the Audi person, the LG person, the ULBS person.

The next question to rise is what does online communication bring to us in addition? Theorists have delineated ten arguments pro social media and four against.[13] In the first category we can mention:
- accessibility, translated in the short time, below one minute, necessary to create an account for blogging, Twitter or Facebook;
- relating, knowing more people, discussions with practically anybody; the speed of dissemination of information uploaded by the publisher will be amazing;
- community, from within it is easy to find “birds of the same feather”;
- information, learning about almost any topic;
- reputation, which is created, maintained and validated online through search on Google;
- efficacy, as a result of transposing the information learned into concrete actions;
- creativity, through relating with creative persons;
- interaction with customers and maintaining direct contact, by offering answers to their questions. Based on visitors’ suggestions, we can update strategy or services and we can tailor our offer to meet their demand;
- low marketing costs, by offering free access to services, information and community, represents one of the reasons why the social media has become the new instrument for sales and effective marketing;
- traffic, achieved through relevant information that is uploaded on the platforms.

The four arguments against social media are:
- too much noise, resulting from the abundance of doubtful quality information;
- anonymity, as an expression of the identity theft practiced on the Internet;
- a time-consuming activity, reflected in the considerable amount of time involved in the social media;
- unwanted reactions of some “jaded” users.

Vodafone is leading in the top of most visible brands in the social media, as a normal consequence of leading campaigns on blogs, Twitter (Vodafonebuzz) and on two Facebook pages (Vodafoneero and Fundatiavodafone).

Among activities performed on Facebook are supporting the film festivals “Anonimul (“Cinefil în Deltă”) and TIFF (“Cluj: The Movie”); a Gadgeteer Awards 1 and 2 (2011, 2012), “Undercloud” (the first theater play on Facebook).

Also, Vodafone has an updated profile on Wikipedia, in Romanian and English, also an account on Flickr (vodafonebuzz) and a YouTube channel (vodafonebuzz). Moreover, Vodafone has sponsored Webstock 2011, How To Web, iPhone Party, Secret Santa Party and Lady Bloggers Party.

Interactivity seems to be thought as very important, since Vodafone is responding to customers’ requests on Facebook, through the application Assistance, on Twitter, on the Vodafone forum and on the main forums in the country. Also, Vodafone has one of the first Pinterest accounts from Romania.[14]

2. THE MODEL OF UNIVERSITY’S FACEBOOK PAGE

In the Romanian academic space we have noted a visible effort of aligning to the new tendencies on the market of online medium resources for attracting as much public as possible.

From the official Facebook pages of Romanian universities, the one belonging to the “Alexandru Ioan Cuza” from Iași, is by far the best, deserving to become a role model for the other institutions of education.

Having scored 15,188 Likes, among which 188 users are concretely discussing about the university, the home page or landing page featuring sections such as “Photographs”, “Appreciations” (that can be visualized), “Discussions on admission”, “Discussions on rent and accommodation”, “News” and video postings. By clicking on “Discussions on admission” we can arrive at the page that offers complex and fresh information about the academia of Iasi, distributed under the titles: “Home”, “Bachelor 2012”, “Master 2010”, “PhD 2011”, “News”, “Archive”, “Partners”, “For high-schoolers”, “Contact”.

The site’s interactive feature is represented by the invitation addressed to visitors to fill out questionnaires and send feedback in the case that they were “unable to find the answer to questions in the site”. All this is living proof of the attention given to the user, as well as the struggle to prevent any unclear areas.

It is to be noted that in the “Partners” list can be found:
- partner sites: Bacalaureat 2012 and Consiliul Național al Elevilor (National Pupils’ Council);
- eight high-schools from Iași, Brăila, Negrești, Piatra Neamț, Bucecea, Focșani, Pașcani, Galați;
- eight media trusts;
- two blogs.

More than that, every user is invited to promote the university, by inserting its banner with the logo onto the personal blog or site page.

The special care shown towards high-schoolers is laudable. Two important articles are addressed to them: “How Is a Student’s Life Different from the Life of a High-Schooler?” and “From High-School to College”. For a seamless dialog between users and the university, 23 “ambassador” students of the university have been chosen, competent and eager enough
to answer questions on courses, professors, practical work, scholarships, studies abroad or other career opportunities offered by the university.

One of the strengths of UAIC is represented by the blogroll on the Facebook page. The blogroll is a kind of connection between blogs. In our case, the blogroll is connecting three blogs: “360 UAIC”, “The official UAIC site” and “UAIC – 150 years”.

As a conclusion, the Facebook page of UAIC has the following characteristics:

- it fully exploits the following techniques of interaction:
  1. conversation, as a fundamental value in social networking;
  2. Facebook Chat;
  3. Creation of connections between Facebook and the on and offline media;
  4. The questionnaire as a useful instrument in generating feedback;
  5. The comments forum;
- texts containing complete and useful information on faculties, admission, accommodation possibilities, etc.;
- photographs;
- video features.

Compared to UAIC, the Facebook pages of the Babes–Bolyai University from Cluj-Napoca and the “Andrei Şaguna” University from Constanţa are quite modest.

With 6.441 Likes and 42 persons engaging in dialog, the “Babes – Bolyai” University is displaying titles such as: “UBB Albums”, “Basic Information”, “Contact Information”, “UBB statistics”, the structure of the study year, tuition fees. For more details you can access six different web sites.

In spite of these inconveniences, UBB is still catching up due to the existence in the blogosphere of both a Twitter and a YouTube account.

On Twitter you can find the so-called tweets, articles meant to keep readers up with events from the Cluj academia. This is the blogosphere space where “Mr. UBB” is interacting and relating with users.

As for the “Andrei Şaguna” University from Constanţa, with 648 Likes, it is posting on Facebook official texts about existing faculties, “basic information de bază”, “general information”, “contact information” that are all accessible from the web. The “Events” section contains one event only. The user can see “The UAŞC Albums” and a few video clips.

Common features of UBB and UAŞC:
- the lack of a colloquial style in the dialog with potential users;
- the use of an official language, inappropriate for the online medium, especially when it comes to the promotion of products;
- reduced interactivity.

3. ACKNOWLEDGEMENTS

The understanding and acceptance of the social media phenomenon entails becoming involved into it.

In other words, it is desirable to create a blog, to open a Facebook and a Twitter account that should be synchronized (it is recommendable that both bear the same name).

Interpersonal communication with customers is indispensable in the blogosphere, the more that you are the representative of a company.

One key element of success in the social media is knowing that very often people make their choices based on recommendations of their friends.

4. REFERENCES

10. Bădău, Horea Mihai, op.cit., p. 27.
FUTURE STRATEGIES IN HUMAN RESOURCES. STUDY CASE: ROMANIA

Radu, Stoika 1 and Madlena, Nen 2
1 Academy of Economic Studies in Bucharest, rstoika@gmail.com
2 Military Technical Academy in Bucharest, madlenanen@yahoo.com

ABSTRACT: Within this article we intend to make an overview of the situation of human resources training in Romanian companies. Taking into account that nowadays the entire world is suffering from the effects of the global economic and financial crisis, each country has different approaches related to the measures that have to be implemented to counter its effects. By taking into account the targets set by the European Commission in the “Europe 2020 strategy” for a smart, sustainable and inclusive growth the importance of human resources management and the way it can be involved to prepare a better response to a very turbulent market is emphasized more than ever. A new design of the human resources strategies is impetuously imposing itself as mandatory in this context. In the final part of this article, we will make a set of recommendations related to the future decisions in human resource management.

Key words: human resources, training, strategy, management

1. INTRODUCTION

Creating a Europe of knowledge is a source of opportunity for universities and societies alike and at the same time, a major challenge. Universities operate in an increasingly globalized environment that is rapidly changing and characterized by increasing competition for attracting and retaining talent, and by the emergence of new applications that require to be answered. So far, European universities have benefited from financial resources under the North American universities. But are they in a position to compete with the best universities in the world and ensure a sustainable level of excellence? This question arises especially in the context of European Union enlargement, by taking into account the often difficult circumstances related to the countries that have recently joined, both in terms of human resources management and finance.

Another action area with major impact on education and training was stated in the Declaration of Bologna - its implementation was designated as a Bologna Process. European university landscape, organized nationally and regionally, is characterized by a high degree of heterogeneity, reflected in the organization, management and effective deployment activities, including the status and conditions of employment / recruitment, of teaching and research. This diversity is apparent between different countries due to cultural and legal differences, but also within the same country, because universities do not react in the same way to environmental changes that are affecting them. Implementation of new reforms that incorporate regulations from the Bologna Process is a considerable effort meant to organize this diversity by providing an European framework, as a condition for increasing competitiveness of European universities both in Europe and also worldwide.

European higher education institutions have redesigned themselves by following the lines of some major models, particularly “the ideal model [2] of university described nearly two centuries ago by Wilhelm von Humboldt, which places both academic and research activity in the centre of teaching knowledge. Current trends are away from these models, leading to wide differences, which are reflected in the emergence of more specialized institutions, with a core of specific skills oriented to both research and education, as well as to other dimensions, the integration strategy regional development through adult education programs.“ (COM/2003/0058 final)

Steady growth [7] in economic and job creation recorded in the last ten years has been cancelled - Europe's GDP fell by 4% in 2009, industrial production dropped to 1990 levels and 23 million people (10% of the EU’s active population) currently has no job.

The crisis has caused a shock to millions of citizens and revealed some fundamental weaknesses in the overall European economy. The crisis made the task of securing the future economic growth more difficult. The situation is still fragile, European financial system holding back recovery and the difficulties faced by both enterprises and households to obtain credit, spending and investing. Public finances have been severely influenced, with the average deficit of 7% from GDP and debt levels of over 80% from GDP, the crisis thus nullifying twenty years of progress in fiscal consolidation in only two years. Many investment plans and ideas may be lost because of uncertainties, sluggish demand and lack of funding. Structural weaknesses have been highlighted throughout Europe. Getting out of the crisis is the immediate challenge, but the biggest challenge is not trying to return to the pre-crisis situation. Even before the crisis there were many areas in which Europe [3] was not progressing fast enough in comparison with the rest of the world:

The average growth rate in Europe was lower than that of structurally main economic partners, largely due to a lag in productivity increase in the last ten years. This situation is due to a series of causes that include differences between the business structures, low levels of investment in research, development and innovation, insufficient use of information and communication technologies, the reticence of some segments of companies to support innovation, barriers to market access and a less dynamic business environment.
Although there has been some progress, the employment rates in Europe, with an average of 69% for those aged between 20 and 64, are still much lower than in other parts of the world. Only 46% of older workers (55-64 years) have a job, compared to over 62% in the U.S. and Japan. Moreover, Europeans work an average 10% fewer hours than their U.S. or Japanese counterparts.

Population ageing is accelerating in Europe. As the generation born after the Second World War (baby boom) begins to retire, the EU’s active population will start to decrease from 2013 to 2014. Number of people aged over 60 years is now increasing twice as faster as it used to do before 2007. The decrease in active population, combined with growing numbers of retirees will put additional pressure on our welfare systems. While Europe must address its own structural deficiencies, the world is changing rapidly and will be very different by the end of the coming decade:

- The European economies are increasingly interlinked. Europe will continue to benefit from the fact that it is one of the most open economies in the world, but competition from developed and emerging economies intensifies. Countries like China and India are investing heavily in research and technology in order to place a higher position in the industry value chain and leapfrog into the global economy. This puts pressure on the competitiveness of certain sectors of our economy, but every threat is also an opportunity. As these countries develop, it will open new markets for many European companies” (Stoika R., 2011).

The European Union has set as one of its primary objectives to achieve an occupancy rate of 75% for women and managed 20 to 64 years by 2020. This objective will be achieved through a greater participation of young people, older workers, workers with low qualifications as well and a better integration of legal migrants. Low rates participation in the labour market has been from very long time ago one of Europe's main weaknesses. Just before the crisis, the employment rates in Europe were a few percentage points lower than the ones in the U.S. and Japan., first competitors when we discuss about the global economy.

The crisis has dramatically increased unemployment rates and demographic changes are likely to further reduce the available number of active workers. A greater participation to the labour market that will have a significant impact on Europe's future sustainable growth. Promoting innovation and growth in European economy also requires qualified and trained workforce masses. It is essential to have a population with a high level of education, training and skill in order to have a better response facing challenges such as demographic change and social inclusion in Europe. Investing in quality education, learning and lifelong learning is therefore a key decision to assure a smart, sustainable and inclusive growth. Europe 2020 establishes two main objectives in terms of education: the percentage of young people aged between 18 and 24 who leave school early to be more than 10% and European young people between 30 and 34 years who have completed higher education or an equivalent level to be at least 40%. In the following pages we propose to evaluate the human resources dimension concerning the European legislation and to present the outcomes raised from our research regarding human resources training in Romanian companies.

2. TRAINING OF HUMAN RESOURCES – NEW DIMENSION OF SOCIAL POLICIES

Taking into account that for the development of the main economy engine – human resources, there aren’t many dedicated spaces in the social regulations, we propose to make a comparison between the initiatives regarding human resources from Romania and those at European level.

According to the European Employment Strategy, regulations are issued by the Member States with a clear intention to make efforts in attracting and retaining people to work in a greater number, identifying ways to promote equity and social protection systems and also guarantee the employment flexibility. Another reference document in this field is the re-launched Lisbon Strategy which focuses mainly on human resources development and on quality improvement of education at all levels. In response, the European Commission issued a document for European cooperation in education and training. This document provides four strategic axes scheduled to the end of 2020: making lifelong learning and mobility of learners, improving quality and efficiency of education, training and learning outcomes, promotion of equity and active citizenship, stimulate innovation and creativity and stimulate entrepreneurship at all levels. According to this document “international student mobility is an essential aspect of lifelong learning and enhancing employability and professional adaptability”. In this regard, it is important that all actors must to be fully committed and that the European Commission diversifies funding resources.

Regarding the national view, Romania has drafted a set of strategic documents such as the National Development Plan 2007-2013, the National Reform Plan 2011-2013 and the National Strategy for Sustainable Development of Romania for 2013-2020-2030 horizons. All these documents were the basis for an Integrated Human Resources Development strategy 2009-2020 – a programmatic document that establishes the framework for those policies dedicated to human resources development. The overall objective of this strategy mentions that improving the quality and capacity of human resources development systems could lead to a high and stable employment rate, a high level of quality life and an effective social inclusion for all Romanian citizens. It is very important that all citizens will use all the best possible opportunities for the current and future personal and professional development in order to create ground for the achievement by 2020 of the key indicators for sustainable development. All these measures create new opportunities in drafting specific future directions to ensure the fulfillment of those targets, in which continuous training of human resources occupies an important place.

Even if one of provisions relating to the development of human resources are not highlighted into social policy, we consider that is necessary to review the main findings in Romanian laws facing the alignment to the European provisions regarding to this field.

According to the European Employment Strategy, some regulations were issued by the Member States in order to focus the efforts on attracting and retaining people at work in a greater number, identifying ways for equity promotion and active citizenship but also in order to increase the quality, efficiency and social protection systems. Commission issued a new document for European cooperation in education and training. This document provides four strategic axes for the end of 2020: making lifelong learning and mobility of learners; improving quality and efficiency of education and training; promote equity and active citizenship; stimulate innovation, creativity and entrepreneurship at all levels of education and training. According to this document “international student mobility is an essential aspect of lifelong learning for enhancing employability”(PNR 2011-2013). Mobility of
student should become more important rather than the exception that it is today. It is obvious that in the future without a very well trained human resources any attempt to reach higher economic targets is under question.

3. RESEARCH METHODOLOGY

Looking form the European macro and micro-economic view in full respect with the new Europe Strategy 2020 we see that are set 4 out of 10 distinct areas of intervention that are linked to the European Strategy for employment:

- improving labour market participation among women and men, reducing structural unemployment and promoting job quality;
- developing a skilled workforce that meet labour market needs and promote lifelong learning
- improving the quality and performance of education and training in tertiary education or equivalent;
- promoting social inclusion and combating poverty.

Each year European institutions check the regulations that implement the European strategy in the national employment policies from each Member States, after which compiles a report designed to improve each country’s particular situation.

In the light that of the increasing role of human resources in the global economy, the need of its development and the obligatory alignment of Romanian economy to the future challenges we conducted a survey among the Romanian companies in order to identify the highlight the situation of human resources training.

The respondents, almost 280 companies, have had to respond to 22 questions, special created to cover 5 areas of investigation: company details, questions related to internal human resource structure, human resources management structures, information’s about the various activities created for training, company vision about present and future selection criteria.

The respondents structure have had a good territorial distribution among the country even though was registered a big concentration of them in Bucharest. Taking into consideration the size of respondents the following structure was registered: 2.53% - big companies (more than 250 employees), 37.13% medium size companies (50-249 employees), 48.10% small companies (10-49 employees) and 12.24% micro companies (less than 10 employees).

4. DATA ANALYSIS AND DISCUSSION

At the level of education, answers provided the following picture: more than 48% of employees have tertiary education the second place being occupied by those that finished a high school. Related to this situation, regarding the selections that were organized in the last three years, companies replied that they selected 31.65% university graduates without previous experience and 25.74% were university graduates with relevant experience. Only 6.33% from the number of our respondents mention that they hired unskilled workers. Regarding the perception of employers about some selection criteria, we concluded that according to the chart below:

- regarding the level of education over 84% of companies considered this criteria important and 13.5% appreciated that is less important;
- qualification is seen as a important selection criteria by 94% of companies;
- the level of experience (national or international) is seen as an important criteria by over 80% of respondents;
- another criteria, the higher education classification, was seen by the majority of respondents as not so important;
- study mobility is very appreciated by the companies in the moment of selection when we look at this question results (over 62% of answers);
- recommendation of reliable persons at the moment of selection is perceived to be important by the companies (over 58% of answers).

Another question from this survey was targeted to the subject of language proficiency. The situation in Romanian companies reflects that most of them request form the future employees English proficiency (49% from answers), followed by French proficiency (26% of total number of answers).

Regarding the question related to importance of existing competences of the future human resources, the majority of answers are influenced by responsibility, capacity to work in stress conditions and communication abilities.

Taking a step further to the area of training of human resources, companies indicated that (in majority of answers), that only 30% of employees have benefited of a training course. Taking into account this fact, it is obvious that the company could face a late response the turbulent changes.

Figure 1. Which aspect does your company appreciate the most?

- recommending the level of education over 84% of companies considered this criteria important and 13.5% appreciated that is less important;
- qualification is seen as a important selection criteria by 94% of companies;
- the level of experience (national or international) is seen as an important criteria by over 80% of respondents;
- another criteria, the higher education classification, was seen by the majority of respondents as not so important;
- study mobility is very appreciated by the companies in the moment of selection when we look at this question results (over 62% of answers);
- recommendation of reliable persons at the moment of selection is perceived to be important by the companies (over 58% of answers).

Another question from this survey was targeted to the subject of language proficiency. The situation in Romanian companies reflects that most of them request form the future employees English proficiency (49% from answers), followed by French proficiency (26% of total number of answers).

Regarding the question related to importance of existing competences of the future human resources, the majority of answers are influenced by responsibility, capacity to work in stress conditions and communication abilities.

Taking a step further to the area of training of human resources, companies indicated that (in majority of answers), that only 30% of employees have benefited of a training course. Taking into account this fact, it is obvious that the company could face a late response the turbulent changes.

Figure 2. Human resources in training

Another important question of this survey was related to the issue regarding the collaboration with higher education institutions. In this view, according to the chart bellow, we concluded that 82% of companies’ answers don’t have any form of cooperation with higher education institutions. Taking into account that only 18% of respondents have various cooperation schemes with the academic area, we can mention that is imperative that future strategies to include various arrangement for increasing link with academic sector.
Another interesting point of view is the perception of Romanian companies regarding the efficiency as a result of human resources training (Figure 3). The majority of respondents (nearly 51% of answers) agree that the main output of this process is increasing loyalty and involvement of employees in the company. Secondly we noted that 23% of answers indicated as second main output - improving the core set of competencies. This situation comes to confirm the perception of employers regarding the immediate results reflected in increasing of sales and also in economic indicators. There are very few companies that believe in fast economic outputs after increasing the performance of human resources and raise awareness of the organizational culture.

The quality improvement of training providers was chosen by competence based on continuous education, aiming on facilitating development. Development of the information and counselling on national no more than 8% of respondents highlighted the need for a more judicious accreditation of skills providers. Next option chosen by employers is that according to which the introduction of tax incentives designed to promote continuous training among employees could be an approach that would ensure mutual gain of all parties.

In the final part of the survey conducted, we tried to request from companies what are the main actions to be inserted into future human resources strategies. The majority of respondents (over 46%) indicated that is very important to include directions for the development of information and counselling related to the EU financing programmes.

This response anticipates the importance of continuing education programs financed by the European Commission and widening to the entire European area with direct implications on the Member States. Only after the implementation of these programmes, European labour market will have a higher qualified human resources capable to increase competitiveness and to ensure sustainable balance between micro and macro economical levels.

5. CONCLUSION AND RECOMMENDATIONS

The idea of lifelong learning is getting more important than ever in the current context of European countries affected by economic crisis and beyond, through which it can be developed a true knowledge society. Along with employees, institutions are important partners in this new society, specially by making available to employees a set of increasingly comprehensive training opportunities to obtain a higher level of the "new" organizational indicator - organizational-level learning. Companies are learning themselves through this process, creating new ways to a better response in the context of an increasingly specialized and productive market. As a direct result of analyzing the situation of regulations at European level and from the dates resulting from the company’s survey, we propose the following directions for future human resources strategies:

- Improving information and counselling on the opportunities and benefits about training sessions for employees;
- Identifying ways for developing human resources motivation in order to be open to new rotations inside the company;
- Preparation of access to opportunities related to training, focusing also on language development;
- Removing obstacles to participate at training in terms of regulations and laws;
- Identify ways to ensure quality from training providers;
- Recognition of skills as an output from training periods;
- Developing partnerships and types of financing both on European and national levels.

6. REFERENCES

2. Communication from the Commission - The role of the universities in the Europe of knowledge, Brussels, COM/2003/0058 final
COMPARATIVE ANALYSIS FOR THE IMPLEMENTATION OF THE CONCEPT:
LIFELONG LEARNING IN PLACES LIKE FRANCE, GERMANY, FINLAND,
ROMANIA

Ana, Tușa¹ Claudiu Sorin, Voinia¹ and Dănuț Dumitru, Dumitrașcu¹
1 "Lucian Blaga" University of Sibiu, danut.dumitrascu@ulbsibiu

ABSTRACT: The paper includes a comparative analysis in terms of lifelong learning in countries like France, Germany, Finland and Romania. The objectives: Update on the definition of each star on lifelong learning concept; Comparison strategies associated with lifelong learning for the countries analyzed; Tracking the contribution of different levels of educational system in terms of lifelong learning. The research was based on studying scientific literature from the country and abroad and it was based on questionnaires distributed. The results of investigation showed that success is related to the projects in terms of institutions, local projects and the project of the entire state that must ensure quality education. After implementing the research, conclusions are that the exchange of information between countries is needed, exchange of experience should head the true value, strategic cooperation projects and the project of the entire state that must ensure quality education.

Keywords: lifelong learning, comparative analysis, educational system

1. INTRODUCTION
Applying the concept of lifelong learning brings benefits to society and people who have access to different forms of education.

For public awareness about the benefits of lifelong teaching and to strengthen cooperation between the structures of education and business community, 1996 was declared the European Year of lifelong teaching (Decision no. 95/2493 / EC).

Lifelong education is a priority of European education systems. The method which must be implemented for the concept of "lifelong learning" is not clearly established, the institutionalization of the concept being a key issue.

European Commission brought together its education and training initiatives under one umbrella "Lifelong learning".

Lifelong learning represents all learning activities undertaken by the person throughout life in formal, non-formal and informal training or skills development for a multi-perspective: personal, civic or employment.

Lifelong learning comprises early childhood education, secondary education, higher education, continuing education and training of adults.

Lifelong learning is focused on training and development of key competencies and skills of a specific area of work or qualifications.

Early "official" Lifelong learning is considered to have been made by Paul Lengrand in 1970, when at the UNESCO conference, was presented the report entitled "An Introduction to lifelong learning".[1]. Following this report, UNESCO created an International Commission for Development, composed of seven experts from the highest level from different countries, but acting on its own, and chaired by Edgar Faure.

The concept was taken over by international organizations and held the attention of various experts, among them being Torsten Hüsien too, who, in 1974, wrote the report "The learning society".

The lifelong education aims to boost competitiveness, skills and personal development. Today lifelong learning is the key point of the EU policy.

In our country, the report "Developing lifelong education in Romania", shows how, after the late '80s lifelong entered into obscurity, and references to this concept were merely incidental, since 1995, the offer of continuing education knows a revival identified by creating a legal framework - favorable, in particular, to continue training - and the creation of institutions specialized in this field.

The research goal is to identify the perspective of the main categories of actors in ongoing training on the knowledge, skills, attitudes and other key requirements in question and the most important roles fulfilled or for which are trained trainers and other professionals involved organizations, other than from public education and evaluation of their effects on these approaches to continuing vocational training system in Romania.

Currently, there are some relatively recent studies on continuing training in Romanian organizations. The only research that are based on full sample statistically representative are conducted by the National Institute of Statistics at the request of and in coordination with Eurostat, the European Commission body dealing with statistics.

Among the research methods used I can mention:
- analysis based on questionnaire;
- factor analysis;
- case studies
- analysis of documents

In the introduction to this investigation is carried out a brief history and continuing education, which seeks to define the term, identifies trends, developments and difficulties in the
implementation of the concept. Education and lifelong learning is the same as a matter of personal fulfilment and the acquisition of capacity to exercise rights as a citizen, as a matter of achieving economic goals.

2. DEFINITIONS OF MEMBER STATES E.U

Definitions of Member States E.U. are quite similar. Lifelong learning includes such items as:

- people learn at every stage of life
- are involved many general skills, personal and professional
- is put on the first place the need for a solid basic education acquired through learning and motivation.

OECD defines lifelong learning as: This conception of education covers personal and social development in all forms and in all contexts, both formal school, vocational education institutions, tertiary and adult and informal - home, workplace and community. It is a systematic approach, focused on standards of knowledge and skills required by all, regardless of age. It emphasizes the need to prepare and the incitement of all children, from infancy to lifelong training, and directs efforts to ensure that all adults, employed or not, who need to improve their qualifications or be reshaped, to be able to do so [2].

FRANCE

- uses the concept of lifelong learning and training and broadens the permanent one.

The right to permanent training is defined as an individual and collective transferable right.

GERMANY

In Germany there is no formal definition of the concept of lifelong learning. Germany considers lifelong learning a global concept of training policy inspired by principles that:

- Develop partnerships between training institutions and traditional non-formal educational contexts.
- skills for a maximum number of individuals
- encourage and improve education in real situations.

Education and training is an ongoing task which requires the parts involved in education.

FINLAND

In Finland the definition of the concept of lifelong learning includes childhood and adult life continues to the end on all aspects of education.

3. STRATEGIES AND OBJECTIVES

FRANCE

Strategies in education or training: [3].

- improving articulation between initial and continuing training
- basic training to enable the acquisition of new knowledge and technological base or general
- training is open to complementarity in terms of validation of skills acquired and to be associated with the choice of the individual path in life
- validation of professional experience.

GERMANY

- The strategy is about enhancing learning in order to strengthen the educational field

- Strengthening the autonomy of students by putting in contact those involved

FINLAND

- improvement of the basic education of young people moving from education to working life, the basic educational level of the middle age, the training capacity of all ages
- increasing emphasis on adult education and the impact of new technologies on employment
- improve the literacy of citizens to use new technologies.

4. THE CONTRIBUTION OF DIFFERENT LEVELS OF EDUCATIONAL SYSTEM

FRANCE

Compulsory education and post-compulsory

French Ministry of Education conducted a policy of improving the educational system to prevent premature abandonment without qualification.

Policy is based on early childhood education, by individualizing education pathways, by supporting fragile students through education in the spirit of the citizens, through the development of an integrated vocational education assisted by the principle of partnership with the professions and local authorities.

The objectives are:

- prevention of child abandonment in the college by using a wide range of measures building pathways-qualifying training after college, maintaining and enriching ways for the CAP certification stage, by setting up networks of professional schools.

The higher education

The French government is concerned about extending classes reinforce a professional degree in the university institutes of technology and development of industry placements.

Pilot projects

Taken steps to improve the capacity to adapt to technological changes:

- three-year development plans, information and communication technologies in education, bringing engineers into schools to strengthen the links between firms and themselves.

GERMANY

The compulsory education

All young people receive a certificate of general or vocational training. Qualified young people is achieved through training traditionally seen as essential for young people's active participation in social life and how to benefit from lifelong learning.

Objectives of measures to promote lifelong learning are:

- motivation of individuals to lifelong learning
- providing the possibility to switch from one course to another
- knowledge-acquisition autonomy by changing educational objectives
- involving a large number of young people and adults in lifelong learning actions.
Lifelong Learning encourages collaboration between training providers and enterprises. Partnerships enhance contact with students and teachers working world through internships in companies for students and offers training for teachers.

The higher education

Service training proposed by the universities is different:

- completed postgraduate diploma, master
- programs and training courses completed by a diploma
- training of staff in higher education

The German higher education institutions offer over 1000 types of continuing education and training. Distance university courses and the ones based on new technologies acquire an increasing share.

Pilot projects

Federal and State lands have developed several pilot projects. Ideas of these projects:

- Developing cooperation and partnerships to provide supply and demand, to tie the various areas of training and be paired with other sectors and policies
- strengthening orientation independent learner through the content of interventions and forms of training to encourage all citizens to follow a type of training.

FINLAND

Formal education system develops opportunities so that most of the population to participate in adult education and training.

Preschool education

Lifelong learning starts in Finland in the preschool.

The compulsory education and upper secondary one

A 94% of teens follow general upper secondary education and 82% of them complete it. This is a basic principle for successful learning strategy.

The higher education

Education strategy states that 70% of young people can pursue their university studies or studies of non-university higher education.

University diplomas obtained clearly define key skills and basic knowledge necessary qualifications and studies are evaluated in relation to the amount of work required.

Adult education

It is important that education aims at improving continue training capacity to increase employability.

For adult students are given more opportunities to graduate university education or non-academic one.

Pilot projects

In Finland the Ministry of Education did not impose an action plan for lifelong learning.

5. ADULT PARTICIPATION IN LIFELONG LEARNING

At European level, three surveys provide data which enable adult participation in education and training to be evaluated: the EU Labour Force Survey (EU LFS), the Adult Education Survey (AES) and the Continuing Vocational Training Survey (CVTS). While the last survey focuses specifically on vocational education and training, the first two provide more general data on the participation of adults in lifelong learning.

The European Labour Force Survey is a data source for the EU benchmark indicator on adult participation in lifelong learning. The benchmark is set at 15% which is to be reached by 2020.

According to the results of the survey, in 2009, almost 10% of the European adult population participated in formal or non-formal education and training during the four weeks prior to the survey.

The Adult Education Survey is a new component of EU statistics on education and lifelong learning which will be conducted across the whole of Europe for the first time in 2011-2012. However, a pilot AES was carried out between 2005 and 2008 on a voluntary basis, involving 29 countries in the EU, EFTA and candidate countries. Unlike the EU Labour Force Survey, the Adult Education Survey is specifically designed to assess the participation of adults in education and training. It also provides more detailed information about the learning activities and programmes in which adults take part.

When comparing the results of the EU Labour Force Survey with the results of the Adult Education Survey, at first glance, the differences might appear rather surprising.

According to the Labour Force Survey, less than 10% of adults participate in lifelong learning, while the results of the Adult Education Survey indicate that around 35% of the European adult population take part in formal or non-formal education and training.

However, this significant difference between the results of the two surveys is partly related to the fact, that the reference period of the EU LFS is only four weeks prior to the survey, whereas the reference period of the AES is 12 months. This means that adults who do not participate in education over the last four weeks prior to the EU LFS (and are therefore regarded as 'non-learners'), may participate in education and training over a longer period (e.g. 12 months). As pointed out by Rosenbladt (2009), the length of the reference period plays an important role especially with regard to the participation of adults in non-formal education and training, since non-formal learning activities are characterised by rather short duration and are often distributed over time.

5.1. Adult participation in formal education and training

Results from the Labour Force Survey as well as from the Adult Education Survey show that the proportion of adults who participate in formal education and training (i.e. education provided in the school system, universities or other formal educational and training institutions; for more details see Chapter 2) is significantly lower than the proportion of those who participate in non-formal learning activities (i.e. organised and sustained educational activities that do not correspond exactly to the above definition of formal education; for more details see Chapter 2).

According to data from the Adult Education Survey, the average participation rate of adults in formal education or training in the EU is 6%.

The situation in individual European countries ranges from less than 3% in France, to more than 10% in Finland.
The country level analysis shows that in certain European countries the participation of under-qualified adults in formal education is clearly above the EU average.

The Adult Education Survey also provides some interesting information relating to the characteristics of the learning activities in which adults participate. One of these characteristics is the number of hours of instruction reported by those who participated in education and training. According to available data, formal programmes are, on average, significantly longer than non-formal learning activities: the average number of instruction hours per participant in formal education is 383 hours, while it is only 71 hours for non-formal education and training.

5.2. Sources of funding for formal adult education

There are three main possible sources of funding for formal education and training for mature students: public funding, fees paid by learners and funding from employers.

Funding from public sources

To some extent, public authorities in all European countries provide funding for formal adult education and training. Public funding is made available either as a result of education policy decisions, or under employment/labour market policies. In the latter case, formal learning activities eligible for financial support mainly include vocational education and training programmes, and the main targets are the unemployed and others vulnerable to exclusion from the labour market. Funding from the European Social Fund (ESF) is often used to complement national financial resources.

Public authorities use various mechanisms to finance formal adult education and training. For programmes up to upper secondary level, funding is usually transferred from central government to local administrations which, in turn, fund the providers. Finance from the central budget may also be combined with various local sources. For example in Germany, municipal adult education (including basic and upper secondary adult education) is funded from the municipal budget, which is made up of state grants and local tax revenues. Providers of formal education for mature students may also be directly funded by central government.

Public authorities can also provide direct financial support for individuals. The level of public funding allocated to local administrations or education providers to enable mature students to complete compulsory or upper secondary level education is often calculated as a percentage of the costs of a full-time pupil in initial education at the same level. For example:

In Finland, the criteria for funding general upper secondary education for adults are in line with those of general upper secondary schools. However, the unit cost for adult education is 60% of the municipal unit cost for upper secondary schools.

6. CONCLUSIONS

Education systems are pressed to each level to a degree who varies from state to state to contribute to the objective of lifelong learning.

Activities in the countries surveyed reflects the problems that the world of education is concerned. These problems are:

- Fight against school dropout
- Cooperation between schools and economic agents
- Identify basic skills.

7. REFERENCES

TOPICS FOR STUDENTS
ENTREPRENEURSHIP & INNOVATION – COOPERATION BETWEEN ACADEMIA & BUSINESS
A STUDY ON COLLEGE UNDERGRADUATES’ ENTREPRENEURIAL QUALITIES IN CHINA – THE CASE OF SHIJIAZHUANG UNIVERSITY OF ECONOMICS

Chen, Chaoqi1 Liu, Yongle2 Yang, Jun3 and Jia, Shuxian4
1 Shijiazhuang University of Economics, Shijiazhuang, China, rockysss6125@gmail.com
2 Shijiazhuang University of Economics, Shijiazhuang, China, terryssss111266@gmail.com
3 Shijiazhuang University of Economics, Shijiazhuang, China, 1151459210@qq.com
4 Shijiazhuang University of Economics, Shijiazhuang, China, shuxian1128@qq.com

ABSTRACT: Based on the result from the survey which carried out in Shijiazhuang University of Economics and the level of entrepreneurial qualities among the college students, this research analyses the level of college students’ entrepreneurial qualities in the area of knowledge, ability and psychology. The result shows that undergraduates’ entrepreneurial qualities are not optimistic due to the deficiency of knowledge structure, weakness in practice. Students have stronger passion for setting up their own business but they may be unrealistic in their planning. For these above problems, some corresponding suggestions for universities and undergraduates are provided.

Keywords: entrepreneurial qualities, college students, knowledge, ability

1. INTRODUCTION

Promoting the university students’ entrepreneurial intention is not only conducive to the expression of the value of the students, but also positively influences the national economic construction. However, new venture creation requires a wide range of supports, and students’ entrepreneurial qualities also play an important role. In academia, the study of entrepreneurial qualities has become a hot spot, and many scholars on the students’ entrepreneurial qualities are carried out into extensive researches. Having a deep understanding of college students’ evaluation of their entrepreneurial qualities could make us more objective understanding of students’ entrepreneurial qualities, and thus it may provide more useful references to the university education for entrepreneurship practice.

2. INTRODUCTION TO THE THEORY

2.1. Triadic reciprocal determinism

From the Bandura’s(1986) Self-Efficacy Theory, personal behaviour can be influenced by the external environment, previous experiences, and the cognition of the things around. Triadic reciprocal determinism[1] has three main factors composed by individual behaviour, the external environment and cognition, emotion and physiological events form within the individual factors. And the three factors affect and restrain each other, while people's cognition, from what we conclude, plays a decisive role. According to Bandura's Self-Efficacy Theory, for college students self-evaluation is based on their previous experiences and environmental factors[1]. Its own comprehensive judgment of the results from the students’ self-evaluation results which can objectively reflect the students’ strength of the actual qualities[2]. Therefore, that the survey data can reflect the objective facts is scientific and rational.

2.2. The theory of entrepreneurial qualities

Presently, the definitions of entrepreneurial qualities are not uniform in the academic. Barlow (2000), in the book of Small Enterprise put forward six characteristics of small businessman: the whole-heart devotion, hard-working, challenge acceptance, and a healthy body, self-control, originality adventure, as well as planning and coordination skills are also necessary[14]. Bing-zhang Zheng (2010) divided the entrepreneurial qualities into three large parts in the book of Business Management: the nature of personality and character, habits and attitudes, and the specialty of ability [3]. And the project team --"Win in China", [10] has put forward the conception of entrepreneurial qualities, that is, in the process of starting business, an outstanding business main body has to be equal to business task and achieving higher business performance with knowledge, skill, ability and peculiarity, etc. According to different scholars[3,5,6,7,8,10,11,13,14], we can divide the key qualities of entrepreneurs into the following aspects: the knowledge qualities, ability qualities and psychological qualities.

2.2.1. Knowledge qualities

Acquisition relevant knowledge is the basic condition since extensive and systematically business knowledge contributes to making right decisions.[12]

2.2.2. Ability qualities

Ability qualities mean that the key skills owned by the entrepreneurs, the overall capacity that an entrepreneur can succeed in doing their duties, which is transformed by a lot of experiences and knowledge. [12]

2.2.3. Psychological qualities

The psychological qualities mean that psychological conditions of the entrepreneurs. The specific performances are rich ideal, optimistic and confident, the sense of urgency, the courage to face risk, and a strong will, etc. As an entrepreneur, the person should have strong self-consciousness; his/her character should be persistent, strong, open, bright and decisive. Successful entrepreneurs can keep their composure when facing success and they do not feel negative and frustrated when facing failure. [9]
3. METHODOLOGY

3.1. Data sources

Firstly, we introduced the questionnaire made by the MIT, and then modified and improved the questionnaire according to the present situation of Chinese college students. After detected, the questionnaire had a high reliability and validity (Table 1).

<table>
<thead>
<tr>
<th>entrepreneurial qualities</th>
<th>questions</th>
<th>Cronbach α</th>
<th>test-retesting correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge qualities</td>
<td>10,11,12,13</td>
<td>.815</td>
<td>.809</td>
</tr>
<tr>
<td>Innovation ability</td>
<td>14,15,16,17</td>
<td>.735</td>
<td>.751</td>
</tr>
<tr>
<td>Coordination ability</td>
<td>18,19,20</td>
<td>.769</td>
<td>.774</td>
</tr>
<tr>
<td>Analysis and decision-making ability</td>
<td>21,22,23,24,25</td>
<td>.808</td>
<td>.804</td>
</tr>
<tr>
<td>Insight ability</td>
<td>26,27,28</td>
<td>.776</td>
<td>.785</td>
</tr>
<tr>
<td>Communication ability</td>
<td>29,30,31,32</td>
<td>.801</td>
<td>.813</td>
</tr>
<tr>
<td>Psychological qualities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurial propensity</td>
<td>33,34,35,36</td>
<td>.754</td>
<td>.789</td>
</tr>
<tr>
<td>Adventure consciousness</td>
<td>37,38,39,40</td>
<td>.683</td>
<td>.702</td>
</tr>
<tr>
<td>Team consciousness</td>
<td>41,42,43</td>
<td>.815</td>
<td>.833</td>
</tr>
<tr>
<td>achievement motivation</td>
<td>44,45,46</td>
<td>.796</td>
<td>.826</td>
</tr>
</tbody>
</table>

In this case, a large amount of electronic questionnaires were carried out among the students in Shijiazhuang University of Economics. There are 796 questionnaires are validated out of the total of 1004 questionnaires. The information from those 796 questionnaires can truly reflect the different respondents and attitudes, otherwise the rest cannot. In addition, the results of the survey have a strong representativeness, and it can reflect the students’ qualities in Shijiazhuang University of Economic.

3.2. Data processing

After the survey, we collected data of effective questionnaires, measured mathematical average scores on each part, got expectation of every measuring item, and then average those expected scores to get overall score. The higher score they got, the better qualities of evaluation they owned, and vice versa. Computation formulas are as follows:

\[ \text{score} = \frac{1}{n} \sum_{i=1}^{n} \left( \sum_{k=1}^{K} \text{score}_i \right) \]

where \( \text{score} \) means the score of first \( k \) qualities of the first \( i \) measurement; \( \text{score}_i \) means the score of first \( k \) qualities; \( n \) means the weight of \( 1 \sim 9 \); \( n \) means the number of the available questionnaire of first measuring has a score of; \( K \) means that how many measuring factors of the specific \( k \) we got; \( n \) means the number of total effective questionnaires.

4. THE ANALYSIS OF PRESENT SITUATION AND REASON

Table 2. Specific score of university students’ entrepreneurial qualities

<table>
<thead>
<tr>
<th>qualities</th>
<th>scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge qualities</td>
<td>4.85</td>
</tr>
<tr>
<td>Innovation ability</td>
<td>4.41</td>
</tr>
<tr>
<td>Coordination ability</td>
<td>4.52</td>
</tr>
<tr>
<td>Analysis and decision-making ability</td>
<td>4.74</td>
</tr>
<tr>
<td>Insight ability</td>
<td>4.74</td>
</tr>
<tr>
<td>Communication ability</td>
<td>4.89</td>
</tr>
<tr>
<td>Executive ability</td>
<td>5.23</td>
</tr>
<tr>
<td>Ability qualities</td>
<td></td>
</tr>
<tr>
<td>Entrepreneurial propensity</td>
<td>5.68</td>
</tr>
<tr>
<td>Adventure consciousness</td>
<td>5.75</td>
</tr>
<tr>
<td>Team consciousness</td>
<td>6.35</td>
</tr>
<tr>
<td>achievement motivation</td>
<td>6.45</td>
</tr>
</tbody>
</table>

By using SPSS software, the data was tested and shown in the table (the scores are between 1 - 9; 1 means the quality is poor and 9 means the quality is excellent, Table 2).

From the result, we can directly cognize college students’ evaluation on themselves. Next we analyze their qualities respectively and deeply, and find out the reasons from the analysis.

4.1. The knowledge qualities: they have the average level of know-how and lack of practical applications

Figure 1. As you learn about a principle, how often do you realize on your own that there are special cases when the principle does not hold up?

Entrepreneurial knowledge is a foundation and strongly demanded to business start-up. The score in the survey that students got in “Understanding what it takes to start one’s own business” is 5.47. “To write a clear and complete business plan” has a score of 4.19. “Estimating accurately the costs of running a new project or venture” has a score of 3.87. So from the data, we can see that students’ understanding of the necessary to start a career in terms of the score is not low, but the score of using knowledge to solve concrete work is lower. The first reason is the lack of knowledge to have adequate preparation by a student. The second reason is that even if students learned related knowledge before, they can’t comprehend completely due to the lack of combining theory with practice. In this way, knowledge cannot be used in practice. The figure below fully explains this view (figure 1), which indicates no more than 5% of the people used
knowledge solution to solve actual problems of high frequency, while for most students, it happens just a few times per month.

4.2. Ability qualities: overall level is not high, especially in some ways.

In terms of the ability qualities, the overall ability qualities is not high, especially on the innovation ability, and the coordination ability (the scores are between 1 - 9, 1 means the quality is poor and 9 means the quality is excellent, figure 2).

![Figure 2. Each ability qualities score chart](image)

4.2.1. **Innovation ability**

For a college student’s innovative ability, the ability of “Designing something new and innovative” achieves a score of 3.97. The ability of “Converting a useful scientific advance into a practical application” has a score of 3.81. “Coming up with an idea and method to start a business” achieves a score of 5.55. The data is sufficient to show that to a certain type of problems, Chinese college students tend to think of putting forward to a solution. But in some specific methods, such ability of applying to new fields is weak, which means the convergence qualities[4] are stronger while the divergent qualities are not enough. According to this phenomenon, we can find out the reason why some individuals are lack of transferable skills from the experience of the past of our students. From the figure(figure 3), we can see, students did little in innovation and designing ideas, but more in simple operations based on traditional methods.

![Figure 3. Have you created or built any of the following?](image)

4.2.2. **Coordination ability**

We got a score of 4.40 in “Getting two professionals from very different fields to understand each other’s point of view”. Also, “Solving the contradiction of the internal team” got a score of 5.13. The cause of conflict is usually that students for the same question often have different perspectives, and when struggling to achieve their goals, they often lost the interests of others. Facing the emotional conflicts in a team, Chinese university students have certain confidence in solving them, but when involving the professional knowledge, they feel their abilities are insufficient. The result from the survey shows that a higher emotional quotient can be found from students’ evaluation of themselves. But due to the lack of professional knowledge and experience, the college students still face a difficult situation to solve the conflicts by themselves.

4.2.3. **Analysis and decision-making ability**

The ability to “Solving the unstructured problems” has a score of 4.38. “Catching technical ideas and the limited conditions, and understanding the best way to use them” has a score of 4.26. “Identifying the tasks needed to solve unstructured questions” has a score of 4.70, which shows that Chinese college students’ divergent thinking is not strong and it attributed to the exam-oriented education which provide questions having a single answer for students. Meanwhile some exercise thinking are also guided by teachers, the students' divergent thinking can not be developed.
4.2.4. **Insight ability**

“Finding out when an idea is good enough to support a major business venture” and “Translated users' needs into requirements for a design so well that users will like the outcome” has a score of 4.55, “Recognizing a good opportunity when you see it” has a score of 5.11, which means that college students do not lack the vision to get an opportunity, but they are lack of the opportunity to practice. Thus students could not grasp the opportunities when they are coming. Compared with western college students, in China, most of the students spend their learning time in classroom, only concentrate on books, and rarely participate in social practice, causing the result to the failure in businesses.

4.2.5. **Communication ability**

“Reaching outside your organization to identify and network with new people to find help and advice” has a score of 5.57. “Working with a supplier to get a better price that helps a new venture become successful” has a score of 4.23. “Convincing a customer or client to try a new product for the first time” has a score of 4.88. We can see, Chinese university students’ overall communication ability is not that good. They like making friends. But once students involving the benefit, the ability immediately becomes weaker with the purpose of public relations.

4.2.6. **Executive ability**

Executive ability has a score of 5.23, above 5 points, showing that Chinese college students have stronger executive ability. As long as they have ideas, they will take the action. But considering that Chinese university student's pioneering work situation, we still hope college students can take the mature idea to start a business.

4.3. **Psychological qualities: the overall qualities are higher, the achievement desire is stronger.**

In figure 4, the scores are between 1 - 9, and 1 means the quality is poor and 9 means the quality is excellent.

**Figure 4.** Each psychological qualities score chart

4.3.1. **Entrepreneurial propensity**

In the test of entrepreneurial propensity, that the students think they can at least take a chance on the business achieves a score of 5.99, “Hoping to improve their ability in formal company” has a score of 6.33, and “Hoping to have the opportunity to join a new company” has a score of 6.50. The students think that even if they have not started the business before 30 years old, it is still very possible to start a business in later years and believe that they would have the chance to set up their own business. They not only want to improve themselves through the regular corporation with a big platform, but also want to keep every step in the start of a new company with more opportunities and challenges, however, they can not have both fish and bear at the same time. For the career planning, they must balance more.

4.3.2. **Achievement motive**

On the description of the achievement motive, “Hoping to get an honor” gets a score of 5.78, “Willing to make other aspects for wealth of sacrifice” has a score of 6.00, “Hoping to get high position in the company” has a score of 6.79, in the hope that “Their contribution and value be recognized” has a score of 7.10. From score of a college student on the wealth, position, the pursuit of personal honour, we can see that it is fully demonstrated that most college students’ business values, however, students want to pursue personal value, expecting their contributions can be known and strongly agreed by others. In the investigation of college students in completing their part-time jobs(figures 5). 57.84% of college students think their finishing results are well. And only 1.96% of college students said not well. From this, we can see the student have very strong working ability, but we should also realize that it is because most of them are a part-time physical labor or simple mental work, which cannot reflect the college students' labor value, this is also the reason for college students strongly eager to show themselves value.

**Figure 5.** In your work in business or industry, in general how well did you feel you had carried out the tasks and assignments you were given?
4.3.3. Adventure consciousness

In the subject, “High risk high return type of enterprise attracting students” has a score of 5.74, “Hoping to meet their challenged desire in the company” has a score of 6.11, “Thinking that establishment of a company is the best” has a score of 7.03. Very obvious, the student has a strong spirit of adventure, and not afraid of failure, and thinking that a failure will not affect their future. Adventure is not equal to the reckless. For these young students, they are impulsive, like the stimulus, but lack of experience, have a spirit like a born calves which are not afraid of the tiger, this spirit is valuable. To the young college students, failure may not be a bad thing, but if not consider practical situation, failure is inevitable.

4.3.4. Team consciousness

In the topic, “Caring about all the members feelings” gets a score of 5.76, “Ready to listen to others views” has a score of 6.11, “Thinking team work has stronger creativity than individual” gets a score of 6.59. From above, it can be seen clearly that these scores are relatively high. Hence we can see that Chinese college students are more concerned with team members’ feelings, ready to listen to others view, keen to team work. This is the indispensable to work in a team. Chinese university students have stronger team consciousness, which is related closely to the education system of China, Chinese education have more emphasis on harmonious, solidarity, team work education. These kinds of education strengthen students’ collective consciousness, but at the same time they also weaken students’ self-awareness.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

Through the analysis above, the university students’ enterprise qualities are not optimistic. Business knowledge is insufficient and the innovation ability level is not high. Although the students have a certain passion and spirit of adventure, business is not synonymous with gambling. Blind venture, is the common problem among college students’ entrepreneurs. At present, undergraduate school and graduated students in Chinese universities have a low rate of starting a business with a low rate of success, which has a big relation to the lack of entrepreneurial education in school. Because the Chinese government only started to realize the importance of entrepreneurial education recently, and started these kinds of education late as well. At present our country's business education is still at the primary stage and some universities’ business education ignores the basic work. Only holding a few lectures and several sessions of entrepreneurial competition are inadequate to train and stimulate the students' creative ability and entrepreneurial spirit. College students’ entrepreneurial education still stays in a superficial form, and not plays a significant role in training and improving students’ entrepreneurial qualities.

5.2. The related suggestions for college students

For college students, on one hand, they should strengthen the learning ability, and improve their knowledge structure. During the period of school, students should learn professional knowledge and expand more their own aspect of knowledge at the same time. It is necessary to make full use of the network and the school library.

On the other hand, they should dare to get to the society. They can exercise their practical ability in the society. During winter and summer vacation, students should test their ability in practice via companies in order to combine knowledge with practice, and achieve the purpose of the application

5.3. The advice to the school

College education should focus on the following three business foundations: the psychological education in the venture as a precursor, the business knowledge education as the main body, to cultivate creative ability for key, so as to cultivate a new social entrepreneurship. For Chinese university education, it is common to open entrepreneurial guidance curriculum recently and to hold business competition. However, what they do is still far from enough. Combined with the developed countries of the entrepreneurship education and China successful experience of some excellent universities’ business education. Our suggestions are as follows.

5.3.1. Integrate campus community resources, enhance business atmosphere

Each school has a lot of associations, such as entrepreneurs association, business war simulation association, and entrepreneurial lectures, the psychological consultation business plan competition. We can let them closely linked up to form a strong body, promote each other, and expand the scope of influence.

5.3.2. Penetrate venture courses to daily teaching work, making the students to accept business education in daily life

In the first place, school authorities should strengthen the teachers in understanding of the business and establish venture tutor team from the extraction of outstanding teachers’ resource which gives guidance to any business students with a more comprehensive implementation. Hire experts from enterprise companies, industry and commerce, taxation, finance bank areas to provide students related business knowledge and policies, and give students the opportunity to receive entrepreneurial training.

5.3.3. Introduction of social resources, establish business incubation garden

Most universities have their own characteristic disciplines, such as the geology exploration of Shijiazhuang University of Economics, the leather process of Sichuan University and the machinery manufacturing of Yanshan University. Colleges and universities should consider their characteristic discipline, make full use of this area industrial cluster resources, set up the college students’ business incubation bases, introduce good project, and provide platform for college students to start a business, which not only reduce the risk of university student's pioneering work, but also make the comprehensive strength for promotion.

6. REFERENCES

12. Xiaoming Ma, technological entrepreneurship: Entrepreneurs and entrepreneurial strategies, Xi'an University of Electronic Science and Technology Publishing House, 2010.04
TANDEM ECONOMIC DEVELOPMENT OF TWO REGIONS OR COUNTRIES

Ileana, Ciutacu¹ Iulian, Săvulescu² and Lumințița Mihaela, Dumitrașcu³
1 Economics Department, Academy of Economic Studies, Bucharest, Romania, ileana.ciutacu@gmail.com
2 Accounting Department, Academy of Economic Studies, Bucharest, Romania, savulescuiulian@yahoo.com
3 Accounting Department, Academy of Economic Studies, Bucharest, Romania, red_mille_ro@yahoo.com

ABSTRACT: In today's economy, one speaks mostly of regions than of countries, at least on European Union territory. So even if the territorial point of view is changing from the idea of countries to the idea or regions, the economic expectations remain the same: how much will that country/region grow and develop over time. The objective of this research is to see the way in which the economies of two regions develop in tandem over time and why. We plan to do this by designing and constructing an agent-based model that simulates a dummy world economy composed of two regions. Each region that can also be seen as a country has its own firms that produce goods and its own inhabitants who work for the firms and consume their goods. The two regions have their own currency, but 'do commerce' mainly through the movement of their inhabitants between them. In this research we chose to construct an agent-based model that simulates economic development and uses NetLogo programming language and interfaces, because of the advantages of this particular approach. Thus, after building the initial Netlogo model and simulating with it certain scenarios and examples of regional economies, by simply changing some variables any user can easily adapt it to other examples, real or not; do the simulations and obtain the desired number of development paths for his or her example. Thus, the result that we expect to obtain is creating agent-based model that can be used as a tool by policy-makers for seeing how different policies can affect or stimulate regional economic development.

Key words: economic development, regions, countries, firms, agent-based model, NetLogo

1. INTRODUCTION

In today's economy, one speaks mostly of regions than of countries, at least on the European Union's territory. Therefore, even if the territorial point of view is changing from the idea of countries to the idea or regions, the economic expectations remain the same: how much will that country or region, depending on the territory taken into consideration for the economic measurement, grow and develop over time. One of the problems here is the fact that when we measure the growth or the development of a country or a region, we tend to do that separately, a separate measurement for each and every single country or region. We rarely do this kind of measurements taking into consideration the whole picture, here being the global economy, or to be more precise, both of the or all the regions or countries that we are studying.

The authors of a recent research, [3] say that “the purpose of the environment created by humankind is the expression of the wisdom based on love, authentic knowledge and faith to underline through and for the benefit of people the potential energies of this world following the win-win rule”. Their paper also says that “so far as we coexist and humankind succeeds generation after generation, any gain, be it of a person, family, organization, community etc. should not be the expression of any energy loss of other subsystems we integrate ourselves with. Thus, for example “when the economic wins the natural shouldn't lose beyond the capacity of the homeostasis to dynamically self-balance”. This means that all the countries and regions are part of a big unique system. They are all interconnected, can't be separated one from the other and give the system the ability to dynamically self-balance. Meaning that, for example if a country wins economically because it sells some of its products in another country, but the products aren't particularly healthy, the country where the first country's products are buyed will lose through its population, because those people can get sick. Therefore, it is best to see the economic growth and development of two or more countries or regions in a tandem, because like this we, the stockholders, the policymakers etc. can see if the economic relationships and not only them, lead to a win-win situation.

Because of its ability to offer a more complex and complete picture of a real situation in which there are more than two entities involved, we chose to use agent-based modeling and the program NetLogo and create an agent-based model (ABM). According to [2], for developing ABMs there were created numerous computer programs and one of these is the one built in 1999 by Uri Wilensky and developed over time at the Center for Connected Learning and Computer-Based Modeling of the Northwestern University, and another is developed in [1]. Be we will talk in this paper about the first one [5]. NetLogo is the successor of multi-agent modelling languages like StarLogo or StarLogoT and can run as a standalone application on the Java virtual machine of computers that use Mackintosh, Windows, Linux etc. platforms.“When using NetLogo, the creator of the agent based model uses a special programming language that allows him to define an environment for simulating natural and social phenomena by using four type of entities: turtles (mobile agents), patches (static agents), links and the observer. These agents can be part of populations that can number up to thousands, operate independently in an artificial 2D or 3D world using predefined rules and instructions. This characteristic of NetLogo makes it possible to explore the connection between the micro-level behavior of individuals and the macro-level patterns that emerge from their interactions”. [2]
2. THE MODEL

As we previously said, for accomplishing the purpose of this paper, we chose to design and built an ABM. The model we created in this paper is based on [4], as is [2]’s simple economy model, but this paper’s ABM is an improvement of [2]’s ABM.

While [4]’s model studies the evolution of two populations that form a prey-predator system: sheep and wolves, [2]’s simple economy model researches an artificial world inhabited by two types of NetLogo turtles: firms and men. The currency of this simple economy is energy and the firms as well as the men use it. The firms produce goods that are consumed by the men for gaining energy, reproducing themselves and surviving. The men, the only agents of this ABM that can move during a simulation, thus giving the world its dynamics by getting jobs and consuming goods can be employed by the firms.

Similar to the previous models, our ABM has more than one prey-predator systems and is also an economical model, but a more complex one. The model we created simulates the economic development of two dummy regions, the Orange region and the Green region, that develop in tandem over time in our artificial NetLogo world. Each region that can be seen also as a country, has its own firms that produce goods and its own inhabitants who work for the firms and consume the goods produced by the firms. The two regions have their own currency, but ‘do commerce’ mainly through the movement of their inhabitants between the regions. Here also, the currency of the world is energy, the difference between the regions’ currencies is that the initial levels of energy and energy gains or losses is one in the Orange region and another in the Green one.

To be more precise, this is the description of our model:

• The world:
  • Is a 71 per 71 patches square with two 35 per 71 patches regions and a 1 patch borderline. The Orange region is on the left and its economy is mainly industrial, while the Green region is on the right and its economy is mainly agricultural.
  • The currency of this world is energy, but the levels of energy from the two regions are different.
  • In our world we can have two situations that can block arriving to a win-win situation and these are when one or both the regions decide to discriminate the other region’s immigrant workers, and the other or both regions decide to impose an embargo on the other region and thus affect its firms, people and economy. These situations can also be combined.
  • The time of our model is measured in ticks, with one tick being the time needed by a turtle to move from a patch to the one near to it.
  • Our model has 10 breeds of turtles, 5 for the Orange region, and 5 for the Green region: one breed of men, two of enterprises and two of products, one produced by the enterprises and the other produced by nature.
  • The men:
    • The men in the Orange region are the workers. They work in factories and produce industrial goods that we choose to name bottles. The men in the Green region are farmers, work in farms and produce agricultural goods that we choose to name plants.
    • Both workers and farmers have different energy levels at the beginning of a world. This shows that in our model, as in reality, people don't have the same resources when they are born, but some are rich, some are poor, some are beautiful, some not, a part are very smart and the other are stupid.
  • With every step they take, our workers and farmers lose 1 energy unit out of their initial energy level. But because in their movement they can encounter firms or products, they can get one tick lasting jobs when encountering a firm, or eat goods produced by the firms or by nature when they encounter them.
  • Both the workers and the farmers can become entrepreneurs if they have a certain level of energy and they encounter another agent of the same breed, meaning worker-farmer, farmer-farmer. In the moment the workers or farmers become entrepreneurs, they stop in the place they created their firm.
  • The men can reproduce themselves when the odds allow then, meaning that the random number chosen by the computer is smaller than the value of the sliders W_reproduce? and A_reproduce?, and when their energy level is bigger than 50 energy units. When they reproduce, the men lose ¼ of the energy level they have in that moment. The agent they “give birth” to has the same characteristics as them.
  • The workers and farmers die and exit our ABM when their energy level is smaller than 0.
• The firms and farms:
  • The Orange region has as enterprises firms, while the Green region has farms. Both type of economic organizations have their own levels of energy that decrease when they produce goods or hire people, because they have to pay the price of resources and labour in energy, and that increases when they sell a good (a man eats it) or receive the labour form the men they hire.
  • If there's an embargo imposed by the Orange region over the Green region's exported products, then no green products will reach the Orange country.
  • Both the firms and the farms produce a different number of products every time, according to their resources and the odds meaning that the random number chosen by the computer is smaller than the value of the sliders Fi_produce? and Fa_produce?.
  • The farms and firms produced by two workers or farmers that encounter themselves, have the energy level bigger that that indicated by the sliders Fi_entrep? and Fa_entrep? have the same characteristics as the regular firms and farms, just that their energy level might be smaller, because these enterprises receive a part of the energy of their entrepreneurs.
  • The firms and farms “die” when their energy level is smaller than 60 energy units, while the firms and farms started by the worker and farmer entrepreneurs “die” when their energy level is smaller than 40 energy units.
  • The goods:
    • The Green region has two types of goods, just like the Orange one. All the goods have a due term date, meaning that after a number of ticks that is set by the user through a slider, they “die” and exit this ABM. This is similar with reality, because all the products have a limited period when they can be consumed safely, after this they either disintegrate or aren't any more healthy for humans.
  • With every step they take, our workers and farmers lose 1 energy unit out of their initial energy level. But because in their movement they can encounter firms or products, they can get one tick lasting jobs when encountering a firm, or eat goods produced by the firms or by nature when they encounter them.
  • Both the workers and the farmers can become entrepreneurs if they have a certain level of energy and they encounter another agent of the same breed, meaning worker-farmer, farmer-farmer. In the moment the workers or farmers become entrepreneurs, they stop in the place they created their firm.
  • The men can reproduce themselves when the odds allow then, meaning that the random number chosen by the computer is smaller than the value of the sliders W_reproduce? and A_reproduce?, and when their energy level is bigger than 50 energy units. When they reproduce, the men lose ¼ of the energy level they have in that moment. The agent they “give birth” to has the same characteristics as them.
  • The workers and farmers die and exit our ABM when their energy level is smaller than 0.
• The firms and farms:
  • The Orange region has as enterprises firms, while the Green region has farms. Both type of economic organizations have their own levels of energy that decrease when they produce goods or hire people, because they have to pay the price of resources and labour in energy, and that increases when they sell a good (a man eats it) or receive the labour form the men they hire.
  • If there's an embargo imposed by the Orange region over the Green region's exported products, then no green products will reach the Orange country.
  • Both the firms and the farms produce a different number of products every time, according to their resources and the odds meaning that the random number chosen by the computer is smaller than the value of the sliders Fi_produce? and Fa_produce?.
  • The farms and firms produced by two workers or farmers that encounter themselves, have the energy level bigger that that indicated by the sliders Fi_entrep? and Fa_entrep? have the same characteristics as the regular firms and farms, just that their energy level might be smaller, because these enterprises receive a part of the energy of their entrepreneurs.
  • The firms and farms “die” when their energy level is smaller than 60 energy units, while the firms and farms started by the worker and farmer entrepreneurs “die” when their energy level is smaller than 40 energy units.
• The goods:
  • The Green region has two types of goods, just like the Orange one. All the goods have a due term date, meaning that after a number of ticks that is set by the user through a slider, they “die” and exit this ABM. This is similar with reality, because all the products have a limited period when they can be consumed safely, after this they either disintegrate or aren't any more healthy for humans.

2.1. Preparing the model and setting the scenarios

We will suppose that the economies of the two regions we present here are open economies. Thus we will set a seed number (288838312), that will help us for seeding the random number generator of our ABM and thus repeat the same experiment in different scenarios that we will run for 300 ticks. For these simulations we will have 349 workers that will have a probability of 13% to reproduce themselves and one of 10%
to become entrepreneurs if they have a energy level bigger than 57 energy units, 323 farmers that will have a probability of 14% to reproduce themselves and one of 15% to become entrepreneurs if their energy level is bigger than 47 energy units, 18 firms that will produce a maximum of 10 bottles per tick with the probability of 11%, 20 farms that will produce a maximum of 9 plants with a probability of 9%. The code of this model, that can be seen in figure 1, can be given by the authors on request.

The scenarios we will run with our ABM are the following: What happens with the two regions when:

1. There isn't any discrimination and the firms and farms are allowed to sell their products abroad (no embargo).
2. The farmers are discriminated.
3. The workers are discriminated.
4. The firms aren't allowed to sell their products abroad (full embargo).

The way our NetLogo model looks and the results of the 1st scenario can be seen in figure 1:

- First scenario's (“There isn't any discrimination, nor embargo.”) results: After running the model for 300 ticks with no discrimination nor embargo, the graph (Fig. no. 1) shows us that in the first 20-30 ticks there was a population boom, both the number of workers reaching 441 agents, while that of farmers reached 371 agents from 323. The number of products was at first bigger in the Orange region, however, because the number of firms decreased slowly to 0 in the 153rd tick, the number of apples was more constant while that of farms decreased to 16 in the 300th tick, from 20 at the beginning of the run.

- Second scenario's (“The farmers are discriminated.”) results: After running the model for 300 ticks with discrimination from the Orange region towards farmers, the graph (Fig. no. 2) shows us that during this run also we had a population boom with a maximum of 437 workers in the 3rd tick, and 358 farmers in the 3rd tick as well. Even if the farmers were discriminated, the products of the farms were produced with a constant ratio until the end of the 300th tick. The bottles were produced only until the 154th tick when only one firm remained on the market, but it didn't have the resources needed in order to produce or hire men. During this scenario there were a few farmers that became entrepreneurs and a few workers as well. The graph with the results of the second scenario can be seen in figure 2.

- Third scenario (“The workers are discriminated.”) results: During this run there was as well a population boom in the 4th tick with 425 workers and 360 farmers, but in the 56th tick, there were no more workers left in our NetLogo world. The same problem that we've saw in both the first and second scenario is the abrupt population decrease from the 10th tick till the end of the simulation. However, again, the number of bottles reached 0 halfway our simulation, while that of plants had a relatively constant evolution. What is interesting about this run is the fact that in the 22nd tick, there were on the market a maximum of 43 firms started by workers that became entrepreneurs. The results of this run can be seen in figure 3.

- Fourth scenario's (“full embargo for the firms”) results: During this run we had as well, a population boom in the 4th tick with 429 workers and 364 farmers that was followed by a rapid decrease for both populations. But there is something interesting about this scenario, because is the only one that shows an increase in the number of farmers after the 56th tick with 425 farmers and 360 farmers, but in the 56th tick, there were no more workers left in our NetLogo world. The same problem that we've saw in both the first and second scenario is the abrupt population decrease from the 10th tick till the end of the simulation. However, again, the number of bottles reached 0 halfway our simulation, while that of plants had a relatively constant evolution. What is interesting about this run is the fact that in the 22nd tick, there were on the market a maximum of 43 firms started by workers that became entrepreneurs. The results of this run can be seen in figure 3.

Figure 1. The NetLogo model and the first scenario’s results

Figure 2. The second scenario's results.

Figure 3. The third scenario's results.

5. The farms aren't allowed to sell their products abroad (full embargo).

The way our NetLogo model looks and the results of the 1st scenario can be seen in figure 1:

- First scenario's (“There isn't any discrimination, nor embargo.”) results: After running the model for 300 ticks with no discrimination nor embargo, the graph (Fig. no. 1) shows us that in the first 20-30 ticks there was a population boom, both the number of workers reaching 441 agents, while that of farmers reached 371 agents from 323. The number of products was at first bigger in the Orange region, however, because the number of firms decreased slowly to 0 in the 153rd tick, the number of apples was more constant while that of farms decreased to 16 in the 300th tick, from 20 at the beginning of the run.
104th tick. The number of plants is as in the previous scenarios, almost constant during all the run, while the bottles have a very interesting evolution. Even if the number of firms decreases to the entire disappearance of firms from our NetLogo world, bottles were produced until the 295th tick. During this run there were no firms, nor farms started by entrepreneur workers or farmers. The results of the fourth scenario can be seen in figure 5.

**Figure 4.** The fourth scenario's results.

- Fifth scenario's ("full embargo for the farms") results: During this run there was the usual population boom with a peak of 442 workers and 366 farmers in the 7th tick. Both the number of firms and farms decreased until the end of the 300 ticks, but the interesting thing is that even if there was an embargo for the farms and they couldn't export their products in the Orange region, in the last tick there were 18 farms and only 1 firm. Another interesting feature of this scenario is the fact that again, the number of plants that were produced was relatively constant, with a peak of 48 plants in the 225th tick, and with 18 in the 300th. In this run, we had no farms that were started by entrepreneur farmers, but only entrepreneur workers that started a maximum of 29 firms in the 22nd tick. The results of the last run can be seen in figure 5.

**Figure 5.** The fifth scenario's results.

### 3. CONCLUSIONS

If we should try to explain a real situation that was modelled in these 5 scenarios, we can say that the abrupt decrease of workers and farmers in the first 2 to 20 ticks might be the cause of a very contagious disease that kills men. But this is not the case, so this model should be revised and verified in order to balance the results of the runs. However, until this model will be revised and its result presented in another paper, we have to observe that the economic development of our two NetLogo regions is as we imagined, in tandem, meaning that the decisions from the Orange region affect the Green region and vice-versa. This can be best seen in the second and fifth scenarios because, even if the farmers and the Green region's exports were discriminated and put under an embargo, the bottles, firms and workers were those that disappeared from the NetLogo tandem economic regional model, not the plants, farms and farmers. So we can say that if we consider that the 300 ticks as long term the bad decisions the Orange region took against the Green region and its agents, boomeranged back at it. The same thing happened for the firms too, because the scenario where their exports were embargoed by the Green region, was the most prolific for the bottles, that were produced in a bigger number than that of the plants.

All these being said we will conclude by stressing that the best scenario for both regions was the first one, because it followed the win-win rule with small differences between the firms and farms, the workers and farmers and the bottles and plants production. Therefore, the world we live in with all its component systems is a bigger system with all its parts interconnected and because of this the best way to evaluate the development of a region or country is in tandem with at least another region or country with which it exchanges goods, labour force or capital.

### 4. AKNOLEDGEMENTS

This article was written as part of the project “Doctorat în economie la standardele Europei Cunoaşterii (DoEsEc)” POSDRU/88/1.5./S/55287. Project co-financed by The European Social fund through POS-DRU 2007-2013 and implemented by the Bucharest Academy of Economic Studies in partnership with the Western University of Timişoara.

A sincere welcome to professor Florin Munteanu and to the entire team the Bucharest Center for Complex Studies.

### 5. REFERENCES


ABSTRACT: The purpose of this paper is to see the situation regarding the indicators from the Sustainability Reports. For this we use a qualitative research, a content analysis of these reports. Our sample is composed by the banks that develop their activity in our country for which we analysed the last year reports at group level. We choose only an industry sector to obtain the homogeneity of the sample. The findings reveal a number of 86 indicators, which were used in these reports. We analyzed the Global Reporting Initiative (GRI) indicators used by 12 companies. The most reported indicators are EN4, EN8, LA1, LA10, while the last reported indicators are E5, E10 E13 E15, EN20, EN21, EN23, EN27, HR9, HR10. The results obtained are important for future research in this area, for both managers and researchers.

Key words: corporate sustainability, banking sector, Global Reporting Initiative

1. INTRODUCTION

Corporate social responsibility and sustainability issues are more and more present in day by day activity of the organizations. So, we can see the companies give importance to these issues and elaborate reports in this regard, like guidelines, because these have a voluntary nature. Organizations take into account the most representative one, the Global Reporting Initiative (GRI, 2006). It contains indicators grouped in economical, environmental, performance, social (labour practices, human rights, society, and product responsibility) indicators (GRI, 2006).

In our demarche we start with a brief literature review regarding the corporate economic, social, environmental responsibility aspects, followed by the description of the research methodology. After these we present the results and some discussions, accompanied by conclusions and future research.

2. THE LITERATURE REVIEW

The notion of sustainability is about ensuring a balanced scale related to the social, environmental and economic aspects. (Figge and Hahn, 2004). An organization whose activity is considering aspects of sustainable development will act in this sense on long term. Sustainability was first mentioned by the World Commission on Environment and Development (1987).

Taking responsibility for its impact on society means, first, that an organization accounts for its actions. Social accountability (Brenman and Solomon 2008), a concept that describes the communication of the social and the environmental effects of the actions of an organization by its stakeholders, is an important element of social responsibility. Many companies publish externally audited annual reports covering sustainable development issues, reports which vary widely in format, style and methodology of evaluation, even within the same industry. (Cheung 2011, Lo and Sheu 2007, Lopez et al. 2007).

There is a very fine line between corporate governance, corporate social responsibility and sustainability. All are extremely important for a company and should not be viewed separately. Responsibility for society is a strong differentiating factor for companies, with implications on sustainable development of society. Social responsibility actions, on short-term, include costs for the organization, but on long term they bring a win-win-win relationship, if we try to look beyond the numbers. Social responsibility is not a necessity, is an important economically, ecologically, and socially obligation.

There are some relevant studies on corporate economical, social, environmental responsibility and sustainability issues. Some authors like Ratanajongkol et al. (2006), Cooke (1989), Deegang and Gordon (1996) highlights that these indicators are undisclosed. Proper management of human resources, sustainable development progress, leading to the increase of the income through the increase of the productivity, which is focused on lowering costs. The notion of corporate sustainability performance measurement has been discussed, among others, by Atkinson (2000) Beloff et al. (2004), Schwarz et al. (2002), Szekely and Knirsch (2005), Tanzil and Beloff (2006). The social or environmental issues can have an influence on economic performance and therefore should be a dialogue with stakeholders to be in constant interaction with the way they develop their activity. A number of publications have focused specifically on the balanced scorecard approach to performance measurement (Hubbard 2009, Schaltegger and
3. METHODOLOGY

Regarding the research methodology, our question is: “what indicators are currently being disclosed in corporate sustainability reports?” To address this question, a total number of 12 banking companies’ corporate sustainability reports, at group level, were identified and analyzed in content. We considered the last reports which were published on their websites.

4. RESULTS AND DISCUSSIONS

The Global Reporting Initiative (GRI), originally started by CERES (Coalition for Environmentally Responsible Economies) and UNEP (United Nations Environment Programme), is an independent multi-stakeholder initiative, which has developed guidelines for sustainability reporting. The GRI guidelines set out reporting principles as well as specific content for the sustainability report. They structure sustainability reporting in terms of economic, ecological and social performance (also known as the “triple bottom line”). GRI reporting is based on eleven principles like: transparency, inclusiveness, auditability, completeness, relevance, sustainability context, accuracy, neutrality, comparability, clarity, timeliness: regular publication of reports.

There are different names to refer to the sustainability reports and also their length varies. This variety denotes the lack of agreement on disclosure of this information.

Table 1. Types and length of reports from the sample

<table>
<thead>
<tr>
<th>No</th>
<th>Type of report</th>
<th>Number of reports</th>
<th>Maximum length</th>
<th>Minimum length</th>
<th>Mean length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Citizenship Report</td>
<td>1</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>2</td>
<td>Corporate Social Responsibility Report</td>
<td>8</td>
<td>180</td>
<td>38</td>
<td>109</td>
</tr>
<tr>
<td>3</td>
<td>Sustainability Report</td>
<td>1</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>Summary</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

We split the indicators into 3 main categories (regarding the triple bottom line). The number of indicators for each category is illustrated in the figure below:

Table 2. Number of indicators and indicator category

<table>
<thead>
<tr>
<th>No</th>
<th>Indicator Category</th>
<th>Number of indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EC Economic</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>EN Environment</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>LA Labor Practices and descent work</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>HR Human Rights</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>SO Society</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>PR Product and service</td>
<td>9</td>
</tr>
</tbody>
</table>

The Citizenship Report, the Corporate Social Responsibility Report, the Sustainability Report highlight more environmental indicators than the others. The environmental category was by far the most represented with 29 indicators, followed by the financial category.

In terms of economic performance, it can be easily measured using internationally accepted indicators. Also, environmental performance is measured by studying the report used resources-results, while social performance is more difficult to calculate. It must be exceeded the threshold under which the concept remains at a philosophical approach stage (determined by the lack of applicability) and recognized that it can be managed properly, becoming a catalyst for sustainability. Managing social responsibility in corporate governance should be viewed as a win-win-win strategy on long term. In U.S.A. corporate social responsibility has a voluntary nature. At European level there are specific settlements, while in Romania we can see the translations of the international organizations corporate social responsibility, without deep involvement.

Michael Porter and Mark Kramer (2002), noted that “in the long run…social and economic goals are not inherently conflicting but integrally connected” (p. 5). They see a symbiosis between economic/social investments/returns, more exactly organizations must focus on that actions that bring benefits both for them and for society.

5. CONCLUSIONS

The 12 corporations studied disclosed a total number of 95 different indicators. The research highlights that all companies from our sample reported on all three areas of the triple bottom line. These findings support the affirmation of Brown et al.’s (2009a) who said that the GRI is becoming an established institution.

Many companies do not communicate about their activities on responsibility. Some do not want to believe that praise or that use a marketing trick. Others believe that a communication relating to social responsibility is the exclusive domain of corporations. And for others, responsible business is something so natural that it never occurred to talk about it. In fact, letting
people know what a company does in socially responsible activity, is provided information that they need about company values, products and services are offered on the market.

As a method of promoting information on the organization’s social responsibility involvement is the preparation and the publication of the social responsibility reports, which must ensure reasonable representation of the performance of the organization, including the positive and the negative aspects. Reporting is an integral part of involving stakeholders in the interaction process. The Corporate Social Responsibility Report forms are: free report (leaflets with information about actions taken by the company), triple bottom line report (includes economic, social and environmental indicators), standardized report (AA1000, SA8000, GRI, etc.).

The results of the research highlights the use of the corporate sustainability indicators in practice and can be a basis for further research in this respect, which can be continued with some in depth questionnaire interview to explain how were selected, how are used, how they evolved etc. The main conclusion of this study is that the indicators disclosed are very diverse and because of this is a bit difficult to elaborate a standard set of indicators.

6. ACKNOWLEDGEMENTS

This article was elaborated in the PhD project in Europe Knowledge Economy Standards, DoEsEC., Financed by the European Union and co-financed by European Social Fund Operational Programme Human Resources Development 2007-2013 in collaboration with the Academy of Economic Studies.

Appendix 1. The sample

<table>
<thead>
<tr>
<th>NO</th>
<th>COMPANY</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ALPHA BANK GROUP</td>
<td>GREECE</td>
</tr>
<tr>
<td>2</td>
<td>BAYERN LB – MKB</td>
<td>HUNGARY</td>
</tr>
<tr>
<td>3</td>
<td>CITI GROUP</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>4</td>
<td>CREDIT AGRICOLE GROUP</td>
<td>FRANCE</td>
</tr>
<tr>
<td>5</td>
<td>ING GROUP</td>
<td>NETHERLANDS</td>
</tr>
<tr>
<td>6</td>
<td>LA CAIXA GROUP</td>
<td>BARCELONA</td>
</tr>
<tr>
<td>7</td>
<td>LEUMI BANK</td>
<td>ISRAEL</td>
</tr>
<tr>
<td>8</td>
<td>NBG GROUP</td>
<td>GREECE</td>
</tr>
<tr>
<td>9</td>
<td>OTP BANK GROUP</td>
<td>HUNGARY</td>
</tr>
<tr>
<td>10</td>
<td>PIRAEUS BANK GROUP</td>
<td>GREECE</td>
</tr>
</tbody>
</table>

7. REFERENCES

society relations. *Journal of Business Ethics*, 61, pp. 263–281


A COMPLEX PERSPECTIVE OF SOCIAL AUDIT IN CORPORATE GOVERNANCE

Mihaela, Dumitrascu\textsuperscript{1} Ileana Ciutacu\textsuperscript{2} and Iulian, Savulescu\textsuperscript{3}

1 Accounting Department, Academy of Economic Studies, Bucharest, Romania, red_mille_ro@yahoo.com
2 Economics Department, Academy of Economic Studies, Bucharest, Romania, ileana.ciutacu@gmail.com
3 Accounting Department, Academy of Economic Studies, Bucharest, Romania, savulescuialian@yahoo.com

ABSTRACT: The social audit is interconnected with the corporate governance and contributes to the increase of the trust and transparency between stakeholders. Social audit aims to analyze social factors and how an organization can contribute to the improvement of its activity. Also it involves analyzing the environment in which the organization operates and how it can help to maintain or even improve it. The contribution of this paper is focused on a qualitative research on social practices within NGOs and banking institutions. There is a limited number of studies in this sense in the literature, because is quite difficult to exist a homogeneous image of a domain rather heterogeneous. The present study follows to build an image, accompanied by examples of socially responsible practices We realized a list with the issues related to social responsibility, with specific examples to argument this aspect.

Key words: social audit, corporate governance, NGO, banks, social responsibility

1. INTRODUCTION

A social audit is that activity which can improve the companies’ social performance. It helps to measure, verify, understand and improve the companies’ social performance. The social audit is interconnected with the corporate governance and contributes to the increase of the trust and transparency between stakeholders. Social audit aims to analyze social factors and how an organization can contribute to the improvement of its activity. Also it involves analyzing the environment in which the organization operates and how it can help to maintain or even improve it.

The social audit takes into account the social-environmental impact through the resources that the organization uses. There are a lot of arguments for or against corporate social responsibility [9, 10]. We can look at costs and benefits regarding corporate social responsibility [11, 12] like increase performance of the employees or other long term benefits.

2. THE CORPORATE GOVERNANCE AND SOCIAL AUDIT, A COMPLEX ADAPTIVE SYSTEM

Believe it or not, all the parts of this world are interconnected one with another and can’t be separated without losing important features, characteristics, behaviours etc. Thus, for a better understanding of the subjects developed we should look at them both from the inside, as observe them from the outside using all the appropriate methodologies and measuring systems humankind invented until now. This perspective comes from complexity science, a new approach of explaining the environment outside every human being, that sees the world and its elements as a fractal which is iterated (an interaction means repeating the same rule over and over again) with complex adaptive systems.

Thus, the entire world is a complex adaptive system which is formed out of parts which are complex adaptive systems of their own. These parts have a similar structure to the whole and as well as the whole initial complex adaptive system, are formed out of smaller complex adaptive systems of their own. So the world, be it seen from a social, political, economic et cetera, point of view is a fractal in which every iteration or new layer of the fractal is a brand new complex adaptive system that is in the same time a part of a bigger complex adaptive system. We used two terms that some of the readers of this paper might not know, so first of all we should explain what a fractal and a complex adaptive system are.

What is a fractal? [1] A fractal is a “mathematical set that has a fractal dimension that usually exceeds its topological dimension and may fall between the integers, meaning that for example its dimension can be 1,79 instead of 1 or 2. The fractal dimension is also known as the housdorff-besicovitch dimension, after the names of the scientists that developed this measurement methodology. Fractals are typically self-similar patterns, where self-similar means they are ‘the same from near as from far’, thus, they may be exactly the same at every scale or they may be nearly the same at different scales. The definition of fractal goes beyond self-similarity per se to exclude trivial self-similarity and include the idea of a detailed pattern repeating itself.” A repetition of that particular detailed pattern that renews itself over and over thus creating a fractal is, what we will further call a fractal iteration. This being explained we can say that we now understand what a fractal is, but what is a complex adaptive system? [2] A complex system is a system composed of interconnected parts that as a whole exhibit one or more properties that are not obvious from the properties of the individual parts. The complexity of a system may appear in two forms: disorganized or organized. Disorganized complexity is a matter of a very large number of parts, while organized complexity is a matter of the subject system that exhibits emergent properties. Many systems that are of interest to human kind are complex systems and for a few of these complexity models were developed. These systems include ant colonies, human economies and social structures, the climate, nervous systems, cells and other living things including human beings, as well as modern energy or telecommunication infrastructures. Complex systems are
studied by many areas of mathematics, social science and natural science, while the fields that specialize in the interdisciplinary study of complex systems include cybernetics, systems ecology, systems theory and complexity theory.”

A special type of complex systems are complex adaptive systems or for short CAS. These types of systems are complex because they are diverse and made up of multiple interconnected elements, and they are adaptive because they have the capacity to change and learn from experience. “Examples of complex adaptive systems include the stock market, social insect and ant colonies, the biosphere and the ecosystem, the brain and the immune system, the cell and the developing embryo, manufacturing businesses and any human social group-based endeavour in a cultural and social system such as political parties or communities. This includes some large-scale online systems, such as collaborative tagging or social bookmarking systems” [2]

Because now we understand what CASs are, we can talk a bit about social audit, corporate social responsibility and corporate governance. In today's world, the great majority of firms, enterprises, corporations and organizations produce goods or different services with the sole main goal of obtaining big profits of money. This is an unfortunate objective because a different services with the sole main goal of obtaining big profits of money profit, but with equal amounts of negative externalities. Therefore, humankind and its economists have not accepted as scientific, this reality was too big for economists not to notice, so they gave it a name and theorized it in economics as negative externalities. There also exist positive externalities, and this occur for example when a person eats more citric or gets an anti flu vaccine in the cold season and because of this 75% of the people he/she gets in contact with every day don't get the flu in that season. And because negative externalities must be cured in a way or another by the firms producing them, a new field appeared in economics and this is corporate governance. This field sets the rules by which every firm should compete with other firms, produce its goods, acquire its resources (labour, prime materials, know-how, technologies etc.), obtain its profits. Thus, the firms can be observed easier by the stockholders (shareholders, government, financial institutions, social institutions, population etc.) and negative externalities can be diminished. Unfortunately, even after the firms have "passed" through corporate governance there are still lots of cases where firms produce great amounts of money profit, but with equal amounts of negative externalities. Therefore, humankind and its economists have created another field as a cure for this: corporate social responsibility. This field means that all the firms should be responsible towards society and diminish the negative externalities they produce by doing this with impact on the social, natural, political or economical environment which bring some balance to all these CASs.

Some elements of social activity are analyzed from the perspective of financial audit as to reduce the risk of material misstatement due to non-compliance of environmental norms. Accountant is required to investigate these issues relating to social audit. Such organizations in sectors like petroleum, construction, production and processing of raw materials are at high risk of environmental pollution. Information should be compared with those from previous years to determine a trend and a potential risk in the activity. Social auditor should formulate specific recommendations for improving the quality of human resource management. Social auditor can also be achieved through service by an external auditor. Organizational structure is located between management and shareholders or between management and other departments. The audit plan is made after the auditor has discussed with management and social work departments impact on the entity. In determining the audit plan should be established for the audit period, the number of people with adequate knowledge and participating in the audit departments where they will perform audit tests. Purpose of social audit is to issue a report on internal social audit recommendations. Before issuing internal audit office report discussing with management to analyze which recommendations can be improved before issuing the report.

3. METHODOLOGY

The contribution of this paper is focused on a qualitative research on social practices within NGOs and banking institutions. There is a limited number of studies in this sense in the literature, because is quite difficult to exist a homogeneous image of a domain rather heterogeneous. The present study follows to build an image, accompanied by examples of socially responsible practices We realized a list with the issues related to social responsibility, with specific examples to argument this aspect. Were analyzed, the Corporate Social Responsibility Reports and other relevant information from their sites.

4. RESEARCH

The Corporate Governance Code of the Bucharest Stock Exchange on Art 9 specifies about Corporate Social Responsibility. Companies should encourage financial activities that create wealth, jobs and sustainability. The listed companies must show concern for nature and for environment. They will also pay more attention to employees, employee representatives, unions and other types of entities such as lenders, consumers, investors in implementing corporate social responsibility practices. Institutions listed on the Bucharest Stock Exchange are required to include in its annual report a section entitled Corporate Social Responsibility. The activities supported by companies listed on the BSE include: funding of governmental organizations on supporting education, tourism, sport, rehabilitation of disaster areas, ecological areas, about helping people with disabilities, art and more

Usually corporate social responsibility is saved for the firms, enterprises, corporations and multinational firms because these organizations are those that in their search for profit produce negative externalities. But these are not the only organizations that try to balance and even cure the negative externalities that humankind produces within its environments, because this is the same purpose that most of the nongovernmental organizations (NGOs) have. NGOs can be specialized on social, environmental, cultural, political, economical issues, and by their actions balance on short, medium or even long term the negative externalities that different firms, the economy and society has on society and the environment. NGOs can be formed out of just a few persons, like in the case of the NGOs formed at local or regional level, up to a few thousands persons, like in the case of “multinational” NGOs like UNESCO or UNICEF are. According to The World Association of Nongovernmental Organizations (WANGO) website, in this moment there are over 52,000 NGOs in the world, from which about 16,000 only in Europe. Of course these numbers are only the top of the iceberg, because according to an article of the Indian Express [4] in 2009 only in India there were over 3.3 millions NGOs. From Romania, over 211 NGOs are WANGO members [3].

588
One first example of how these NGOs try to balance the CASs that we live in Romania are the magazine “About us”, edited by Agenția Împreună and Unicef Romania, a magazine in which a few gypsies that were able to leave behind the bad image romanes people have and do something big with their lifes, tell their stories [5]. By this approach Unicef and Agenția Împreună hope to inspire other gypsies to change their lives to something that will bring positive externalities to society. Another example that of the project “We are the product of the environment”, developed by the EU and the development Division of the United Nations. By this project, the organizations developing it hope to make the population aware that all the persons that get in jails for different reasons (theft, crime, illegaliies etc.) arrive in that point because of the social environment they live in. So, if the social environment of these persons society calls “criminals” changes when they are young, their future and that of the communities they live in can change. [6] Another very good example is that of the SOS Children's Villages NGO, that tries to help families stay unified and if they don't, it tries to help the children from those families be reintegrated into society. According to them, the results they have in changing the future of these children are good. In Romania there about 1,000 children that benefit from the work of this international NGO [7].

These three examples are just a few all the NGOs that work in Romania and succeed to change a bit of the negative externalities that affect society. Of course, there are also NGOs that work for the environment like Greenpeace, for the acceptance of different ways of living one's life like Accept, or for the liberty of information and mass-media like Transparency International. The list doesn't end here.

Corporate social responsibility politics of the banks involvement in community projects requires both an own format, and partnerships with NGOs, which are running projects according to the bank's values, especially on long term. Also, the banks involved in projects that involve teamwork and encourages volunteerism among its employees. Banks give attention to social causes in the following areas: economical, environmental, social, education, citizenship, culture, sport, human rights. The last corporate social responsibility published budget varies between 10000 Euros - 200000 Euros

Since 2010, banks have gathered all the information about its corporate social responsibility projects and reports on a dedicated website. The website allows all stakeholders to find in one place the information that interests them, and get involved in the bank’s shares, or enter into dialogue with it. Internally, the banks have implemented an integrated program of recycling for paper, pet, cardboard, glass, lamps, metal and printer cartridges. In the first operations using recycled paper products and energy efficient light bulbs. Bank computers are automatically closed outside office hours, using a special application. In addition, the headquarters of some banks are hosted by buildings which are certified organic. The banks also encourage its customers to use banking individuals in an environmentally responsible manner, choosing iStatement (electronic statement) and iBanking (Internet Banking). Last but not least, the Bank staff is involved in training programs and awareness of sustainable development, enabling them to participate in training sessions, presentations, discussions or online courses.

Advantages of social audit: encourage the local community participation, helps the disadvantaged groups, increase the transparency, Develops human resources, promotes social responsibility and promotes sustainability.

The organizations have proposed to more accurately measure the impact their projects have on (non)-financial activity. Consequently, the banks published the corporate social responsibility reports, or an assessment of community involvement projects. In the future, the bank's representatives have proposed to improve their reporting so that it is consistent with most widely used model in this area, namely the model GRI (Global Reporting Initiative).

5. CONCLUSIONS

The main idea of this paper is that firms should be more aware of the fact that they and the people that own and work in them aren't separated off the environment in which they develop their activity. Thus, all their actions have positive or negative effects on the entire environment or environments (economic, politic, social, natural etc.) these firms get in touch with, and like this also on them. This happens because the world we live in is like a network of complex adaptive systems that are interconnected and that fortunately or unfortunately work also after the “butterfly effect”. The “butterfly effect” is the metaphor that E. Lorenz used in his 1972 lecture from Washington to explain the sensitivity of a system to the initial conditions, and to be more exact that the flap of a butterfly's wings in Brazil could be the cause of a tornado in Texas or of bad weather in Europe [8].

Social auditor has a responsibility to ensure that projects within (s)he participated were viable, the documentation was well done and also to pursue social activities in time to see the results delivered. Within the organization is much easier to track social responsibility. Although social responsibility has no experience in Romania we can say that these activities can brings added value to business.

Once again, the research conducted highlights the importance of the social audit in corporate governance, seeing that the activity of a company impacts positive or negative the world we live in.. So, is our choice what way we go, but we must bear in mind that the resources are limited and we must focus also on medium and long term perspectives, and we refer here to social, environmental activities, not only on profit.

6. ACKNOWLEDGEMENTS

This article was written as part of the project “Doctorat în economie la standardele Europei Cunoașterii (DoEsEc)” POSDRU/88/1.5./S/55287. Project co-financed by The European Social fund through POS-DRU 2007-2013 and implemented by the Bucharest Academy of Economic Studies in partnership with the Western University of Timişoara.

7. REFERENCES (HEADING 1)

an ngo for every 400 people in india


ABSTRACT: The paper aims to present the most important features of technological entrepreneurship, both in industrial and non-industrial organisations, and its important role in organisational development. The conceptual model used to describe our approach is the Balanced Scorecard, with a focus on learning and growth perspective. Within this view, a set of specific indicators is proposed in order to assess the performance of technological entrepreneurship and intrapreneurship. The result will reflect entrepreneur’s perspective, internal innovative processes, innovation and growth of an organization.

Key words: technological entrepreneurship, organizational development, The Balanced Scorecard

1. INTRODUCTION

The development of global economy led to the increasing of modern business practices. The entrepreneurial skills have contributed to improve the business environment, through expanding the entrepreneur’s horizons and by assuming a substantially higher risk in decision making.

The evolution of entrepreneurship led to its diversification depending on the industry, social and economic context, entrepreneurs’ skills and objectives, and other factors. In the study of these forms a special attention was given to technological, social and green entrepreneurship.

This research is aiming to define technological entrepreneurship as one form of entrepreneurship, currently in full development. According to Byers (2008) “technology entrepreneurship is a style of business leadership based on the process of identifying high-potential, technology-intensive business opportunities, gathering resources such as talent and cash, and managing rapid growth using principled, real-time decision-making skills.” [2]

The conceptual model which can provide a new point of view about technological entrepreneurship is the Balanced Scorecard (BSC). According to Kaplan and Norton in 1992, BSC was designed as a management tool for performance measurements. It took several years for the authors to redefine Balanced Scorecard. At the end, the authors defined BSC as a tool for translating organizational strategy into specific actions, engaged 4 interrelated perspectives: financial, customer, internal innovative processes and learning and growth. [8].

The Balanced Scorecard has emerged as a proven tool in meeting the many challenges faced by the modern organization [14]. In Gupta’s work since 2004 it has been shown that BSC is important from a point of view that enables connections between organizational objectives in terms of four perspectives: financial, customer, internal processes and learning and growth [8].

The current research develops a new definition of technological entrepreneurship, using the Balanced Scorecard conceptual model as a core method for defining this concept.

Although multiple measures of entrepreneurship exist, the use of key performance indicators (KPIs), common for industrial and nonindustrial companies, can highlight the Learning and Growth (L&G) principles from the innovation point of view.

The main goal of the current research is to distinguish technological entrepreneurship from the other types of entrepreneurship using internationally comparable indicators used for learning and growth perspective of an organization.

2. THE MAIN CHARACTERISTICS OF TECHNOLOGICAL ENTREPRENEURSHIP

Technological entrepreneurship is defined as an important modality to commercialize technical inventions [23], as a bridge between technological evolution and commercial exploitation, which includes all activities linked to the identification of potential entrepreneurial opportunities, arising from technological development, and, likewise, linked to the exploitation of these opportunities through the success of innovative products.

Technological entrepreneurship was interpreted in different ways and at different levels of analysis, as a system [1], as a policy [20], as a strategy [7], as a process [16] or as an individual attitude [5].

Within the context of technological changes, the interest for the ecological domain and social dimension is important to describe several types of entrepreneurship. As mentioned before, within this framework, there were selected to describe three types of entrepreneurship: technological, green and social. This comparison can provide a better understanding of the main characteristics of entrepreneurship domain and it is presented in table 1.

3. BALANCED SCORECARD PERSPECTIVES

A new form of Balanced Scorecard was developed in 1996 by Kaplan and Norton [10]. The new model, realized for translating the strategy into specific actions, engaged 4 interrelated perspectives: financial, customer, internal processes and learning and growth. In fact, these 4 perspectives
represent a balance between long and short term organizational objectives, between lag and lead performance measures [15].

Table 1. Differences and similarities between the three types of entrepreneurship

<table>
<thead>
<tr>
<th>Type of Entrepreneurship</th>
<th>Differences</th>
<th>Similarities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Specific to social organizations</td>
<td>Innovation</td>
</tr>
<tr>
<td></td>
<td>Involve social objectives for each activity [19]</td>
<td>Private business sector</td>
</tr>
<tr>
<td></td>
<td>The emphasis is more on individual than on collective models [5]</td>
<td>Business orientation on specific domains</td>
</tr>
<tr>
<td>Green</td>
<td>Has the environment as central objective</td>
<td>Learn &amp; Growth</td>
</tr>
<tr>
<td></td>
<td>Promotes corporate social responsibility and sustainability</td>
<td></td>
</tr>
<tr>
<td>Technologic</td>
<td>Emphasise technological changes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learning and growth in technological innovation field</td>
<td></td>
</tr>
</tbody>
</table>

3.1. Financial perspective

According to Kaplan and Norton’s conceptual model, this perspective offers an overview of financial performance measures. In time, this perspective evolved and was materialized through specific performance measurements. It is important to measure organizational success and financial evolution of an organization, also this perspective offers a new point of view on organizational financial objectives [12]. This perspective aims to provide information about financial and non-financial performance indicators and necessary data for analysing process of organizational success [6].

3.2. Customer perspective

It is based more on organizational and market actors. Michalska J. in 2005 [13] presented this perspective, through the organizational effectiveness, as an overview of all available sources of financial success, such as market position and customer satisfaction. In fact, this perspective should respond to the question: “How should be a firm perceived in eyes of customers?” When Kaplan and Norton (1992) first time introduced the Balanced Scorecard, this perspective was evaluated just from the customer’s point of view.

3.3. Internal Processes

This perspective reflects manager’s point of view on its own business processes. The main question of this perspective is: what management process a company should adopt to be more efficient? In fact it will use client’s demands to produce new products and obtain better outcome [3].

3.4. Learning and growth perspective

Kaplan and Norton in 1996 defined this perspective through three main dimensions: people, systems and organizational procedures. As researchers went further, this perspective became an important part of performance analysis. In fact, this perspective is about the ability of each company to adapt to the market’s condition, to new challenges, to change [13] or to be in the same line with new technology.

Also this perspective aims to provide the analysis of the most important objectives, according to main idea of technological change and development of human resources of each company.

4. INDICATORS AND RESEARCH METHOD DESIGN

In order to provide a better understanding of performance measurements for technological entrepreneurship, we made a compilation of performance indicators for each dimensions from Balanced Scorecard’s perspective of Learning and Growth (Table 2).

According to the main idea of this study, it aims to provide not only a new definition of technological entrepreneurship, but also to provide a new flexible method to adapt this concept for each company depending of performance indicators. The method was structured in four steps.

1. First step – defining selection criteria

Establish the main criteria for selecting the performance indicators which can be used for assessing the dimensions of the Learn and Growth perspective of BSC. In this case, the criterion used was the structure in three dimensions, given as “sources” of this perspective by Kaplan and Norton in 1996.

2. Step two – selecting the indicators

Establish reliable sample of KPIs for companies / organizations from different types of industries, or different types of activities (table 2). The KPIs were chosen from a large available list which aims to provide information’s about innovation. To know which KPI’s are important and appropriate for learning and growth perspective, it was agreed to rate them using a scale from 1 to 10 (1 – the less important, 10 – the most important). These notes will reflect the minor or major interest of entrepreneur for innovation part of Balanced Scorecard’s Perspective of Learn and Growth (table 3).

The notation which will be used is:

a) P1-6 – KPIs for the first dimension: People
b) S1-6 – indicators for the second dimension: System
c) OP1-6 – indicators for the third dimension: organizational procedures.

3. Step three – defining the structure of the performance indicators system

Translate the organisation approach of the Learning and Growth perspective into relations between performance
indicators from each of the three dimensions: people, systems and organisational procedures. The main objective is to realize the best combination of indicators. An example is shown in Figure 1.

**Table 2.** KPIs specific for three sources of Learning and Growth perspective from Balanced Scorecard (source: www.indicatorideperformanta.ro)

<table>
<thead>
<tr>
<th>People</th>
<th>Systems</th>
<th>Organizational procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education, training, counselling programs</td>
<td>New technology involvement</td>
<td>Investment agreements process</td>
</tr>
<tr>
<td>Cross training of work quality</td>
<td>Low yield of equipment</td>
<td>Stakeholder involvement</td>
</tr>
<tr>
<td>Management skills and life-long learning</td>
<td>Equipment availability</td>
<td>Investments of exploration of new markets</td>
</tr>
<tr>
<td>Employees implicated in innovation processes</td>
<td>Performance systems</td>
<td>Dedicated resources for innovations</td>
</tr>
<tr>
<td>Research and development employees</td>
<td>Internal platforms for knowledge exchanges</td>
<td>Optimized procedures</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>Regression tests</td>
<td>Innovation Pipeline Strength</td>
</tr>
</tbody>
</table>

**Table 3.** Notation of indicators

<table>
<thead>
<tr>
<th>People</th>
<th>Systems</th>
<th>Organizational procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₁</td>
<td>S₁</td>
<td>OP₁</td>
</tr>
<tr>
<td>P₂</td>
<td>S₂</td>
<td>OP₂</td>
</tr>
<tr>
<td>P₃</td>
<td>S₃</td>
<td>OP₃</td>
</tr>
<tr>
<td>P₄</td>
<td>S₄</td>
<td>OP₄</td>
</tr>
<tr>
<td>P₅</td>
<td>S₅</td>
<td>OP₅</td>
</tr>
<tr>
<td>P₆</td>
<td>S₆</td>
<td>OP₆</td>
</tr>
</tbody>
</table>

In this case, the best combination was established based on marks 9 and 10.

This combination was chosen because we aim to define firstly innovation and describe it through performance indicators. So, we chose from our list (Table 2) the KPIs for innovation, based on the best marks that are shown in Table 3.

4. **Step four – defining the organisation’ customized approach of technological entrepreneurship**

Formulate definition of technological entrepreneurship according to indicators which were used and which match the activity of organization. To better understand this step and to perform scenarios analysis, we proposed 4 new indicators that are calculated by formulas:

\[
I_{P} = \frac{GP_{1} + GP_{2} + \ldots + GP_{n}}{S_{1} + S_{2} + \ldots + S_{m}}, \quad (1)
\]

\[
I_{S} = \frac{GS_{1} + GS_{2} + \ldots + GS_{n}}{S_{1} + S_{2} + \ldots + S_{m}}, \quad (2)
\]

\[
I_{OP} = \frac{GOP_{1} + GOP_{2} + \ldots + GOP_{n}}{S_{1} + S_{2} + \ldots + S_{m}}, \quad (3)
\]

where GP, GS and GOP are related grades for each dimension.
where \( x \), \( y \) and \( z \) represents grade’s weight from each dimension: people, systems and organisational procedures, calculated by formula 4.

\[
\{ x, y, z \} = \frac{G}{S} \times \frac{100}{N_i}, \quad (4)
\]

where \( G \) represents grades for each type of dimension;
\( S \) – maximum grade of the used scale and
\( N_i \) is number of indicators from each dimension.

\[
I_{LG} = \frac{I_P + I_S + I_{OP}}{2}, \quad (5)
\]

\( I_P \), \( I_S \) and \( I_{OP} \) represents weighted mean of grades from each type of dimensions: people, system and organisational procedures.

\( I_{LG} \) is a composite indicator, which represents Learning and Growth Perspective, calculated as arithmetic average of weighted means of each type of dimension.

5. SCENARIOS FOR IMPLEMENTING THE RESEARCH METHOD

At this point, there will be listed all possible resulting combinations of indicators, based on marking process.

a) Case 1:

This case it is an ideal one. It means that this case describe the technological entrepreneurship through all performance indicators with 9 and 10 marks.

![Figure 2. First case structure](image)

Basically it is presented data flow among the entire organization. From this point of view, the technological entrepreneurship could be defined as a data flow through and among the organization, between employees and systems in friendly environment, which describe technological changes and innovation processes in the organization.

b) Case 2:

In this case, of major interests, are the indicators with 10 marks. Like in the previous case, there are bilateral relations between indicators. The difference is that we cannot speak about data flow, but we bring in front organizational sources.

![Figure 3. Second case indicator combination](image)

c) Case 3:

It involves the question: “how people can influence or be influenced by organizational procedures?”. It means that future innovation projects depend on R&D employees and good and optimized organizational processes.

![Figure 4. Third case indicator combination](image)

c) Case 4:

This case presents a situation in which all indicators, from KPI’s database, are used. It means that there is no limitation about importance grades.

In order to perform scenarios analysis, there were calculated: weight and specific indicators (table 4 and table 5). According to the results from table 5, the most valuable scenario for implementing the proposed method is case 2, which is based totally on Learning and Growth Perspective (100%). Although case 1 provides significant result (96,2%), we can notice that the influence of organisational procedures decreases. The result from case 3 indicates that the absence of a dimension causes an inappropriate approach of Learning and Growth Perspective. The last scenario indicates that Learning and Growth Perspective is influenced by systems and organisational procedures indicators more than people’s KPIs.

### Table 4: Calculating weights

<table>
<thead>
<tr>
<th>People</th>
<th>Grade</th>
<th>Weight</th>
<th>System</th>
<th>Grade</th>
<th>Weight</th>
<th>Organisational Procedures</th>
<th>Grade</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>3</td>
<td>5</td>
<td>S1</td>
<td>10</td>
<td>16.67</td>
<td>OP1</td>
<td>4</td>
<td>6.67</td>
</tr>
<tr>
<td>P2</td>
<td>5</td>
<td>8.33</td>
<td>S2</td>
<td>7</td>
<td>11.67</td>
<td>OP2</td>
<td>5</td>
<td>8.33</td>
</tr>
<tr>
<td>P3</td>
<td>3</td>
<td>5</td>
<td>S3</td>
<td>7</td>
<td>11.67</td>
<td>OP3</td>
<td>8</td>
<td>13.33</td>
</tr>
<tr>
<td>P4</td>
<td>10</td>
<td>16.67</td>
<td>S4</td>
<td>7</td>
<td>11.67</td>
<td>OP4</td>
<td>10</td>
<td>16.67</td>
</tr>
<tr>
<td>P5</td>
<td>9</td>
<td>15</td>
<td>S5</td>
<td>10</td>
<td>16.67</td>
<td>OP5</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>P6</td>
<td>7</td>
<td>11.67</td>
<td>S6</td>
<td>8</td>
<td>13.33</td>
<td>OP6</td>
<td>9</td>
<td>15</td>
</tr>
</tbody>
</table>
6. CONCLUSIONS

Although it was already defined, the technological entrepreneurship, this conceptual method provides a new type of definition, based on concrete indicators.

If in the beginning of this study, technological entrepreneurship was defined as a strategy, a process, a system or attitude, than according to proposed method, it is more about data collection, employee involvement, knowledge database and organizational sources.

Basically Learning and Growth perspective from Balanced Scorecard provide for this study information about employees involvement, information and informational systems between organizational departments and organizational environment.

Based on case structures, the important features of technological entrepreneurship are:

a) Reflects entrepreneur’s perspective  
b) Employees involvement in innovation processes  
c) Provide knowledge “database” for managers  
d) Establishing bilateral relations between performance indicators  
e) Applying the designed method for those three perspectives of BSC: people, systems and organisational procedures

The advantage of this proposed method is that technological entrepreneurship gets to be defined from different point of view (researchers, managers, etc.). It seems to become more specific and it could be illustrated in several directions.

The primary KPI database can be also defined by the company, and after that it can be structured according to the proposed method.

The designed method can be applied for different types of organisations from different industries, including educational institutions, public administration and NGOs also.

The limitation is that by using this method it could not be known if the performance indicators are chosen correctly or if selection criteria are matching the intentions of those who want to define this concept

7. REFERENCES


RESEARCH ON THE CONSTRUCTION AND OPERATION MODE OF COLLEGE STUDENT ENTREPRENEURSHIP ALLIANCE – TAKING HEBEI PROVINCE AS AN EXAMPLE

Bo, Liang ¹ Ke, Zhang ² and Baihua, Li ³
1 Shijiazhuang University of Economics, Shijiazhuang, China, liangbo2007@163.com
2 Shijiazhuang University of Economics, Shijiazhuang, China, 178980128@qq.com
3 Shijiazhuang University of Economics, Shijiazhuang, China, 1029549936@qq.com

ABSTRACT: The construction and good operation of college student entrepreneurship organizations play an important role in the cultivation of college student entrepreneurship awareness and the improvement of college student entrepreneurship ability and success rate. This paper summarizes the factors restricting student entrepreneurship and proposes the suggestion of constructing student entrepreneurship alliance based on the analysis of the education and the current operation status of entrepreneurship organizations in Hebei Province. With the idea of “Promoting employment by entrepreneurship to realize social entrepreneurship” and the target of “Improving college student entrepreneurship success rate”, college student entrepreneurship alliance integrates multi social resources with the involvement of the government, society, enterprises and colleges. The operation of the alliance is divided into education stage, incubation stage and marketing operation stage. By the three stages’ cultivation to college students, it plays a positive role in aspects such as the participation of college education and social education, the promotion of entrepreneurship education development and college student entrepreneurship success rate and district economic development.

Key words: entrepreneurship organizations, college students, entrepreneurship alliance, success rate

1. THE CURRENT DEVELOPMENT STATUS OF COLLEGE STUDENT ENTREPRENEURSHIP ORGANIZATIONS

With the nationwide spring up of college student entrepreneurship organizations and their promotion to local college student entrepreneurship and local economic development, college student entrepreneurship issue has attracted the attention of Hebei Province, and different kinds of entrepreneurship organizations have been established and developed in the recent years. By our research, college student entrepreneurship organizations in Hebei Province could be divided into two types based on the establishment subjects. One type is college student entrepreneurship incubation bases established by colleges. The other type is organizations aimed at helping college student with entrepreneurship which were established by the government, folk organizations or enterprises. Among them there’re 14 established by the colleges and several tens established by the government and other social organizations, and some of them are entity organizations providing funding and sites, some are network platforms promoting entrepreneurship education and training. Based on the statistics, there’re more than 40,000 college students applying entrepreneurship guidance in college entrepreneurship organizations every year, the current entrepreneurship organizations make some effect on entrepreneurship activities, but it’s not very evident. Based on the statistics, the success rate of college student entrepreneurship in Hebei Province is only 0.3%. Each organization puts forward to provide the support such as the funding, technology and sites to the initial stage of college student entrepreneurship. However, due to the difference of organization properties, conditions and the asymmetry of the information and resources, their guidance effects are different.

2. THE EXISTING PROBLEMS OF COLLEGE STUDENT ENTREPRENEURSHIP ORGANIZATIONS

2.1. The imperfection of entrepreneurship course system and the manpower insufficiency of the teachers

College student entrepreneurship organizations partly provide entrepreneurship education relevant training, but there’re many shortages in the course system and the teacher manpower. What’s worse, quite a part of entrepreneurship organizations don’t supply any entrepreneurship training at all. The main problems existing in training providing organizations are: They don’t have a complete entrepreneurship education course system but simply provide counsels in aspects such as management, financing and policies. Besides, they don’t have professional training teachers guaranteeing the teaching level. Although some organizations refer to international entrepreneurship training system like KAB and SYB and have a relative complete course system, there’re still many problems with the teachers’ number, teaching level and the implement of the course system.

2.2. The imperfection of the entrepreneurship incubation mode

In our country, the entrepreneurship incubation bases usually give general supports to college student entrepreneurship in some main aspects including infrastructure, technology, training, policies and financing. As to the entrepreneurship organizations in Hebei Province, although they provide supports in these aspects, there’re still some problems with the comprehensiveness and systematicness which mainly show as: The resource range is too small, the entrepreneurship education form is too foundational, the entrepreneurship training is lack
of pertinence and operability, the service system covering from entrepreneurship education to entrepreneurship incubation is not completely provided, and it doesn’t make the organic combination of college education and social education, etc. Besides, with different establishing subjects and developing directions, these organizations don’t have complete operation mode and entrepreneurship incubation mode, so they don’t really solve the key issues such as program, funding, and experience. Therefore, the incubation result is not very evident with few entrepreneurship programs settling in the bases and little successful incubation cases.

2.3. The asymmetry of information and the non-sharing of resources

Different establishing subjects of college student entrepreneurship organizations lead to the difference of the resources and information among different entrepreneurship organizations. There’s a lack of efficient communicating and exchanging platforms, so each organization could use only what it possesses to assist college student entrepreneurship. This asymmetry of information and monopolization of resources directly influences the development of college student entrepreneurship organizations and the support to the entrepreneurship activities in Hebei Province, so it becomes a significant issue in the current stage that how to solve the asymmetry of information and the non-sharing of resources among different organizations.

2.4. The imperfection of entrepreneurship environment

The entrepreneurship environment is relatively bad in Hebei Province. The social entrepreneurship cultural atmosphere is frail, and the entrepreneurship activities don’t get the support and the acknowledgement from the society and families. Besides, college students are lack of entrepreneurship knowledge and experience which lead to the low success rate and high risks. What’s worse, the enterprises don’t pay much attention to college student entrepreneurship and the assistance college students get from social organizations is limited, which lead to their failure in the society. Therefore, it’s necessary to start with the support and encouragement of the government to make the cooperation of colleges and enterprises, and to establish different kinds of social organizations, and to optimize and distribute the resources, so as to build the environment suitable to the survival and development of college student entrepreneurship and to realize the successful entrepreneurship.

3. THE ESTABLISHMENT OF COLLEGE STUDENT ENTREPRENEURSHIP ALLIANCE

With the comprehensive analysis of the rapid increase of employment stress and low success rate of college student entrepreneurship, the imperfection of entrepreneurship education system and the entrepreneurship incubation mode, the lack of social resources supports and the unsatisfactory of current status of resource integration in Hebei Province, the author considers to transform the operation mode of existing entrepreneurship organizations, with the cooperation of all and the benefit to all, establishing a new style of college student entrepreneurship organization in Hebei Province—College student entrepreneurship Alliance of Hebei Province.

The college student entrepreneurship alliance is a NGO which is led by the labor employment security bureau, the communist youth league and the employment guidance center of Hebei Province, and it was established with the participation of colleges and enterprises in Hebei Province. With the idea of “Promoting employment by entrepreneurship to finally realize social entrepreneurship” and the spirit of “Serving college students, instructing college student entrepreneurship, and developing college student entrepreneurship awareness and skills” and the propose of “optimizing entrepreneurship environment and increasing college student entrepreneurship success rate”, the alliance integrates different local resources of the government, society, enterprises and colleges and mixes entrepreneurship theory, experience education, entrepreneurship skills training, entrepreneurship practice operation together to a multifunction entrepreneurship education system. With two modes of entrepreneurship mode and entrepreneurship incubation mode, it develops college student entrepreneurship abilities and spirits to finally improve their entrepreneurship success rate so as to really realize efficient resources integration and utilization to promote the development of entrepreneurship education, the connection of school education and social education, and local college student entrepreneurship success rate, then finally to promote the development of local technology and economy to realize the favorable situation of all-winning.

![Figure 1](image_url) Figure 1. The establishing scheme of college student entrepreneurship alliance Large
4. THE OPERATION MODE OF COLLEGE STUDENT ENTREPRENEURSHIP ALLIANCE

The operation of college student entrepreneurship alliance is mainly divided into 3 stages, i.e., entrepreneurship education stage, entrepreneurship incubation stage and entrepreneurship program marketing operation stage. Thereinto, entrepreneurship education stage is mainly finished in the colleges, entrepreneurship incubation stage is finished in the incubation bases, and entrepreneurship program marketing operation stage is a stage in which entrepreneurship programs secede the incubation and proceed marketing operation.

4.1. Entrepreneurship education stage

4.1.1. Theory education
The alliance establishes an excellent entrepreneurship teacher team whose teachers are with entrepreneurship education research experience from different colleges of Hebei Province together to teach college students entrepreneurship relevant theory knowledge. Besides, it hires first-line managers with social practical experience from enterprises and public institutions as the visiting lecturers to teach students entrepreneurship practical experience, which is complementary with the theory teaching. What’s more, it hires experts in entrepreneurship education field from society to research issues about teaching system and course arrangement, etc. Thus it forms the team with 1/3 college teachers, 1/3 practical experienced managers from enterprises and public institutions and 1/3 entrepreneurship education experts to make tour teaching in colleges in Hebei Province to improve the theory teaching quality.

On the other hand, the alliance Optimizes entrepreneurship course system. Based on its inherent law, the aim of entrepreneurship teaching course should be the education in aspects of knowledge, ability and spirit. Alliance’s audiences in the first stage are the whole college students in Hebei Province, and its course mainly stresses on the guidance of entrepreneurship awareness, the education of entrepreneurship spirit and the teaching of foundational entrepreneurship knowledge. The members who pass the selection to enter the incubation bases will receive further entrepreneurship education and training in the later stage. The course includes enterprise management, risk investment, finance foundation and market survey methods.

4.1.2. Practice education
In the meantime of theory education, each college shall pay attention to the practice and applications of the theory, such as carrying out entrepreneurship relevant competitions or actively organizing the students to participate in existing national competitions like “The Challenge Cup” national college student business plan competition, “The Challenge Cup” national university student extracurricular academic science and technology work competition, National college student mathematical modeling competition and ERP sand table simulation competition, etc. Constructing the practice platform of theory based on entrepreneurship relevant competitions to let students acquire simulative entrepreneurship experience, learn and accumulate entrepreneurship knowledge, develop entrepreneurship ability, and practise the abilities of teamwork, communication, expression, organization and management.

Through the analysis of entrepreneurship surroundings in Hebei Province, we found that most students don’t have social practice experience. To solve this problem, the alliance strengthens the cooperation between colleges and enterprises, colleges and the government, colleges and social folk organizations to realize their interaction, so as to provide favorable practice environment. At the same time, it also strengthens the construction and completion of the internship bases and the entrepreneurship practice bases, carries out professional skill training specifically, and organizes special social practice activities.

4.2. Entrepreneurship incubation stage
The alliance establishes entrepreneurship incubation bases. The bases decrease the risk and cost of newly-established enterprises and increase their survival rate and success rate by providing sites for the research, production and operation, and sharing equipments for communication, network and office work, and systematic training and consulation of policy and law, and the financing and marketing promotion.

4.2.1. Entrepreneurship training
For college students who have finished entrepreneurship education training by the alliance already, if they pass the selection and possess basic quality and ability that entrepreneurship need, they could enter the training bases in entrepreneurship incubation bases to get the training. The training bases help them organize their entrepreneurship plans, evaluate entrepreneurship programs, raise entrepreneurship funding, and arrange their enterprise operation. The bases satisfy the graduates’ entrepreneurship accumulation by entrepreneurship internship.

4.2.2. Program recommendation
By the forms of “Collecting from the basic layers, the society, the internet and enterprises”, etc, the alliance recommends a certain number of entrepreneurship programs with low investment, fast effect and good market prospect, and conducts program exhibition activities in colleges, entrepreneurship internship bases and entrepreneurship incubation bases.
4.2.3. **Entrepreneurship incubation**

The alliance integrates resources actively and establishes a comprehensive, cascaded entrepreneurship incubation service system for college graduates in different stages. Based on entrepreneurship incubation bases and business areas of each district, it makes local employment of business type entrepreneurship graduates come true. The alliance utilizes existing conditions like college science parks, software parks, industry parks, the researching, studying and production bases, engineering centers, key labs and training centers to help students conduct entrepreneurship practice.

4.2.4. **Entrepreneurship guidance**

The alliance hires successful entrepreneurs, experts, researchers and the government department staff widely to provide entrepreneurship consultation service. And it establishes and completes college graduate entrepreneurship tutor regulation, and organizes and establishes college graduate entrepreneurship tutor team and expert volunteer team to provide consultation, information and individual tutorship to graduates’ entrepreneurship. It also establishes college graduate entrepreneurship club and entrepreneurship sodality to build entrepreneurship communicating platforms to the graduates.

Meanwhile, based on the specific condition of each entrepreneurship program, the alliance sets the incubation period, evaluating the incubating programs every year. To the programs with full incubation period and qualified evaluation, they could leave the incubation bases to operate independently in principle, thus it decreases the risk and increases the success rate to the further.

4.3. **Marketing operation stage**

The programs with full incubation period and qualified evaluation could choose either to enter the market independently, or to attach themselves to base enterprises. They could also enter the market in other modes. After the enterprises gain profits, they’ll pay the incubation fees of the programs back to the incubation bases. They could also give some return to the bases if they’re able to, so as to guarantee the regular operation of bases’ finance. At the same time, the incubation programs could also choose not to enter the market and go on with their completion or reserve them without any further development. But if so, they must report the specifications to get the bases’ permission.

5. **REFERENCES**

ABSTRACT: As the world developing rapidly, worldwide educational system needs an urgent breakthrough on establishing a rational and feasible innovative talents training system. The paper takes as the case study training path within Student Science and Technology Association of Shijiazhuang University of Economics, elaborating the six features of innovative talents in their growing up. They are, but not limited to, "difference", "sustainability", "publicity", "perseverance", "exploring" and "inclusiveness". It describes the association's constructing a scientific and comprehensive training system based on its exploration. Besides, the paper discusses the way to reform teaching and learning system as well as the training talents referring to the experience of students' self-managing. In the end, the paper tries to offer meaningful approaches to building an effective innovative education.

1. SUMMARY
1.1. The situation of innovative talents training
With the rapid development of knowledge-based economy, the pace of economic globalization and internationalization of higher education to accelerate economic, technological and personnel increasingly competitive, innovative talent is the inevitable choice of the era of knowledge economy of personnel training.

The Boyer research universities in the United States Undergraduate Education Committee published a research report named "Reinventing Undergraduate Education: A Blueprint for America's Research University", which clearly stated, "Exploration, survey and discovery" is the core of the University. Everyone in the university should be the discoverer and learner.

The British University in order to detect the potential of mining and development of students, inspire individual creative spirit for the purpose, cultivate generation after generation of high-quality talent. British University has high-quality talent from generation to generation, taking exploring, mining, developing potential ability of students, and inspire the spirit of individual creativity as purpose.

In recent years, German universities actively reform the university's internal organizational structure, to strengthen interdisciplinary research and teaching, and cultivate students' creative ability and focus on improving the personality of the students, cultivating students' independent learning ability, identify problems and problem-solving skills, organizational skills, innovation and independent research capacity.

Our community has gradually carried out research on innovative talents and achieved success. For example, quality education is extensively carried out; innovative graduates of higher education committed to research and training; the country has established a variety of personnel training research institutions; national talent scholars gathered in "China Talent Study Forum" event in exchange learning.

1.2. The put-forward of innovative talents with "Six Characteristics"

In the relevant literature at domestic and international, we did not find the equivalent concept of "creative talents" or "creative talent".

Understanding of the creative talents at domestic and international are in the emphasis on the human personality all-round development while highlighting the sense of innovation, innovation ability.

The Chinese education sector is mainly explained from the perspective of creativity, sense of innovation, the spirit of innovation, innovation capability, creative talents or creative talents. This seems like giving people a false impression that specialized training of innovative talents will be successful, as long as they have the qualities mentioned above.

From the innovation and personnel training of educational, there are obvious deficiencies on Chinese traditional culture theory, methods and systems, which has a serious impediment to the budding talents of innovative thinking, such as emphasizing on the tools attribute of the talent and ignoring the essential attribute of talent, emphasizing the visibility of innovation while ignoring their sustainability, emphasizing on innovation itself and ignoring the spread of innovation, emphasizing on innovative thinking of the talent and ignoring the personality, emphasizing on respect for obedience to authority and ignoring the question, emphasizing the intensive of the professional skills and ignoring exclusiveness of knowledge.

In the context of educational development domestic and international, Shijiazhuang University of Economics set up the Student Technology Fund in 2003, I aiming at training innovative talents with the ability to innovate, research capabilities, hands-on practical ability. At the same time, Student Science and Technology Association (hereinafter referred to as "SSTA") do the management work, which specializes in innovation management?
In addition, the association since its establishment has been committed to each person to develop into independent-minded, personalized and innovative talents, providing a theoretical and practical support for schools carrying out "Six Characteristics" innovative education and necessary preparatory work for training on innovation management personnel and dissemination personnel.

In area of innovative talents' training, Shijiazhuang University of Economics has gained great effects, after years of practicing and perfecting.

Based on their own working experience in SSTA, authors have interviews with 760 members and former members of SSTA. After analyzing the investigation results of questionnaires, we can see:

![Figure 1. Which do you think is the key supporting that SSTA offers when training innovative talents?](image)

In result, we conclude "different train" "continuing education" "publicity and propagation" "tenacious will" "actively explore" "harmonious and inclusive" to "difference" "publicity" "perseverance" "exploring" "inclusiveness" and these are the "Six Characteristics".

2. THE SUMMARY OF INNOVATIVE TALENTS TRAINING WITH "SIX CHARACTERISTICS"

2.1. Difference

There is a wide range of differences between people, and the biggest difference is the difference of cogitation, it burst out innovative ideas. With this innovative thinking will it take for technology to be developed, Society to be progressed?

Not only do we have to understand the fact that there are differences in cogitation, but also better to take advantage of differences in this feature.

To make us speak, act in an objective way. Difference in mentality of innovative also affects different people in academic attainments.

The most important thing in the students' research work is the ability to innovate with mentality. It is precisely because of these differences, the level of scientific research using a variety of innovative ways of mentality to get success.

Student Technology Fund research projects of Shijiazhuang University of Economics is the paradise of differences in mentality.

First talk about the application from the Student Technology Fund research projects, while applying projects, It would be the first to find their own partners, this is a test for captain of team capacity and team coordination, teamwork.

The captain's purpose is not just to find people who can give him their own effort but also rely on a variety of innovative mentality of more members to consider the issue.

Second is to choose the issue. Different people have different way of thinking.

Everyone come up with ideas for the issue, open up the world with their own unique way of thinking on the issue, to explore in depth. More valuable things waiting to be found here.

Followed is the research process, everyone expert different social skills and analytic ability, the differences in dealing with others can be reflected by the differences of cogitation.

Everyone in the entire research demonstrated their unique ability.

Finally is the end of the issue. Each project team member has their own division of labor and their respective mandates. In the division of labor, they express their views with their own unique thinking ability, to make the research finished orderly.

Everyone tries his best to enliven thought, write paper, and prepare for thesis in this process.

The innovation of thinking is dominant, is the key to success.

2.2. Sustainability

Sustainability is a permanent expansion of the new thinking, new ideas. Put new ideas into practical activities, do not give up halfway and stick to it.

People like innovation, with these positive creative thinking as a foundation, "Six Characteristics" innovative talent needed to have it continued operating and stick to it.

Around us there is such an example——Lv Kejian, the general secretary and guiding teacher of SSTA.

He is mainly engaged in the research work of students to science and technology management, urban ecological security, has presided over and participated in nearly 10 various types of research projects, more than 20 papers published in various academic journals.

Guide the students engaged in scientific and technological research and social practice actively.

Guiding students science and technology fund research projects 6 times, Student Science and Technology in Social Practice ——The practice of extra-curricular subject more than 10 times, and was awarded the honorary title.

In the various activities organized by the Students' Science and Technology Association we can clearly feel that he has innovative mentality.

Since Student Science and Technology Association established in 2003, he created many classic activities, such as Classic Technology activities—orienteering, attracted scientific activities—"one versus one hundred" etc.

Time has inspected this scientific and technological worker in nine years.

There are a serious activities every year in recent nine years, such as "Science and Technology Week in May", "Students Technology Fund research project", "The practice of extra-curricular subject". Each activity has benefited from his active creative thinking. It can be said that precisely because of his
perseverance, and only today's development of students' scientific and technological work of Shijiazhuang University of Economics. This is a good examples of sustainable development.

2.3. Publicity

A psychology expert in Yale University, said that "dissemination is the process of person (disseminator) who disseminate stimulation (Usually language) to affect others (receiver) ".

It is thus clear that personal innovation does not belong to individual, it depends on the surrounding environment to all the information he had spread.

Dissemination in the form of bi-directional flow of the process of information.

In the society of the individual accept social information and feedback information, in order to achieve understanding, cognition, and innovation process.

Li Chuangnong, the vice chairman of the second session of SSTA, is a talent.

With distinct propagation of characteristics. In school, he participated in a wide range of innovative activities actively. He has participated in scientific research activities of students Technology Fund, and was awarded the Presidential Award of the second session of the Student Technology Fund research projects.

After Graduation he has been working in the Ministry of Land and Resources.

Li Chuangnong love to learn, good to make friends with a certain degree of communication skills and have a good infectant power.

On the basis of Ensuring outstanding professional achievements, he get involved in school students' scientific and technological work actively.

In the process of carrying out the work of SSTA, he continued to learn new knowledge and exercise their own management capabilities, and cultivate a high sense of innovation.

No matter in study, at work or in life, he infected with classmates and friends around his own enthusiasm and sense of innovation.

To drive everyone around him through his own actions. He let more people deeply understand the new affairs, to promote the innovation consciousness of everyone.

Leading Others through himself fully reflects Li Chuangnong's ability to communicate.

Publicity is an integral part in the process of innovative talents training. Only thus can continue to pull the universal sense of innovation.

2.4. Perseverance

As the innovative talents in new century, in addition to the quick thinking, other than the superior innovative thinking and unique personal charm, perseverance is an integral part of the necessary qualities.

Perseverance, not only means determination, toughness but also more patience. You should have the psychological quality of being able to withstand a sudden blow in the face of difficulties with no fear. Also a virtue of insisting on justice and faith while adhering to the correct truth whether you are in good times or bad and maintain a calm state of mind regardless of the face of temptation or suffering.

There have been a large number of science and technology workers with perseverance since SSTA was founded nine years ago. Their perseverance perfectly applied to the practical work, which means a good service for the research work.

Huang Pengfei, 2012 session of the outstanding graduates of Hebei Province, the seventh Student of Science and Technology Association Chairman is a striking illustration of these people.

College Entrance Examination, an important turning point in Huang Pengfei's life. He would encounter tough choices. In this important examination, he played a serious disorder, but he did not give up. However, with concrete actions he proved his motto "Destiny is always in his own hands". Despite the doubt about his decision from people closed to him, he refused to take another year to prepare for College Entrance Examination. Soon after, he was out of the haze of failure and put into a wonderful university life.

However, fate seemed to mock him. He eager to prove himself by getting some results based on his unremitting efforts in the University activities. Although missing the good results again and again, he never discouraged. Also the growth of experience and hardship tempered him more mature, he is no longer pursuit of vanity but devote himself to the cause of passion. Students CAST process practical hard-working, solidarity and cooperation, failing pride not in haste, won the appreciation of the people around. He even received a high evaluation from Lv Kejian, director of Student Office of Science and Technology Affairs that he is a good learner with good temper who could endure hardship and understand management.

2.5. Exploring

Innovation in large part is a constant discovery and problem-solving process. The key to innovation ability training is the ability to identify problems and propose unique ideas. exploring is kind of a spirit and attitude that someone is able to actively examine the known and unknown knowledge and phenomenon from different angles and summarize and raise questions, in order to think about new ideas and solution afterwards.

In the face of an unknown situation, the first step to solve the problem is to discover and raise this issue. But the difficulty on the process of making the ultimate conclusion and the value of its own also depends on the exploring. exploring is the indispensable quality of an innovative talent. For various reasons, today's Chinese college students in generally do not have many opportunities to touch with the community. Their social vision and awareness and critical thinking ability is not strong enough, so they are often be inadequate to explore some unknown fields.

SSTA as the management and guidance of the scientific and technological work of all students has a very clear understanding about that. It will also put inspiring and guiding the exploring and innovation in a prominent position of its work. According to the characteristics of students 'research work to guide students' attention to life in a targeted manner and gradually inspire students' innovative thinking from different angles.

The work of in scientific research is the management and advancement of the Student Technology Fund Research
Li Songze's own experience has fully proved: inclusiveness is the essential quality of the talent needed by the society.

3. THE SYSTEM CONSTRUCTION OF INNOVATIVE TALENTS TRAINING WITH "SIX CHARACTERISTICS"

3.1. The Theoretical and Practical Basis about the System Construction of Innovative Talents Training with "Six Characteristics"

Training system problem is an important factor in restricting innovative talents training. At present, the system of innovative talents training is rather vague, which has significant limitations. With the continually increasing demands for talents, the country gradually pays more attention on talents. Cultivating innovative talents needs a concrete practical system.

SSTA achieved the students' self-management organizations and the activities of independent planning in the operation process. For students can not only improve the interest and ability of independent innovation, but also continue to adhere to innovation, and expand the sphere of influence.

During this period, to guide students through professional experiments and research activities, bold exploration of unknown areas, continue to overcome the challenges facing the process, combined with the experience and knowledge of different disciplines in the field and make the appropriate way to deal with, so that students learn to think and practice, provides a good practical basis for innovative talent training system, cultivate student's "six characteristics" in a relatively good way.

3.2. System structure of "Six Characteristics" the innovative talent training

The construction of "six characteristics" talents training system will be effective for the students to choose the correct development direction, and develop the innovation capability of "Six Characteristics", and let the students receive the support of funds, facilities and methods from the universities.

The establishment will make the development of students' innovation ability has theory to be relied upon, rules to follow, path to follow.

3.2.1. The Complete Organizational Structure

Innovative talents training with "Six Characteristics" is related to the interaction of many departments and levels.

We should set up a professional organization for training talents and a management mechanism that adjust to the development of talents.

Only in this way can we carry out the training for innovative talents better.

Under the cooperation and every effort of all levels of Student Science and Technology Association, SSTA gradually forms a management mechanism about student scientific activities that is "University—SSTA of school-level—SSTA of college-level".

The inner work of the organization should be sectorial, so we have to divide work clearly and focus on coordination.
Moreover, organizational structure should be rigorous, flexible and can adapt to the change of new situations.

It is adapting to local conditions and continuously improves the organizational mechanism that is the organizational support and momentum of innovative talents training with "Six Characteristics".

3.2.2. A Reasonable Selection Mechanism

A distinctive, original, and reasonable selection mechanism have a good role in promoting the train of innovative talents with "Six Characteristics". Innovative organization should develop democracy from beginning to end and enhance the transparency of personnel selection according to the principle of "fair, open, compete and select the best".

SSTA adopts an assessment mechanism that is strict and has organizational characteristically.

We assess organized personnel from the entire school at multiple levels, which contribute to promoting the train of "Six Characteristics".

3.2.3. Rich innovation activities

Student Technology Fund research projects, "The practice of extra-curricular subject", one versus one hundred "Science knowledge competition" and such a series of innovative activities organized by SSTA are unique features.

Its success is to inspire a strong sense of curiosity of the organizers and participants, training the careful observation, strengthening the memory and giving full play to the imagination, thus creating a favorable physiological conditions and external environment for the development of intelligence.

At the same time, it provides a rich foundation of knowledge for training the innovative talents stimulates the desire of creative thinking and innovation and provides a realistic incentive for the cultivation of innovative talents.

3.2.4. Comprehensive information institutions

Informatization means one can fully figure out the information and expand the field of information, so that they can achieve their goals with limited resource.

Only if the department of information can show their powers in more sides, will it lead to guiding and conducting based on proper information, will the goal of training innovative talents be achieved.

In recent years, the information system of SSTA has developed by leaps and bounds. It comprehensively promotes the training of innovative talents with "Six Characteristics".

The system provides supports for a large number of students who need to get fresh information on science researching or other aspects. Before and after holding an activity, all kinds of ways, especially network, are used to make sure as many as possible students informed. Student's suggestions can also be transformed within assistance of the system.

3.2.5. Unique organizational culture.

Organizational culture is often in the form of psychological atmosphere, and hidden intrinsic motivation is always for the mode of action, if essence of an organization is the innovation, it will affect its entire internal staff in the nurture and promote the cultivation of innovative talents.

SSTA have been taken orders the spirit of SSTA all the time since its inception, which is "enlightenment science and technology innovation, develop academic new talent, build technology atmosphere, advocate academic argument", sticking with the requirements of using a scientific perspective; using the concept of development; using cautious attitude; using the spirit of dedication; using indomitable perseverance; using noble quality; treat people, treat things, which promotes the training of personnel of the organization. Innovative talents training with "Six Characteristics" needs a culture of innovation philosophy throughout, so as to maintain its sustainable development.

3.3. System application

The scope of application of the construction of the "Six Characteristics" innovative talent training system is relatively extensive.

First of all, colleges and universities are the main application places of the system; each university has its own set of unique personnel training, but also has their own unique style and the traditional way of school training.

In the training system of colleges and universities for students could combine with the actual situation of the school to improve the focus and the main requirements of cultivating innovative talents properly. For example, the school can take the "Six Characteristics" as the main frame of reference in the curriculum, the guidance of teachers, the abilities of students. On the top of that, in some educational institutions, "Six Characteristics" innovative talent training system meets today's demand for talents.

They can start personnel training from the more specific and complete aspect and be emphasized to improve students' capacity.

In the application on the basis of the "six characteristics" training mechanism, SSTA pays much close attention to the organic combination of quality development, practice-oriented and scientific arrangement and makes the system more effect in actual use.

For the cultivation of members of the association, it uses different management philosophy and tools for effective study and management to give the members some Quality Developments irregularly.

In addition, the association also organizes various activities for students in school and arranges a time to effectively carry out the training for college students in scientific way.

4. SUMMARY AND PROSPECTS

In this paper, we use a systematic and comprehensive way of thinking to combine theory and practice. Combining with instances of the SSTA innovative talents training, we propose the concept of innovative talents training with "Six Characteristics". We deeply analyze and demonstrate the accuracy and comprehensiveness of the concept of "difference", "sustainability", "publicity", "perseverance", "exploring" and "inclusiveness".

We hope the "Six Characteristics" innovative talent training system proposed and built in this paper can play a certain reference. We believe SSTA will adhere to the "Six Characteristics" innovative personnel training system, training more highly qualified personnel in line with national requirements.
It also will have some reference value and certain value for the future development of the colleges and universities on innovative personnel training.

5. REFERENCES

1. Liang, Quanrong., Jia, hongyan., New research about concepts of innovative talents, Productivity Research, No 10, pp. 124 -125, (2011)
WAYS OF LIFELONG LEARNING
ABSTRACT: Due to a medium-low level of young students’ technical knowledge from previous school classes the first year of university seems to be very difficult. The complex phenomena and the abstract concepts represent the first lectures avoided by the students if the temporal burden becomes uncomfortable. Therefore the lecture has to be designed in which the prospective engineer clearly recognise their profit. Using the modern educational instruments as DidaTech Platform, CAD or C++ program presentations in higher education for engineering the level of comprehending and interest in the profile subjects should increase. The main concern of this paper is to demonstrate how using electronic methods young engineers learn about the descriptive geometry and improves the student’s intellectual capability of space perception. This will be absolute necessary for the students’ preparation for the Mechanical Drawing and CAD subjects.

Key words: blended-learning technologies, descriptive geometry, DidaTec

1. PROJECT PRESENTATION AND DESCRIPTION OF DIDATEC

Starting with September 1, 2010, till August 31, 2013 the DidaTec POSDRU project is working on an effective implementation of modern educational instruments and blended-learning technologies in higher education teaching-learning for engineers.

Some aspects of preparing the didactic materials are presented with specific requirements of blended-learning technologies thru the DidaTec POSDRU project.

The DidaTec project was initiated by Technical University of Cluj-Napoca and several large universities from Romania joined this project too. One of them is “Lucian Blaga” University of Sibiu represented by professors, assistant professors and other members of academic community from Sibiu area.

The general objective of the project is the improvement of education and training processes in the technical higher education (engineering sciences) through a complete and unitary program (national approach) of lifelong learning and training for higher education teachers. The project’s aim is the acquiring of competencies in interactive techniques of teaching & learning and IT&C, as a key factor for a relevant education in accordance with the specific needs of the economy.

The project emphasises on different synchronous and asynchronous learning methods, one of them being presented with regard to the basic object for engineers: descriptive geometry.

DidaTec is an association of words, that contains the word “Didactic” and the word “Technology”, but the synergy of the two words refers to modern learning technologies applied in the educational process.

The stated goal of this project is to provide a framework structure for the implementation of informational technologies in engineering technologies. The specific objectives of the project are:

• The consolidation of cooperation between Romanian universities in regard with the development of an efficient system of education from the field of engineering;
• The elaboration of guidelines for professors in the field of engineering education for higher education institutions;
• Acquiring of competences in the development of procedures and methodologies for training programs and continuous education on the institution level;
• Training and assistance for academic professors to achieve a higher level of success in teaching and learning techniques using electronic instruments;
• The improvement of personal or professional development for young teachers of entry-level in a mentoring program;
• The improvement of human resources involved in teaching activities by creating didactic materials and communication platform (figure 1).

![Figure 1. The DidaTec platform, [8]](image-url)
The main constituents of DidaTec project are subdivided as follows. The first component was referring to blended-learning concept using information technology and communication as a combined teaching using traditional and electronic methods, where students can learn engineering concepts in a modern environment using on-line and off-line tools. Online tools available for blended learning techniques are: webcasts, virtual classes, conference calls, video broadcasts, virtual laboratories, instant messaging and online collaborations.

Traditional tools for blended learning techniques are: laboratory activities, courses, seminars and projects. Materials used are tutorials, quizzes and assessments, simulations, virtual libraries and multimedia records, LMSs, blogs, wikis, expert systems, mobile services. The communication methods were instruments used to implement the procedures of transmitting the messages from emitter (teacher) to the receiver (student) using communication channels and feedback in an environment without perturbations or noises that might interfere with the communication process.

Combining the traditional class with a virtual learning environment in order to improve the educational process we get the right infrastructure needed for blended-learning. It was studied the hardware and software elements connected to the Learning environment and Learning Management System. Along with the network services used to communicate without perturbations in audio-visual manners.

The third component analyses the structure of the didactic materials:
- defining the objectives (the main structural element)
- the curricula (the element of communication that was analysed with concerns for intellectual property and plagiarism)
- the assessment (the element of evaluation of the achievements obtained in the educational process).

The seminars are usually activities of communication in form of workgroups that needs to work, communicate and assess the results of their work. The fourth component is referring to seminar activities, using active learning, cooperative learning and inductive learning methods. The implementation of seminars was realized by using software products specialized on virtual instrumentation, virtual presentation of important concepts and virtual collaboration presented in the curricula. The management of documents, the annotation process, sharing process and dissemination of the theoretical concepts presented in the curricula are also an important factor here.

The fifth component refers to electronic evaluation of individual or group activity inside of the educational process. The process of evaluation requires the measurements, comparisons and estimations in order to obtain useful information regarding the student level of education, the quality of education process, followed by decisions with regard to optimisation of the didactic activity for the evaluated field.

The last component refers to advanced instruments and technologies to communicate inside the educational process. They are named generic as web 2.0 technologies, like RSS, blog, wiki, collaborative bookmark systems, social networks. Another advanced instrument is the audio/video conferencing system, used to increase the awareness of student regarding the importance of the educational process while the professor is situated geographically in a remote location.

This instrument keeps the advantage of face to face presentation while the other person is away by maintaining the visual contact, the awareness of being on screen or hearing its own voice, especially by knowing that the session is recorded. Virtual classrooms are learning environments that allows the interaction between different persons with different roles of host or guests using didactic materials.

The DidaTec Project allows obtaining improved results in the education process, by implementing the blended learning concept, using tools and instruments to complement the theoretical education with skills and abilities by means of electronic and virtual instruments in the field of engineering education.

2. STRAIGHT CIRCLE CONE

2.1. Introduction in Descriptive Geometry

The contents of Descriptive Geometry courses, respectively that of Mechanical Drawing represents an equilibrium between, on the one hand, the minimum of information needful to a complex technical grounding and often difficult and, on the other hand, the number of course hours studied through the curriculum (plan of education) of different technical specialization.

The theoretical and applicable study of these disciplines, closely attached themselves through continuity, can be realized on three directions, namely [3]:
- Through the theoretical notions taught at course hours
- Through the graphical mappings of these notions, performed individually or at lab hours
- Through the theoretical notions assimilated on the basics of the individual grounding using a selective bibliography

The Descriptive Geometry course introduces fundamental principles and improves the student’s intellectual capability of space perception. Descriptive Geometry has always been a method to study 3D geometry through 2D images, thus offering an insight into the structure and metrical properties of spatial objects, processes and principles. Topics covered in a Descriptive Geometry course include: true length, piercing points on a plane, line intersections, true shapes, revolutions, and developments using successive auxiliary views [4].

Students could review the theoretical notions taught at the classes by consulting the online platform of DidaTec where the courses are uploaded. The supplementary training provided by DidaTec platform resources brings a lot more beneficial to the student and increases the efficiency of the course.

The teaching activities are improved by creating didactic materials and communication platform using the DidaTec program.

2.2. Geometric solid design. The triple orthogonal projection of the cone.

In the following there is a modern presentation of a geometric solid designed in axonometric and isometric view made with the C++ program. The straight circle cone (figure 2) is situated in the first projection trihedral (out of eight).

Because the projection planes are considered infinite, these ones divide the space in eight projection trihedral, noted with roman numbers: I, II, III, IV, V, VI, VII and VIII of points situated in these trihedrons are presented in the table below [3].
Table 1. The sign of each coordinate on the I-VII trihedral.

<table>
<thead>
<tr>
<th>Coordinate projection trihedral</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscissa (a_x)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Remoteness (a_y)</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dimension (a_z)</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Through the association – in relation of perpendicular alignment - of the three spatial planes, on which a point is projected, one can obtain the triple orthogonal projection of the solid in the orthogonal system (figure 1) [1].

We’re going to use different colours to make it easier for the students to recognize, understand and memorize the drawing process.

The graphic construction of the triple orthogonal projection and of the epure of a cone are going to follow the order below:

[\(H\)] - orthogonal projection of the cone on the Horizontal plane that will have a yellow colour

[\(V\)] - orthogonal projection of the cone on the Vertical plane that will have a red colour

[\(L\)] - orthogonal projection of the cone on the Horizontal plane that will have a green colour.

The same colour system will be also used in the epure construction and for the geometric solid (that will be designed just in axonometric view) we are going to use the blue colour.

The cone large end (the base) is situated on the \([H]\) plane of projection of the orthogonal system, so the base (blue coloured) is going to be in the same place with its projection on the \([H]\) plane (yellow coloured).

Synthetically, this succession of the construction of the intuitive image of any point’s projection (we consider point S – the cone top) when is known also its spatial position and projection the plane \([H]\), \(s\) is the following (being considered known, \(s\) is chosen in the circle’s center) [2]:

\[
\begin{align*}
\overline{SS} & \perp [H] \cap [H] = s \\
\overline{s} & \in [H] \\
\overline{ss_x} & \perp [V] \\
\overline{ss_x} & \perp [H] \Rightarrow \overline{ss_x} \cap [V] = s_x \in Ox \\
\overline{ss_y} & \perp [L] \\
\overline{ss_y} & \perp [H] \Rightarrow \overline{ss_y} \cap [L] = s_y \in Oy \\
\overline{s_x} & \in [V] \\
\overline{s_x} & \in [V] \\
\overline{s_y} & \in [L] \\
\overline{s_y} & \in [L] \\
\overline{s''_x} & \in [V] \\
\overline{s''_x} & \perp [L] \Rightarrow \overline{s''_x} \cap [L] = s_x \in Oz \\
\overline{s''_y} & \in [L] \\
\overline{s''_y} & \in [L] \\
\overline{s''} & \in [V] \\
\overline{s''} & \in [V] \\
\overline{s''} & \in [V] \\
\overline{s''} & \in [V] \\
\end{align*}
\]

2.3. The defining of the epure. Epure’s construction of the cone.

By the revolving of the horizontal plane, around the \([OX]\) axis, as well as of the lateral plane by the turning around the axis \([Oy]\) the trihedral projection becomes a plan projection which is called epure. Proceeding this way, the triple orthogonal projection of the point becomes the point’s epure (figure 4) in which the spatial point is defined only by its projections. Together with the revolving of the projection planes, the geometrical elements in those planes revolve (figure 4).
In other words, in the epure, the spatial elements don’t show up anymore, they remain in space, and in the epure’s plane will be represented only their images on the three projection planes.

The \([\text{Oy} \text{ axis from the trihedral projection is an common axis to the planes } [\text{H}] \text{ and } [\text{L}])\) and after revolving two axis will result, each of them accompanying in the revolving the plane to which it belongs. The axis correspondent to the horizontal plane is noted with \([\text{Oy1}])\), and with \([\text{Oy}])\) the axis correspondent to the lateral plane.

As it was shown, a spatial point \(S\) is characterized by the following geometrical elements: the coordinates of the point \(s_x\), \(s_y\), \(s_z\) and the projections of the point \(s, s', s''\). As in the case of graphic construction of the triple orthogonal projection of the point in intuitive (axonometric) image, for the epure’s construction we need a minimum number of elements from those which characterize the spatial point. We presume for instance to be known the points \(s\) and \(s''\), disposed in the epure on the same projection, parallel with \([\text{Ox} \text{ axis which intersects } [\text{Oz})\). Further on, for the graphic discovery of the other elements one can proceed in the following succession [2]:

\[
\begin{align*}
- & s_{y1} \perp \text{Oy}_1 \\
- & s_{y1} \cap \text{Oy}_1 = s_{y1} \\
- & \text{Oy}_1 = \text{Oy}_y \quad \text{(the point } s_{y1} \text{ is revolved on the } [\text{L}]) \text{ plane)} \\
- & s' \perp \text{Oz} \\
- & s' \cap \text{Oz} = s_z \\
- & s_y, s'' || \text{Oz} \\
- & s'', s_z \perp \text{Oz} \\
- & s_y, s'' || s'' s_z = s'' \\
\end{align*}
\]

Figure 4. The cone epure projection.

As we can see in figure 4 the projection obtained is situated in the first trihedrons. The construction proceeding is similar for any other point situated in one of the trihedrons V-VII in epure image.

3. CONCLUSIONS

The DidaTec Project allows obtaining improved results in the education process by implementing the blended-learning concept using tools and instruments to complement the theoretical education with skills and abilities by means of electronic and virtual instruments in the field of engineering education.

The modern presentation of a topic (geometric solid design in axonometric and isometric view) helps the students get a better view and improves the student’s intellectual capability of space perception.

The electronic tools and instruments that the youth is familiarized with is an efficient instrument to create a way better accepted for training the 3D (three-dimensional) imagination. Applying these tools is a useful additon but from the didactic point of view it cannot replace the classic Descriptive Geometry.

4. REFERENCES

7. * * * DidaTec Brochure available online at: http://ctmtc.utcluj.ro/sites/didatec_/didatec_public_document/DidaTec%20brochure.pdf
8. * * * DidaTec official site available online at: http://www.didatec.ro/default.aspx
FACILITATING LEARNING USING MODERN E-LEARNING TOOLS IN TECHNICAL DRAWING AND INFOGRAPHICS TEACHING

Bogdan, Chiliban ¹ Damaris, Căuneac ² and Marius Chiliban ³
1 Lucian Blaga University of Sibiu, bogdan.chiliban@ulbsibiu.ro
2 Lucian Blaga University of Sibiu, damaris.cauneac@ulbsibiu.ro
3 Lucian Blaga University of Sibiu, marius.chiliban@ulbsibiu.ro

ABSTRACT: Licence and Master’s Degree Programs generally use specific e-learning methods as a complementary training. The design of master’s degree academic curricula in e-learning system will involve the curricular development, the designing of the learning resources. The local Lucian Blaga University of Sibiu was making progresses during the last years and with the help of learning technology as well as the development and simulation of the instructive-educational web-based process solutions, the school will be offering a lot of facilities for the management and presentation of various types of educational content, such as multimedia interactive materials, simulations, and tests, covering a wide range of subjects. The present paper will propose a Technical Drawing and Infographics course and lesson after making out a case for using offline and online e-learning tools.

Key words: e-learning tools, technical drawing, infographics, online learning

1. FACILITATING LEARNING BY DISTANCE E-LEARNING PROGRAMMES.

We tend to use the words ‘education’ and ‘training’ somewhat interchangeably, but it is useful to try to distinguish between them. Stenhouse (1975) argued that there were four fundamental processes of education:

- Training (skills acquisition)
- Instruction (information acquisition)
- Initiation (socialisation and familiarisation with social norms and values)
- Induction (thinking and problem solving)

This can be a useful way of thinking about education, but in thinking about engineering learning, it is probably more helpful simply to distinguish between education and training.

“Education is a learning process which deals with unknown outcomes, with circumstances which require a complex synthesis of knowledge, skills and experience to solve problems which are often one off problems….education refers its questions and actions to principles and values rather than merely standards and criteria” (Playdon and Goodson, 1997).

In mainstream education, training can be defined as “a learning process with known outcomes, often dealing in repetitive skills and uniform performances which are expressed as standards or criteria.” (Playdon and Goodson, 1997).

“The concept of training has application when:

(a) there is some specifiable performance that has to be mastered;
(b) practice is required for the mastery of it;
(c) little emphasis is placed on the underlying rationale…teaching implies that a rationale is to be grasped behind the skill or body of knowledge” (Playdon, 1999)

The main characteristics of adult learning are:

- the learning is purposeful
- participation is voluntary
- participation should be active not passive
- clear goals and objectives should be set
- feedback is required
- opportunities for reflection should be provided

We aim to implement the core principles of adult learning, vocational and professional training starting with the basic e-learning tools.

E-learning includes all forms of electronically supported learning and teaching, and more recently Edtech. The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process.[5]. The term will still most likely be utilized to reference out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum. Abbreviations like CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning.

E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual education opportunities and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio. [8]
There are a number of models for E-learning developed and used throughout the world in the framework of education from a distance. Each university/institution that offers such programs by adopting the right match and is considered the most effective for this type of training.

But even E-learning is naturally compatible with distance or/and flexible learning, it can also be used to improve the face-to-face teaching, in which case the term blended-learning is commonly used.

Traditional education system offers the pattern of the e-learning system models. It is desirable that these models to provide educational solutions as good as or even better than the classical models. In the education offered by the E-learning, most of the work is submitted either by individual student, or by group of students who share the same concepts.

In order to implement a E-learning model should be consider the technology available for the development. From this point of view there are several models of systems E-learning.

E-learning system is structured as two different components as illustrated in figure 1.

The purpose of an internet application or platform is to provide information for students, the possibility for the publication of theoretical courses, and for the transmission of text messages or online conferences and also to provide teachers a platform for that generates tests and testing of students.

To give life and functionality to the application we need a platform easy to use and common both students and professor. That platform is represented by a branch of IT. This makes it possible to achieve through their computer connections both between students and between the student and the needed information.

The application has the representation a web site built from dynamic web pages, which through dialog facilities contained, it offers all the functions for the user testing and communication. Usually the platform has been created with three types of fields by the user: administrator, teacher and student.

The main advantage of an online learning platform is that gives the freedom to:

- study one or more of the several approaches (as different methods provided my the teacher for learning) matched to each student interests,
- enter into learning at an appropriate level matched to the student’s existing skills and knowledge as well as his learning goals,
- follow each curiosity and learning own path,
- study in each student’s own rhythm and speed,
- inform about studying on a regular basis if the student lives locally, studying face-to-face classes periodically if the student lives elsewhere, or studying at a distance from anywhere.

An example of an e-learning resource is www.LearningMethods.com. The program is made up of a number of modules that a trainee can take separately or combine in various combinations with different entry levels and different study streams.

The Modular Training is an ambitious multi-faceted program and to do each part justice, it is being implemented in stages. The first stage, which has already been launched, is the online distance learning stream — LearningMethods Online.

![Figure 1. E-learning environment [5]](image1.png)

![Figure 2. LM Modular Learning [10]](image2.png)

2. ONLINE LEARNING COURSES

2.1. Online learning course development models

In several important ways online-learning environments with their dependence on technology are very different from conventional educational settings. In the second case a lot of the responsibility for teaching and learning is in the hands of the teacher who is also the subject matter expert in contrast...
with the online-learning environments where the teacher who may also be the subject matter expert is no longer in complete control of all the activities.

Robin Mason (1998) of the United Kingdom Open University has suggested that most online-learning courses sit on a continuum of a “partially online” or a “fully online-learning course” (see http://www.aln.org/publications/magazine/v2n2/mason.asp).

A “partially online” course is one that integrates existing resource materials that are available either in print or non-print form such as textbooks etc. with some elements of online learning. This might include the use of a learning management system or simply a mailing list for some asynchronous discussion (for example see Naidu, & Oliver, 1999). Such courses promote the concept of what is commonly referred to as “blended learning”, where more than one mode is used to teach a course. Most distance educators have known such courses as “wrap around courses” because much of the teaching and learning activities in such courses are wrapped around existing resource materials such as textbooks. [6]

A “fully online” course, on the other hand, is one that will have most of its learning and teaching activities carried out online. I say “most of its learning and teaching activities” because invariably everything about a course could not possibly be carried out online. Moreover, it might not be advisable to do so. For instance, students would always be studying away from the computer from printed materials, textbooks and other resources from libraries. There would be no real need to put these online, and it might not be possible to do so for reasons that have to do with costs and copyright laws. Mason calls this “integrated courses” (see http://www.aln.org/publications/.[6]

2.2. Online Technical Drawing and Infographics

Course Proposal

The local Faculty of Engineering has a informative website http://inginerie.ulbsibiu.ro/ , but there’s no online learning platform for every group of disciplines.

Starting with September 1, 2010, till August 31, 2013 the Didatec project is working on an effective implementation of modern educational instruments and blended-learning technologies in higher education teaching-learning for engineers.

Some aspects of preparing the didactic materials are presented with specific requirements of blended-learning technologies thru the DidaTec POSDRU project.

The DidaTec project was initiated by Technical University of Cluj-Napoca and several large universities from Romania joined this project too. One of them is “Lucian Blaga” University of Sibiu represented by professors, assistant professors and other members of academic community from Sibiu area.

It would be a lot efficient to create a online platform so that the e-learning process become complete. So, there are some guidelines useful in the development of a future platform like that.

Online Technical Drawing and Infographics course objectives are:

- The trainee must be familiar with a range of terms and definitions in the field studied;
- Trainee must be able to identify chapters, the steps presented in the instructional material
- The trainee must acquire some knowledge by which to develop their practice skills, etc.

Online Technical Drawing and Infographics course structure and content would aim the acquisition of knowledge through the internet. Those who master such knowledge may go on to the training or test of knowledge of creativity and e-design.

Thus online Technical Drawing and Infographics course structure aims the presentation of:

- general information and of the knowledge base for each type of processing or topic described;
- construction and stages of the design of machines parts (for each category);
- exploitation of the machines parts
- practical application;
- specific tests for each chapter;

The application shall comply with the structure of a computerized educational material:

- course content description
- the trainee’s benefits of the course;
- main aspects description: course objectives, to whom it is addressed, thematic course, what qualifications and skills gained by the trainee;
- presentation; duration, who can participate, the language used, other aspects;
- course structure: syllabus, content;
- auxiliary support materials: bibliography, other links;
- online and offline help: forums, online communications, etc;
- terms and conditions of registration: ULBS student, a specialist in business partners;
- minimum requirements of knowledge for participant;
- participant feedback.

2.3. Example of Online Technical Drawing and Infographics Lesson Content

Technical Drawing and Infographics forms an integral part of the technical subjects and give basic general information needed in the technical communication, used for solving graphical problems that all the technical subjects contain.

Technical Drawing and Infographics course objectives for the technical specializations are:

- To orient students to the range of drafting methods, topics, and occupations that characterize the field. Learning the rules and national standards of plane
drawing of a spatial image (real or fictive), of the technical communication of different elements (a plane drawing) specific in the technical field.

- To introduce in bidirectional communication of the technical and technological messages used in the transfer of the technology information which is usually made through plane images (technical drawings).

Technical Drawing and Infographics Subject contributes to develop specific skills needed for preparing a correct and complete graphical documentation that every future specialist in mechanical engineering field will be able to possess. It forms the spirit of technical view, a clear, logical and organized way of thinking and contributes to the familiarization of the students with the economic aspects of the technical creativity.

After acquiring the basic notions of technical drawing subject, the students will go thru the following topics in the training process of AutoCAD 2D and 3D drawing subject which is Infographics:

- introductive topics of infographics
- parts representations used in mechanical drawing
- drawing process and standards of different parts-machine
- dimensional standards used in mechanical drawing
- precision of the finished mechanical components

Just after getting through AutoCAD 2D drawing training, the students will be able to design different parts using AutoCAD 3D software such as in the figure 3 and figure 4.

On the left end of the shaft there will be assemble the two radial ball bearing (of different dimensions) pls the safety ring and on the other end will be assemble the two row radial cylindrical roller bearing.

If the first stage of assemblage was successfully passed, we pass on to next stage of final assembly in the slide bearing (figure 6).

As the slide bearing assembly is almost done, the last step is the screwed jointing in the detachable top as shown in figure 7.
Figure 7. The screwed jointing in the detachable top
Figure 8 shows all the parts of the big assembly from the figure 9 as they have been “exploded”.

Figure 9. The final assembly

3. CONCLUSIONS

Among platform benefits of E-learning specific to an integrated it system, include, but are not limited to:

- Resources required to the workstation are minimal, the server is processing all operations necessary to give the results to the user.
- The searched information can be found very easily, the database structure and the links on the platform are constructed in an intuitive manner.
- The application has a friendly graphic user interface, structured in a pleasant and effective navigation.
- The learning process is done in each student’s own rhythm and at his own speed.
- There is no time limit. If the internet connection exists, the information is available 24/7.
- There is no space limit. The student can study at home, at school, at work or travelling.
- Materials can be downloaded to be studied.
- Students can give on-line tests, eliminating the paper support and issues related to the deciphering handwriting.
- Better communication between the members same education communities.[1]

4. REFERENCES


8. ▲ ▲ ▲ Find Teaching and learning methods here: http://www.faculty.londondeanery.ac.uk/e-learning/small-group-teaching/Facilitating_learning_teaching_-_learning_methods.pdf


A MODERN 2.0 E-LEARNING PLATFORM IMPLEMENTED AT LUCIAN BLAGA UNIVERSITY OF SIBIU

Radu Adrian, Ciora¹ and Eduard, Stoica²
1 Lucian Blaga University of Sibiu, radu.ciora@ulbsibiu.ro
2 Lucian Blaga University of Sibiu, eduard.stoica@ulbsibiu.ro

ABSTRACT: Our proposal explores access issues, availability and potential of e-Learning education in creating a modern learning environment as well as enhancing cultural understanding for both Romanian and foreign students at Lucian Blaga University of Sibiu. We argue that the use of e-Learning can be further extended to corporate training and other learning environments whose primary aim is facilitating knowledge, increasing access and enhancing cultural understanding and building mutual trust. Moreover it squeezes out the old-fashioned learning which is limited and constraint. Unlike that, a learner should be given a free hand with regard to selecting the course schedule. One should be allowed to learn just-in-time, on-demand. Moreover, he/she should have influence on the contents of the classes. Learning should be customized, initiated by user profile and demands. This is actually what e-Learning is aiming at.

Key words: e-learning platform, participatory e-learning, cultural-understanding

1. INTRODUCTION

E-Learning defines the means of delivery of educational content through any electronic media, including the Internet, intranets, extranets, satellite broadcast, audio and video tapes, interactive TV, CD-ROMs, interactive CDs and computer-based training. It is expected to squeeze out the old-fashioned learning. In the old approach, a student is passive, pushed to learn. He or she is obliged to obey some rules denying when and where the classes take place and what their actual content is. Thus, the learning process is constrained and limited. Unlike that, a learner should be given (to some extent) a free hand with regard to selecting the course schedule. One should be allowed to learn just-in-time, on-demand. Moreover, he/she should have influence on the contents of the classes. Learning should be customized, initiated by user profiles and business demands [1]. This is actually what e-Learning is aiming at.

There are two communication technologies used for e-Learning: synchronous and asynchronous. The first expects students to gather face-to-face or use chats, video conferences, etc. The latter approach is characterized by using modern Web applications such as blogs, wikis or discussion boards as tools for sharing opinions or learned experience. All in all, both approaches support informal learning [2].

2. DEVELOPMENT OF E-LEARNING TECHNOLOGIES IN ROMANIA

After 1990, the role of Romanian universities has become crucial in (re)negotiating a new relationship with online and lifelong learners and in bridging the gap of social, age and educational disadvantage between intra-national and international communities of students. Distance education was the first to be introduced through state initiatives and to take account of all missing lifelong learning issues which concern all components and levels of education and training and includes non-formal and informal education contexts alike. This accounts for the lateness, occasional slowness and difficulty in the implementation of all educational segments, starting with early education, education in family, education through mass media, education for democratic citizenship, training in enterprises, initiation into ICT as well as developing modern learning technologies. Following the Soviet Union model – a model known for its extensive use of distance education for post-secondary studies in conventional universities, teacher training and polytechnic colleges as well as in a number of specialized distance teaching universities - correspondence education has been combined with face-to-face sessions in a "consultation model" so as to enhance distance education teaching and learning [3]. Furthermore, Romania has been catching up very fast in the last decade on ICT learning, as universities have been called to respond to ever new challenges, bringing not only new forms of technology-enabled education to learners of all ages, but also making sure these devices reach out and contribute to social cohesion and bonding. These efforts have characterized along a whole shift of paradigm in education, determined by flowing (interchangeable) roles, shared resources, virtual facilities and combined asynchronous teaching and learning processes. As a result, the emerging generations have better IT skills and competence, which make them more prepared to respond to the new national and international labour market demands and specializations. According to an EC Report, between 2000-2006 in Romania, the annual growth rate of graduates in mathematics, sciences and technologies was 5.5%, that is 1.1 percentage points above the European average rate (Preliminary Report of the European Commission in 2008, regarding education and training progress). For example, in 2003/2004, this annual growth rate represented 24.4% of the total number of Romanian graduates, which ranked Romania higher than other recently adhered EU member states such as Hungary, Poland, Latvia, Estonia, Slovenia, and even well above the EU average rate, 24.1% (Eurostat 2005) [5].
3. ROMANIA-CHINA RELATIONS

Against this digital knowledge background, in the last decade, Romania and China’s excellent economic relations have blossomed significantly due to the entrepreneurial model, which was initially based on identifying an empty niche in low-price consumer goods and setting up networks of “Chinese markets” and “Chinese shops”. This was first developed in Eastern Europe and then replicated in other regions and represented the foundation on which Romania, a country with a comparatively small size and population, was to develop the capabilities to build a successful and fast-expanding trading relationship with the world’s largest market. To quote an example along this line, in 2002, the trade volume between China and Romania reached USD 0.753 billion, with an increase of 112.6% from the previous year. So far, there have been nearly 8000 Chinese companies registered in Romania with a total investment of USD 51.7 million, 0.6% of the total investment Romania absorbs from foreign countries. With this development, the demand for expertise in Chinese business and training in Chinese language and culture has increased dramatically over the last decade. A better knowledge and greater understanding of China has become thus crucial to increasing Romania's competitiveness and capacity to take advantage of the potential of the Chinese market, with a mutual benefit and potential for parties, with China on the one hand and former Eastern bloc countries (more related in former ideologies than the rest of the European countries), on the other. To meet such increasing demand, several Confucius Institutes were set up in Romania, the first of which was established in 2006 at Lucian Blaga University of Sibiu, in cooperation with the Beijing Language and Culture University (BLCU) China. It was intended to strengthen educational cooperation between the two countries, support and promote the development of Chinese language education as well as increase mutual understanding between the peoples of Romania and China. Very soon, it became clear that multilingual e-Learning contexts can successfully enhance communication and appreciation of intercultural differences which can break down barriers, build trust and strengthen relationships, open horizons and yield tangible results.

4. E-LEARNING SOLUTIONS AND DESIGN AT LBUS

At Lucian Blaga University of Sibiu, the number of incoming foreign students is increasing every year along with a fast growing availability for new modern e-Learning technologies; in this context, we argue that with an ever larger number of foreign exchange students who wish to take up Business and Cultural Studies (in Romanian) all the while soaking up Romanian culture and civilization and an increasing number of Romanian students accessing our university’s e-Learning platform on the other, a reconsideration of intercultural interactions and learning dynamic processes has rendered participatory e-Learning more adequate and better equipped as a learning technology for the newly formed communities of foreign and Romanian learners (who are close in digital knowledge and Internet accessibility).

With adequate equipment and professional monitoring, we maintain that this new engaging model of learning can be further extended multi-cultural training with slight alterations for a differently focused curriculum and architecture of web course design.

5. PRESENTATION OF THE LBUS E-LEARNING PLATFORM

The shift from former education institutions and processes, toward diverse learning opportunities that are more process and outcome oriented, has been at our university gradual, constant and accelerating. In the following, the technical data on the most recent e-Learning system implemented at our university show why and how this new engaging modern learning technology can better serve all learners, particularly the new Chinese community of learners.

In 2010, through the European Structural Funds, the POS CCE Sectorial Operational Program funded and assisted Lucian Blaga University of Sibiu in the implementation of a complex e-Learning platform with a view to increasing regional development through a more open and flexible education system. The immediate aims were the improvement and diversification of educational services as well as increasing access for traditional and non-traditional students, irrespective of prior training, money availability and regional distribution; achieving a better and closer learning output monitoring, overcoming traditional education barriers of face-to-face teaching and learning by introducing participatory e-Learning; and last but not least, enhancing and diversifying participatory e-Learning activities, etc.

This e-Learning Platform is based on Workplace Collaborative Learning, an IBM-standard tool for online personalized E-education resources. The system has its own relational database (WCL database) – where the entire courses’ materials are kept and which also stores info on users, courses and settings for both Learning Server and Delivery Server [6]. It is linked to the university’s student management database (UMS database) from where it takes the necessary information about the student and teachers so that it will be to generate authentication information for them. The course packages have to be created in a SCORM compliant format and then uploaded on a FTP Server. The Workplace Collaborative Learning service is the meeting place for all our university’s e-Learning services. It is built on top of WebSphere Portal Server which is a foundation of course offerings with enterprise portal capabilities that enable you to quickly consolidate applications and content into role-based applications, complete with search, personalization, and security capabilities. It sits on top of WebSphere Application Server which offers valuable options for a fast and flexible Java application server runtime environment and enhanced reliability and resiliency. The WebSphere Application Server hosts a dynamic web application that requires web tier clustering and failover across multiple application server instances.

The Workplace Collaborative Learning, which provides workspace and communication facilities, such as: document libraries, Wikis, blogs, forums; an Instant Messaging Server and Virtual Classes, which facilitate chat among users as web server through the IBM Lotus Sametime Platform, as well as virtual class environments, such as: whiteboard, online presentations, desktop sharing, polling, course chat sessions, audio/video communication; and a Content Developing
Instrument, which allows content to be developed and get uploaded on the e-Learning platform. The system is thus meant to provide an integrated set of collaborative instruments (web conferences, chat rooms, forums for discussions) in addition to traditional teaching and learning activities so as to make up in range and availability for what they lack in (individual) participation and complexity [9].

*IBM Lotus Quickr* is team collaboration module meant to help in accessing and interacting with the people, information, and project materials. It is a platform offering a rich set of features, such as team spaces, content libraries, discussion forums, and wikis, enabling team collaboration. It allows organizing and sharing documents and information with team spaces, content libraries, team discussion forums, wikis, and connectors. It reduces “inbox bloat” by providing a central, shared way to share attachments and large files [10].

The e-Learning platform has also an electronic archiving module, for storing documents – mainly courses, catalogs, scientific notes, papers, etc.

Another aspect which the e-Learning platform is covering is internationalisation. As the platform is bilingual – Romanian and English, it is easy for foreign students use it.

6. PARTICIPATORY E-LEARNING

This e-Learning system at LBUS, a provider of institutional services geared towards a better collaboration and communication between students, teachers and administrators can be additionally complimented and enhanced by participatory e-Learning via the Internet. This is the learning framework for such newly emerging learning beneficiaries at our university, primarily because what may act as a deterrent, the use of Romanian as the language of teaching, is thus completely removed and replaced by English, the common, universal web means of communication. In the common cyberspace of active learning, all cultural barriers of communication in this model are broken down. With growing economic, social, political and cultural availability and fewer IT knowledge constraints, e-Learning platforms and technologies allow for more participatory room and scope in the classroom. In this way, students will be the authors of the content of the assigned courses in the online meeting rooms.

7. SERVING OUR STUDENTS BETTER; DIVERSIFIED AND PERSONALIZED MEANS

Traditional e-Learning technologies and distance education opportunities continue to increase worldwide due to growing digital knowledge and almost universal Internet access. Despite such arguments that emerging online technologies have widened the digital divide instead of reducing it, since access to the Internet is required [4], we hold that our university e-Learning platform in combination with active and participatory consumption-based learning technologies—such as online photo albums, blogs, wikis, podcasts, e-books, YouTube videos, virtual worlds, wireless and mobile computing— are apt to bring newer avenues for our university’s students. Empowered foreign and Romanian learners alike are granted thus more choice and self-determination in their own learning. For mixed foreign and Romanian student groups, taking up either Cultural...
Studies or Business Programs, regular class participation can be more successfully replaced with weekly participation in online courses and webinars, tidbits and shared online video (You Tube and Teacher Tube), all of which are better adjusted to enhance the interactive and collaborative learning. Traditional methods only are no longer equipped to deal with such groups primarily because of the inter-cultural component embedded in the learning activity for which such modern e-Learning activities provide immediate solutions and affordance in these modern times. Undoubtedly, developing inter-cultural relationships and improving inter-cultural trust via such learning technologies are conducive to a long-range and long-term effect on social and economic links between our university and other countries and, if used in combination, the e-Learning system is more adequate to accomplish this due to the openness, common sharing and curiosity fuelling all virtual visitors; teachers can be thus more thoughtful and can act as effective online instructors as well as business negotiators who do no longer teach but moderate, coach and assist students in the learning process of knowing each other’s culture. Connectivity, social knowledge and participatory learning can be enhanced in consultation and browsing sessions of Wikis, Wikipedia and Wiki-books combined with Networks of Personalized Learning (e.g. language learning, tutoring). Traditional class participation is reflected only in the combination of article readings, verbal and written reactions to ideas, observing demonstration tools or videos, discussions of culture-specific ideas, tidbit rankings, simulations of business environments, synchronous session attendance, in fact, a mere combination of quantitative and qualitative elements.

8. ADVANTAGES OF PARTICIPATORY E-LEARNING

The participative e-Learning model envisions a self-driven learning, where the content of the course is updated no longer only by the teacher, but also by the students.

Self-driven learning has a number of interpretations from motivated students in a prescribed and dependent study through student generated study material and learning path. The former suggests an environment dependent learning with a high level of directed study, whereas the letter is more self-guided learning where students are able to develop the topic, timeline, pace and place of learning.

Participatory e-Learning offers new opportunities for learning by creating new and exciting ways to engage these students in the learning process and use what they have in common: digital knowledge. Active engagement strengthens learning whereas traditional forms of learning have proven much less able to engage learning. Likewise, the particular advantage of participatory e-Learning for foreign incoming students is that it empowers them to control their own learning in terms of when, where and, above all, how they learn. Both Romanian and Chinese learners will have thus full freedom to access, sequence and repeat their learning materials outside the constraints of their course on and off the LBUS Platform.

9. CONCLUSIONS

e-Learning and Participatory e-Learning allow for a radical change of the relations between the higher education institution and work organization, students and teachers, development of telework, organization of space as well as lack of need to develop new schemes for accreditation of prior learning for incoming ECTS credit students. Additionally, this also represents a strong point in our argument that such a combination of learning technologies can be extended to corporate training for business practices. From a technological point of view, this indicates a shift from mass media to knowledge media which empowers individuals, not just as consumers, but also as co-producers of information, knowledge and culture. In corporate training sessions, focused on specifics of inter-company or multinational scope, such learning technologies are apt to lead to the foreign trainees’ better integration within the Romanian business-learning environment. At our university, (participatory) e-Learning technologies in the classroom prove to be the current mutually beneficial model that allows for better cultural scope and outreach, outsourcing more and diverse learning environments throughout the country and region.

10. ACKNOWLEDGEMENTS

This work was supported by Sectorial Operational Programme Human Resources Development 2007-2013 Priority Axis 1: “Education and training in support for growth and development of a knowledge based society”, key area of intervention 1.5: “Doctoral and post-doctoral studies programmes for research support”. The project title is “Harmonization of the Romanian academic valences of the European Community”. Contract code: POSDRU/CPP1077/DI1.5/S/76851 whose beneficiary is Lucian Blaga University of Sibiu.

11. REFERENCES

8. The POS-CCE project, Regional Development through Open and Flexible Education - Implementing a comprehensive platform of e-Education at the Lucian Blaga University of Sibiu, 2010
USING THE FINITE ELEMENT METHOD IN TEACHING STUDENTS ABOUT THE PHENOMENA OCCURRING AT THE FLOW OF METHANE GAS THROUGH PIPES AND FAUCETS

Alina, Gligor¹  Valentin, Oleksiuk²  Valentin, Petrescu³  Cristian, Deac⁴ and Alecu Sorin, Huidan⁵
1 Lucian Blaga University of Sibiu, Faculty of Engineering, alina.gligor@ulbsibiu.ro
2 Lucian Blaga University of Sibiu, Faculty of Engineering, valentin.oleksiuk@ulbsibiu.ro
3 Lucian Blaga University of Sibiu, Faculty of Engineering, valentin.petrescu@ulbsibiu.ro
4 Lucian Blaga University of Sibiu, Faculty of Engineering, cristian.deac @ulbsibiu.ro
5 S.C. Hasel Industrial SRL Targu Mures, sorin.huidan@hasel.ro

ABSTRACT: Due to the fact that it has been shown that students have difficulties in understanding the complex phenomena occurring at the flow of methane gas through pipes and faucets as taught in the classical, analytical manner, the current paper suggests the usage of the finite element method for aiding the teaching of these phenomena. This method allows the determining of important parameters such as the gas speed, the occurring pressure losses, the energy consumed in various flow types without requiring the memorizing or deduction of complex equation systems. The main benefit brought by this method in the teaching of undergraduate students, graduate students or doctoral students is that the visual impact it brings helps to increase the degree of comprehension and also the students’ interest in furthering their technical training.

Key words: finite element method, gas flow, technical training

1. INTRODUCTION

While at first, in the education system the computer was regarded just as a work instrument for informatics laboratories, where only students training for this domain had access, the last few years brought a conceptual revolution in education, the computer becoming a teaching and learning tool in general, for most if not all disciplines in the curricula.

The extraordinary development of multimedia technologies has contributed to the appearance of a new domain, the educational software, in fact a hybrid between computer programming, psycho-pedagogy and various disciplines from the curricula, which today goes beyond the stage of experiments and is about to become a domain in its own right, with a safe future in the educational offer.[2]

The act of learning is no longer considered to be the sole effect of the professor’s undertakings and work, but it includes also the result of the students’ interaction with the computer, on the one hand, and of the cooperation with the professor on the other hand.

This change in the education system has two main targets:

1. Increasing the efficiency of the learning activities;
2. Developing the communication and individual study competences

Using the computer in education activities brings several advantages [2, 5]:

3. Stimulation of the ability of innovative learning, adaptable to fast social change conditions;
4. Stimulation of the logical thinking and imagination;
5. Introduction of a cognitive, efficient style, for working independently;

6. Consolidation of the scientific investigation abilities;
7. Forming of useful practical skills;
8. Providing a permanent feedback, the professor being able to redesign the activity function of the previous sequence;
9. Providing the selection and usage of adequate strategies for solving various applications;
10. Development of the thinking so that, starting from a general manner of solving a problem, the student finds on his/her own the answer for a concrete problem;
11. Development of the visual culture.

Although it is very useful to carry out real experiments, their preparation and realisation takes up a lot of time and teaching resources. Therefore, computers are very useful because they simulate complex processes and phenomena that no other teaching instrument is able to highlight so effectively. Through it, students are offered modellings, justifications and illustrations of abstract concepts, illustrations of processes and phenomena that are otherwise impossible or hard to analyse and not least it allows to carry out experiments that would be impossible to be done in practice in a certain learning institution, due to the difficulty to acquire the appropriate equipment.

Students can modify very easily the conditions under which a virtual experiment is taking place, they can repeat it for a sufficient number of times so that they can track the manner in which the studied phenomena unfold, they can formulate functioning laws and extract conclusions.

Nowadays, the computer facilitates the achievement of important goals in learning and can be used by professors in a variety of situations. It is actually much easier for the professor to become a mentor, a partner of the student in his/her learning activity.
Beneath the informative and formative advantages of using information and communication technology, there needs to be mentioned also the aspect of attractiveness, a concept that is considered to be important in the current pedagogical concepts. Computers and computer-based tools and technologies increase significantly the attractiveness of the educational process.

There exists, however, a principal limitation of the possibility to use computers in education, a limitation that can be surpassed only by maintaining an important role for the professor in acquiring, processing and using information in the training of practical skills and abilities. Therefore, the interest for developing a technological competence has to go beyond the stage of the initial training for a profession and needs to be present throughout the career, requiring also a continuous redefining of the training objectives.

Starting from the above-mentioned ideas, the authors have sought to outline, in the present paper, some ideas and possibilities for introducing computer-assisted, finite-element-based learning in a specific area of natural gas engineering education, namely in the area of studying the methane gas flow through pipes and faucets, as commonly encountered in gas distribution pipelines.

2. THE THEORETICAL, ANALYTICAL STUDY OF GAS FLOW PHENOMENA

Currently, the speciality disciplines emphasise either the tackling of phenomena from a practical, experimental point of view, or an analytical approach, based on mathematical formulas that usually imply a high complexity.

In the specific case of natural gas engineering, for example, the flow of methane gas through a pipe is described by a series of equations, such as:

- the continuity equation:

\[
\frac{\partial \rho}{\partial t} + \frac{\partial (\rho v_x)}{\partial x} + \frac{\partial (\rho v_y)}{\partial y} + \frac{\partial (\rho v_z)}{\partial z} = 0,
\]

where \(v_x\), \(v_y\), and \(v_z\) are the components of the speed vector on \(x\), \(y\) and \(z\) directions;

\(\rho\) is the fluid’s density;

\(t\) is the time;

- the moment equations:

\[
\tau_{ij} = -P\delta_{ij} + \mu \left( \frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i} \right) + \delta_{ij}\lambda \frac{\partial u_i}{\partial x_j},
\]

where \(\delta\) is the stress tensor;

\(u_i\) are the orthogonal speeds;

\(\mu\) is the dynamic viscosity;

\(\lambda\) the second viscosity coefficient.

- the equation of the compressible energy:

\[
\frac{\partial}{\partial t} \left( \rho C_p T_\text{o} \right) + \frac{\partial}{\partial x} \left( \rho v_x C_p T_\text{o} \right) + \frac{\partial}{\partial y} \left( \rho v_y C_p T_\text{o} \right) + \frac{\partial}{\partial z} \left( \rho v_z C_p T_\text{o} \right) = \frac{\partial}{\partial x} \left( K \frac{T_\text{o}}{C_p} \right) + \frac{\partial}{\partial y} \left( K \frac{T_\text{o}}{C_p} \right) + \frac{\partial}{\partial z} \left( K \frac{T_\text{o}}{C_p} \right) + W' + E' + Q + \Phi + \frac{\partial P}{\partial t},
\]

where \(C_p\) is the specific heat;

\(T_\text{o}\) is the total temperature;

\(K\) is the thermal conductivity;

\(W'\) is the mechanical work due to viscosity;

\(Q\) is the volumetric heat;

\(\Phi\) is the heat loss due to viscosity;

\(E'\) – kinetic energy.

The solving of these equations leads in the end to fully describing the state or evolution of the flowing fluid system under certain conditions.

However, this analytical approach does not offer the students an overview of the transformations that occur, being very hard for them to understand, for example, the transformations taking place in the case of simultaneously varying two or more parameters present in these equations.

Given the central role of the flowing phenomena in the whole theory and practice of natural gases engineering in general and in the design and realising of specific technologies and equipments in particular, it is very important for the students to understand the process of determining the motion parameters, especially in the case of the internal motions. These are motions of the fluids taking place within domains with closed frontiers (pipes, channels, nozzles etc.). Within capillary tubes, the motion is entirely viscous even when the fluid itself has a very low viscosity and the tubes are very short. The viscous motion can be laminar or turbulent, depending on whether the fluid layers glide one over the other or whether their gliding is blocked by the presence of pulsating speed components, developed on all directions of the space occupied by the fluid. For flow analyses of static type but also for flow analyses of transient type, the speeds are obtained based on the principle of momentum conservation, while pressures are obtained based on the principle of mass conservation.

This comes to underline that a theoretical study, based on analytical instruments such as the mentioned mathematical equations, is difficult to present by the professor and also difficult to understand by the students.

3. THE USAGE OF THE FINITE ELEMENT METHOD IN TEACHING GAS FLOW PHENOMENA

In order to overcome the disadvantages presented above and to benefit from the capabilities of modern design methods, in the last year there have been introduced in teaching several computer-based numerical simulation and modelling methods, among which the best known is the finite element method.

The finite element method is a numerical method used for solving equations with partial derivatives, that can model physical systems with an infinite number of degrees of freedom. By applying the finite element method, these equations with partial derivatives are reduced to a system of algebraic equations, i.e. to a discrete system with a finite number of degrees of freedom. The fundamental idea of the finite elements method resides in the fact that the given domain for a certain problem is represented as a collection of subregions called finite elements. These elements are interconnected through points called nodes.[1]

The finite element method is thus based on the concept of building complex objects from simple objects, or on dividing complex objects into simpler objects, for which known calculation schemes can be applied, i.e to replace a complex problem with a collection of simple problems. In many situations, the existing mathematical apparatus is not sufficient for finding an exact solution and in some cases even not sufficient for finding an approximate solution for practical problems [1,4].

The finite element method has found applications in various engineering domains (and not only), where there are physical
phenomena described by equations with partial derivatives. Among the main domains in which this method can be used, there can be mentioned: structural analysis, fluids analysis, magnetical analysis and electrical analysis.

There are three possibilities for formulating the finite element method [1]:

a) direct formulation;
b) variational formulation;
c) residual formulation.

The direct formulation is based on the matrix calculus of structures based on the displacements method.

The variational formulation is based on minimizing the potential energy of the deformable solid, based on a criterion of stationing the potential energy. It uses the principle of virtual mechanical work or energy theorems such as the theorem of minimal potential energy, the theorem of minimal complementary energy, the Hellinger-Reissner theorem or Hamilton's theorem for dynamic problems.

The residual formulation can be used when there exists no functional formulation, being a more general formulation than the variational formulation. This formulation may employ the method of the smallest squares, the Galerkin method, the colocation method etc.

Problems that may be solved using the finite element method can be grouped into three categories [1, 3, 5]:

1. equilibrium problems, case in which the unknown functions do not depend on time. This type of problems occur for example when determining the elastic behaviour of solid deformable bodies, in static regime;
2. eigenvalue problems, where parameters are independent of time, being determined certain critical values of these parameters. Such problems occur when determining the critical stability loss forces for structures or in the modal analysis of structures, when there are determined the eigenfrequencies and the eigenmodes associated with these frequencies;
3. propagation problems or problems in which the unknown functions are time-dependent. Such problems occur when studying the dynamic reaction of a structure.

For example, in the case of the flow problems mentioned above, it is considered that the flow problems are nonlinear problems and for their solving, the calculus software requires a certain number of iterations. The number of iterations necessary for solving a flow problem depends on the size of the problem (the number of finite elements in the network) and on its stability. The speciality literature [1, 3] mentions, for example, that bidimensional problems of laminar type imply a number of 40-50 iterations, while those of turbulent type require a higher number of iterations: 60-80.

4. THE TEACHING AND LEARNING METHOD IMPLYING THE USAGE OF FINITE ELEMENT ANALYSIS

The teaching of methane gas flow phenomena using the finite element method, for students of the Natural Gases Engineering study program, may employ as teaching aids software packages such as Ansys, ABAQUS, Nastran, Cosmos, Algor etc.

Ansys, for example, allows the integration of analytical equations such as the ones presented in paragraph 2 of this paper, in a numerical structure and the visualisation of results in a graphical form.

The software also allows to obtain variation graphs on various sections, the students having the possibility to visualise all these details.

In order to test and exemplify the capabilities offered by Ansys as a teaching aid, the authors have started from simulating, using the finite element method as implemented in Ansys, the flow of methane gas through a state-of-the-art faucet.

Figure 1 presents the network of finite elements and nodes, together with the corresponding loads, for the analysed situation.

Figures 2, 3 and 4 present maps of the methane gas speed variation on different directions.

Figures 5 and 6 present the maps of the pressure difference and of the kinetic energy in the analysed situation.

Figure 1. Finite elements network and the corresponding loads for the case of a faucet transited by a flow of methane gas

Figure 2. Speed in the faucet expressed as vector [m/sec]

Figure 3. Speed in the faucet on x direction [m/sec]
Any of the graphs presented in figures 2-6 can be analysed fairly rapidly by the students and they can tell, based on the knowledge they had gained previously in this domain, on the difference in colors and using the color chart at the figures's bottom as reference, what happens in a certain situation, where the most problematic area is located and even what could be done in order to eliminate the noticed problems.

5. CONCLUSIONS

The authors have thus shown in this paper that using the finite elements method in the teaching of specific engineering problems, such as the problem of methane gas flow through pipes, is beneficial to the students and presents several advantages, such as:

- the usage of visual, interactive methods makes it easy both for experienced people and for novices to understand the characteristics of the dynamic flow of methane gas (or of any other type of fluid);
- it does not require expenses for the endowment with sophisticated, expensive laboratory equipment other than computers with enough computing power, which however have become in recent years fairly common and relatively cheap;
- the method’s precision is very high and depends only on the manner in which the finite elements network is discretised;
- since, in most cases, faucets and pipes are axis-symmetrical parts, it suffices to model the transversal cross-sections of those parts, so modelling activities and the calculus effort is reduced to a minimum;
- by using parametrisation methods, there are created part families, the numerical simulations being much easier to realise and leading to the capability to construct within a short period of time several variants, which allows the students to cover a wide range of constructive solutions.

This method also guarantees a much higher degree of attention granted by the students to learning and understanding the presented matters (due to the attractiveness of any computer-based application, but also due to the fact that they can very easily transpose the knowledge gathered here to other similar problems and even to other topics or even subjects).

For the future, it is intended to seek a better integration between analytical methods and numerical (finite-element-based) methods in teaching, so that students can have a better, holistic image of the topic being taught.

6. REFERENCES

2. Constantin, L.-V., Dinica L., Eficienţa utilizării TIC în procesul instructiv-educativ, Conferinţa Naţională de Învăţămănt Virtual, ediţia a IV-a, 2006, p. 297
COLLABORATION IN ENGINEERING AND BUSINESS EDUCATION
NEW METHODS FOR LEARNING IN COMPUTER SCIENCE EDUCATION

Iunia-Cristina, Borza
University "Lucian Blaga" of Sibiu, iunia.borza@gmail.com

ABSTRACT: Computer Science has an important impact on our every-day lives. Education in Computer Science is a difficult process that in the last decade has known radical transformations. New concepts were brought to life, for example K12, which regulates the way that the education develops in this domain from an educational system point of view and also from the teaching ways of the professors. The wide-range development of the Internet generated new ways of teaching in computer science. In this paper, I would like to present the way in which an interactive lecture can be held between a student and its teacher, a course that respects the SCORM standards of WEB implementation. Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for e-learning. This collection of standards is defined by the de Advanced Distributed Learning (ADL), an organization from the USA Defence Department.

Key words: computer science, software, course, database, programming

1. INTRODUCTION

In this paper we present the main features of the model curriculum for K-12 computer science, methods of achieving a course e-learning SCORM compliant tooth teacher and student interaction in this process. The ACM Model Curriculum for K-12 Computer Science has made a significant contribution to computer science education, providing a practical guideline for educators seeking to ensure that students acquire the skills they need to succeed in an increasingly technology-imbued and globally competitive world. SCORM standards are very important for e-learning courses.

2. A MODEL CURRICULUM FOR K-12 COMPUTER SCIENCE

The model curriculum can be used to integrate computer science fluency and competency throughout schools and universities, both in the United States and throughout the world. It is written in response to the pressing need to provide academic coherence to the rapid growth of computing and technology in the modern world, alongside the need for an educated public that can utilize that technology most effectively to the benefit of humankind. As a basis for describing a model curriculum for K-12 computer science, the definition of computer science is required. Computer science (CS) is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.

This definition requires that K–12 computer science curricula have the following kinds of elements: programming, hardware design, networks, graphics, databases and information retrieval, computer security, software design, programming languages, logic, programming paradigms, translation between levels of abstraction, artificial intelligence, the limits of computation (what computers can’t do), applications in information technology and information systems, and social issues (Internet security, privacy, intellectual property, etc.).

The goals of a K–12 computer science curriculum are to:

1. introduce the fundamental concepts of computer science to all students, beginning at the elementary school level.
2. present computer science at the secondary school level in a way that would be both accessible and worthy of a curriculum credit (e.g., math or science).
3. offer additional secondary-level computer science courses that will allow interested students to study it in depth and prepare them for entry into the work force or college.
4. increase the knowledge of computer science for all students, especially those who are members of underrepresented groups.

2.1. A comprehensive model curriculum

The overall structure of this model is shown in Figure 1. As this figure suggests, the model has four different levels, whose goals and content are introduced below.

Level I [1] should provide elementary school students with foundational concepts in computer science by integrating basic skills in technology with simple ideas about algorithmic thinking. This can be best accomplished by adding short modules to existing science, mathematics, and social studies units.

Students at Level II [2] should acquire a coherent and broad understanding of the principles, methodologies, and applications of computer science in the modern world. This can best be offered as a one-year course accessible to all students, whether they are college-bound or workplace-bound. Since, for most students, this Level II course will be their last encounter with computer science, it should be considered essential preparation for the modern world.

Figure 1. Structure of a K–12 Computer Science Curriculum

Students who wish to study more computer science may elect the Level III course, a one-year elective that would earn a curriculum credit (e.g., math or science). This course continues the study begun at Level II, but it places particular emphasis on
the scientific and engineering aspects of computer science—
mathematical principles, algorithmic problem-solving and
programming, software and hardware design, networks, and
social impact. Students will elect this course to explore their
interest and aptitude for computer science as a profession.

Finally, the Level IV offering is an elective that provides depth
of study in one particular area of computer science. Any Level
IV course will naturally require the Level II course as a
prerequisite, and some will require the Level III course as well.

2.2. Implementation Challenges

Teaching any subject effectively depends on the existence of a
sound curricular model, explicit teacher certification standards,
appropriate teacher training programs, and effective curricular
materials.

For schools to widely implement this model, work is needed in
three important areas: teacher preparation, state-level content
standards, and curriculum materials development. In addition,
persons in leadership positions must acknowledge the
importance of computer science education for the future of our
society. States and accrediting organizations should make this a
factor in overall school accreditation.

2.2.1. Teacher Preparation

For students to master this new subject, teachers must acquire
both a mastery of the subject matter and the pedagogical skills
that will allow them to present the material to students at
appropriate levels.

It is understood that there must be a match between the
computer science skills and knowledge defined for the students
and the acquired skills and knowledge of the teachers. At the
same time, teachers must have a greater depth of knowledge
than that embodied in the topics they are teaching.

2.2.2. State-Level Content Standards

Recently, efforts have increased to develop national and state
content standards for computer science. Curriculum standards
serve to define the skills and knowledge of the discipline to be
acquired by every student. For this to happen, school curricula
must be aligned with these standards. Content standards for
computer science education need to be developed and adopted
in a way that parallels what has occurred in disciplines such as
science, mathematics, and language arts. Curriculum frameworks aligned with these content standards can then be
developed for the classroom.

2.2.3. Curriculum Development

This report presents a model for computer science education,
but not a complete “deliverable” curriculum. Additional steps
need to be taken to formulate content standards, define
professional development needs, develop curriculum
(textbooks and laboratory materials), and disseminate
information to students in the classroom. For all this to happen,
teachers must play a substantial and leading role in the
formulation of curriculum components. This will also require
the participation of university faculty and professional
organizations to serve as facilitators and guide a process that
will yield a deliverable and effective curriculum.

2.2.4. Implementation and Sustainability

This report proposes a model, but not a “deliverable”
curriculum in the form of teaching materials, lesson plans, a
trained teaching cohort, or an operational budget to deliver K–
12 computer science in the way suggested above. Additional
steps are needed to begin this process of implementation in K–
12 schools. The following are essential.

Buy-in—these recommendations should be endorsed widely by
organizations that have a stake in their implementation: ACM
SIGCSE, ISTE SIGCS, ASCD curriculum directors in school
districts, state boards of education, NEA, NASSP, and NSBA.

Curriculum and course development—Funding sources like
NSF should be approached to assist teams of K–12 teachers
and other computer science educators to develop pilot courses
along the lines suggested in this report. Concurrently, textbook
and Web-based publishers should be encouraged to invest in
these experimental courses, so that the resulting teaching
materials can be widely disseminated and used elsewhere.

Professional societies—Support the establishment of a
“National Computer Science Teachers Association,” a new
professional society for K–12 computer science teachers,
which has recently been proposed by ACM (ACM, 2003).
Similarly, ACM SIGCSE and ISTE’s NECC should continue
to broaden their missions and conferences to better
accommodate K–12 computer science teachers. State and
regional organizations should provide ongoing support and
collaboration for K–12 computer science teachers at the local
level.

Culture—Most teachers who now offer computer science in K–
12 schools are experiencing a strong sense of isolation and
vulnerability. This frustration has many roots, including the
glacially slow pace of attitudinal and programmatic change, the
battle to obtain adequate computing resources, the lack of
acceptance of computer science among math and science
colleagues, the absence of state curricular standards, the
shortage of opportunities for in-service and pre-service training
in computer science, and the unusual vulnerability of computer
science faculty and courses to budget cuts during times of
fiscal restraint.

3. THE LEVEL III: OBJECTIVES AND
OUTLINES MODEL

The Level III course [3], broadly described in the Model,
focuses on introductory computer science analysis and design
concepts. It provides learning objectives, detailed focus points,
assessment measures and sample educational activities for each
topic in the Level III course.

The Level III course places analysis and design front and
centre in the study of computer science. As such, it is targeted
to high school students who may be interested in pursuing
further study in the computing disciplines beyond high school.
It is not intended to be a first course in computer science.
While it may be a final course for some students, the goal is to
present the various facets of computer science in a broad and
compelling manner so as to excite students and encourage
continued study of the computing disciplines. Level III
establishes a framework of topics that are typically introduced
in depth at the undergraduate level.

3.1. Content of Level III Model [3]

The document contains 10 main topics. For each main topic
there is a general description, statement of necessary resources,
learning objectives, assessment guidelines, a list of focus areas
that fall within the main topic area, and a sample activity or
two that suggests the anticipated level of student learning. The
sample activities are meant to be representative; they are not to
be taken as required implementations of the student learning
objectives. Careful consideration must be given to choosing a set of activities appropriate to a given classroom situation.

3.2. Presentation of topic 1: Program Design and Problem Solving

This topic provides an introduction to the fundamental ideas about problem solving and program development including style, abstraction, and discussion of correctness as part of the software design process. Students design algorithms and programming solutions to a variety of computational problems. While the choice of programming language is left to the instructor, the programming component should include control structures, functions, parameters, objects and classes, and structured programming and event-driven programming techniques.

Table 1. Student Learning Objectives

<table>
<thead>
<tr>
<th>Student Learning Objectives</th>
<th>Assessment Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe a problem statement in a natural language</td>
<td>Written Activity</td>
</tr>
<tr>
<td>2. Use design tools such as flowcharts or UML diagrams to express a solution to a problem</td>
<td>Lab activity</td>
</tr>
<tr>
<td>3. Solve problems by applying programming language concepts and translate the solution into a program that uses appropriate subroutines and control structures</td>
<td>Lab activity</td>
</tr>
<tr>
<td>4. Implement a linear, procedural, and object-oriented system</td>
<td>Written Activity</td>
</tr>
<tr>
<td>5. Find a solution to ensure that it meets the stated requirements</td>
<td>Lab activity</td>
</tr>
</tbody>
</table>

Table 2. Assessment Recommendations

<table>
<thead>
<tr>
<th>Assessment Recommendations</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>An average of 70% from combined assessment measures is required to demonstrate proficiency in course material.</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
</tbody>
</table>

3.3. Facets of Computer Science

Computer science can be seen as comprising four facets:

- **Computer Hardware**
- **Using Computer Software**
- **Solving Problems by Developing Software**
- **Computers, People, and Society**

3.3.1. **Computer Hardware**

The development of the electronic computer has been one of the technological marvels of the last century. Research and development of computers and peripherals actively continues.

Principal concepts and themes of this facet are:

1. At a fundamental level, all computers are collections of circuits.
2. The most common architecture for computers is based on a central processor, memory, and peripherals.
3. Memory storage devices (including punch cards, paper tape, cassette tapes, hard disk drives, floppy disks, CD-ROMs and DVDs, memory sticks, RAM, ROM, cache, and video memory) have a variety of characteristics.
4. Memory storage devices usually store information in units called bytes, and each byte has a numeric address.
5. Computer processors (chips) are almost ubiquitous in cars, cell phones, traffic signal controllers, and other embedded devices.

3.3.2. **Using Computer Software**

Some software is written to be tightly integrated with specific hardware, as in a cell phone or a digital camera. In other cases, a software application, such as a word processor or a Web browser, is primarily designed to run on standard hardware. Sometimes software works "behind the scenes" and can be almost invisible, as in the Internet or many parts of an operating system. Familiarity with a variety of computer software programs and with the basic concepts underlying many of them is a prerequisite for many jobs and for understanding a large part of 21st century culture.

3.3.3. **Solving Problems by Developing Software**

Computer software solutions are created by identifying a need or opportunity, analyzing how it can be addressed with software, designing and coding the program, carefully testing the program, and in many cases writing documentation and training the users. Gaining a basic understanding of how software is created gives students a deeper understanding of what computers can do.

3.3.4. **Computers, People, and Society**

Technical advances have driven social changes throughout history, and tools have shaped culture in many ways. The rapid development of computers, networks, and peripherals has an ongoing impact on society.

Principal concepts of this facet are:

1. Computer technology and software changes more quickly than ethics and laws, thus creating a constant tension in society.
2. The ubiquity of data in digital format presents new issues of privacy and security.
3. Computerized data is often copied and rarely deleted, raising issues of privacy, ethics, and ownership rights.
4. Humans are best at recognition, making connections between similar things, and learning by doing. Computers are best at following small instruction steps and processing digital data quickly and consistently.
5. A human-computer interface is the meeting point of the human and computer realms. A good interface minimizes the human's short-term memory load, is compatible with a diverse set of users, and prevents errors.
6. Computers are tools with several functions: to process data (to compute), to store data, to acquire and display data, and to move data from one computer to another (to communicate).

4. SCORM STANDARD

Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for computer-assisted learning (e-learning). This collection of standards defined by the Advanced Distributed Learning (ADL), an organization within the U.S. Department of Defense. SCORM is a model for multiple use and its goal of standardizing content and content technology for education and online education, such training. More specifically SCORM is a set of technical standards for e-learning software. SCORM says programmers how to write their code so that it was “fit” with several e-learning software. Specifically, SCORM eLearning and regulate the content of LSM (Learning Management Systems). Take, for example, DVDs. When buying a new DVD movie, it works on all brands of DVD players, as they are made according to certain standards.

SCORM defines the communication between the content on the client system and a host system called the run-time environment (commonly a function of learning management system). SCORM 2004 introduces a complex idea called sequencing, which establishes a set of rules that specify the order in which the user can access training topics can experiment and use different teaching materials. The standard uses XML, and is based on results obtained by AICC (CBT) Training IMS Global Consortium and IEEE.
4.1. SCORM components

SCORM specifications are defined in three main documents[4]:

- SCORM Content Aggregation Model (SCORM aggregation model content) defines the requirements for assembly and packaging of content, requirements for content editors, so any package that complies with these requirements can be loaded on any platform and run e-learning in it.
- SCORM Run-Time Environment (SCORM runtime environment) defines requirements for running the content, applicable to both an LMS (software learning management) and content objects.
- SCORM Sequencing and Navigation (SCORM Sequencing and Navigation) defines requirements for the order in which various items of content are delivered on students and how this order can be controlled by a series of events generated by the student navigation or content.

From a structural, SCORM is constitute of 4 sequences, respectively:

- sequence overview at the conceptual level (refer to SCORM version)
- sequence describing the unit components
- sequence showing learning management (learning progress)
- Navigation and production sequence of events

SCORM Sequencing defines the requirements on the order in which various items of content are delivered on students and how this order can be controlled by a series of events generated by the student navigation or content.

Sequencing rules allow the author to do the following: to determine what Moodle LMS should provide student (buttons previous / next); specify the order of activities; to do so some parts of the course to be more important than others.

In terms of information, a SCORM object is a zipped file containing the definition of a file name extension with IMS manifest, XML. Xml files showing all the other components of the object specification use.

4.2. SCORM Versions

The SCORM’s versions is presented in figure 2. They are: SCORM 1.1 - is the first version, little used because of its rigidity; SCORM 1.2 base version for most platforms; SCORM 2004 - current version to resolve some ambiguities found in version 1.2 and adding new specifications for learning management [5].

SCORM 2004 editions: 3rd edition (October 2006); 4th edition (March 2009)

Producing SCORM objects is the result of a conversion with a module attached to an editor (eg Microsoft Word) or as a result of interaction with a specialized editor (UDUTU, CourseLab, exe, etc.).

CourseLab software [6] is one of the most important editor for e-learning courses. The objects of this software respect SCORM standards.

Product eXe (eLearning XHTML editor) is an editor available at http://www.exelearning.org, offered free.

Udutu[6] is an online editor that can be used freely by creating a user account on the site located at http://www.myudutu.com. Pedagogical support to create courses. Can be imported created using other text editors.

5. CONCLUSIONS

Computer science is a very important discipline that can no longer be ignored by public schools in the 21st century. K12 model curriculum provides a basis by which states, schools of education, and individual school districts can begin to implement a coherent computer science curriculum that is available to all students. K 12 model curriculum, allows important courses for e-learning. Making computer science courses shall conform to SCORM standards.

6. REFERENCES

IMPACT OF INSTRUCTIONAL TECHNOLOGY INCLUSIONS IN COURSE DELIVERY FOR ENGINEERING AND BUSINESS EDUCATION

Rizwan, Muhammad1 Nisa, Fakharun2 Adeel, Muhammad3 Ramzan, Muhammad3 Lal Mohan, Baral4
1 “Arid Agriculture University, Rawalpindi” e-mail: rizwan.bk93@yahoo.com
2 “University of Management & Technology Lahore” nisa.umt16@yahoo.com
3 “Lucian Blaga” University of Sibiu”, e-mail: ramzan1665@yahoo.com, adeel.mgt93@yahoo.com,
4 ”Lucian Blaga” University of Sibiu”, e-mail: baraltex@aust.edu

ABSTRACT: As new technologies are emerging, new trends are also emerging in teaching and learning. Technology inclusion in teaching provides alternative ways to deliver education in pursuit of promoting learning. One of the innovative methods is Blended Learning (BL). This method incorporates both, the traditional Face-to-Face (F2F) instruction and Web-based distance learning method and it imparts an improved learning experience for the students. In this case study, BL models were adopted involving the teaching of two courses—business management and industrial manufacturing at University of Management and Technology (UMT) Lahore. In the models, students’ performance in terms of their liking threshold, were used as the output. The results revealed that instructional technology inclusion caused greater successes in terms of course acceptability by students. This showed an average improvement of 64% in the student performance. ICT or Information and Communication Technology have gained popularity in education sector. In the recent years the term “e-learning” has emerged as a result of the integration of ICT in the education field, but some pitfalls have been identified and this have led to the “Blended learning” phenomenon. The paper can provide directions for the future blended learning environment that may be opted by all the three main stakeholder student, tutors and institution to make strategic decision about the learning and teaching initiatives. The paper concludes that blended learning offers the most flexible and result oriented learning. This paper provides case studies of two of the BL courses including the mode of offering, content with assessment strategies for students to meet the learning outcomes of the courses in detail.

Key words: Technology, Education, Student, Blended learning, instructor

1. BACKGROUND INFORMATION

In the ever changing world it is necessary to determine the factors that affect student’s perception of quality of education [1]. Due to competition students are becoming more critical of the quality of education they are receiving. Students enrolled on E-Learning courses want to make sure that they are receiving the best training from highly qualified instructors, most of whom they will never meet face-to-face. The two stake- holders, academic institutions and tutors must address these issues to satisfy students before deploying any virtual learning environment. No matter how good the E-Learning environment is and what best technology is used to create it, if students are not satisfied then it is of little use.

Through the past decades, the world of education has been varied by the fast and rapid revolution in computer and the Internet technologies which according to Sethy (2008: 29) [1] new findings are generated and become established at breathtaking speed”. This has revolutionized teaching and learning particularly distance education. The arrival of World Wide Web (WWW) has increased the demand for distance education and concepts like online learning or e-learning has emerged, as a result. The system of online learning has been largely used in higher education, and a lot of studies have been done to discover both its strengths and weaknesses [2]. Since e-learning environments present some disadvantages such as inhibiting increased because instructors believe that varied delivery methods can increase students’ satisfaction from the learning experience as well as their learning outcomes [4]. In a more narrow side, the authors [5] have cited the three most common definitions of blended learning:

1. A combination of online and face-to-face instruction
2. A combination of instructional modalities (or delivery media)
3. A combination of instructional methods

Bonk [5], claimed that blended learning is a mixture of online learning and classroom that contain some of the facilities of online courses with the presence of face-to-face communication. Other researchers believe that the systems called blended learning integrates face-to-face instruction with computer mediated learning.

the socialization process of individuals resulting in lack of face-to-face communication; a new environment has surfaced. This new environment combines the e-learning and the classical learning environments. It has been termed as “blended learning, hybrid or mixed learning”. The very important goal of blended instruction was to overcome the flaws of pure online instruction. Since either pure e-learning or traditional learning hold some weaknesses and strengths, it is better to mix the strengths of both learning environments to develop a new method of delivery called “blended learning” [3]. Thus the application of blended instruction has quickly

Figure 1. Schematic diagram of Blended Learning
The availability of digital learning technologies has led to increases in the integration of computer-mediated instructional elements into the traditional Face-to-Face (F2F) learning experience [6]. Blended Learning (BL) is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication amongst all parties involved with a course [7]. BL focuses on optimizing achievements of learning objectives by applying the “right” learning technologies to match the “right” personal learning style to transfer the “right” skills to the “right” person at the “right” time. BL programs may include several forms of learning tools, such as real-time virtual/collaboration software, self-paced Web-based courses, Electronic Performance Support Systems (EPSS) embedded within the job-task environment, and knowledge management systems. BL training involves interacting with a faculty member and other learners via the Web in real time using technologies such as virtual classrooms and/or chat rooms. It also enables the learners to interact with their colleagues and faculty member at their own convenience; such as interacting through email [8].

In expanding and enriching 21st century BL has become an acceptable and effective learning model. BL gives institutions a useful strategy for overwhelming the constraints presented by limited resources, time problems, and budget pressures. It also gives educators the new range of options to craft updated curriculum to learn more successfully in their technology-infused environment. This model can be used in developing countries like Pakistan and Bangladesh to assist in solving the numerous problems faced by education sector. With limited number of tertiary educational institutions, a large number of senior high school graduates are refused access to tertiary education due to limited infrastructure and limited seats available. An implementation of a BL platform will enable the country train her human resource without necessarily increasing physical infrastructure. On the other hand, physical infrastructure can be improved in terms of computer networks with access to internet so that it can cater for the large demand of tertiary education with geographically dispersed students.

While there are various BL models, Different institutions implement BL in different ways. The online component of a course replaces a portion of F2F instruction with Web components allowing for the flexibility of utilizing Web resources to reduce the on-campus time, yet allowing F2F interaction as well, it is important to ensure that the effective integration of the two main components (F2F and Internet technology) takes place [9].

2. USE OF INSTRUCTIONAL TECHNOLOGY IN BLENDED LEARNING

There are many reasons that an instructor, trainer, or learner might pick BL over other learning options. Osguthorpe and Graham [10] identified six reasons that one might choose to design or use a BL system:

Pedagogical richness, Access to knowledge, Social interaction, Personal agency, Cost-effectiveness and Ease of revision. Another advantage of blended learning environments is its potential to offer many sources for learners. Azizan [4] concluded that utilization of technology in physical classrooms offer extra resources for the students and this is expected to enhance learners’ confidence and competence as well as improve the quality of learning. Harrington [11] coined the combination of traditional classes with online ones as ‘hybrid classroom’ and stressed that educators are increasingly engage in hybrid classes as they have become aware of the benefits. Moreover, she emphasized that most EFL/ESL students enroll in hybrid classes too.

BL environment can also mix the least effective elements of OL and F2F if it is not designed well. People choose BL for three reasons: improved pedagogy, increased access and flexibility, and increased cost-effectiveness [12].

3. FORMS OF LEARNING

The three basic forms of learning include self-paced, F2F and online collaborative learning. Self-paced learning provides the flexibility to learn according to the availability of learners’ own time and pace [13]. F2F learning refers to learning that occurs in a traditional classroom setting where a faculty member delivers instruction [14]. Online collaboration involves interaction between learners and faculty members through the web; it enables learners to interact with their colleagues and faculty member at their own convenience; such as interacting through email [8].

4. PURPOSE OF STUDY

Advances in digital technology continue to dramatically change teaching and learning. Among these changes is the emergence of multimedia teaching and learning tools, online degree programs, and hybrid classes that blend traditional and digital content delivery [15]. This research intends to demonstrate that a Blended Learning Model (BLM) can provide an effective method for addressing some of the concerns noted above. To achieve this, a BLM was developed and used for a required first year Business management & manufacturing engineering course at University of Management & technology (UMT), Lahore.

4.1. Objective

In this thesis, the main objective is to measure the degree of success that can be achieved when instructional technology is blended with the traditional F2F instruction in the teaching and learning process. To achieve this, the specific objectives include:

1. To develop a BLM
2. To implement the BLM in the teaching and learning of two courses at a higher learning institution in Lahore and
3. To analyze the impact of the BLM using students’ performance in semester examinations and students’ responses to questionnaires from conducted surveys.

We expect to obtain results to help various institutions to realize the following:

1. The benefits derived from blending courses
2. What to consider when preparing to blend courses
3. The need to be adequately prepared before employing instructional technology in the teaching and learning process.

5. METHODOLOGY

5.1. Designing a BL course

Designing a BL program requires thoughtful integration of F2F experiences with online learning experiences [9]. While it is appealing to consider the benefits of integrating the strengths of F2F instruction with online learning activities [9].

5.2. The “BLM”

The model implemented in this instance involves recorded lecture videos, a course self-tutor, and F2F interactions. Presentation graphics software. Classroom Presenter is used in the preparation of lecture notes and also for F2F interaction with students. With Classroom Presenter, presentations can be prepared using images or files created from Microsoft Office PowerPoint 2003 or 2007 versions.

Lecture sessions were recorded with a laptop’s video camera and illustrations made with the Classroom Presenter software can also be saved just as it had been written. At the end of every lecture session, the recorded video is made available to students. F2F interactions were made with students as it is done in the traditional classroom setting. However, online sessions were also made available to students for further studies. These two platforms were run concurrently. The course was supported by classroom instruction, hands-on learning activities, and online assessments that provide personalized feedback.

5.3. Classroom presenter

This was used in the preparation and presentation of lectures. This software was designed by the University of Washington; Department of Computer Science. Classroom Presenter is a Tablet-PC based interaction system that supports the sharing of digital ink on slides between instructors and students. When used as a presentation tool, Classroom Presenter allows the integration of digital ink and electronically prepared slides, making it possible to combine the advantages of the whiteboard style and slide based presentation.

There are two different instructor set-up options: stationary and mobile. For a stationary presentation you will need a Tablet PC running Windows XP or Vista connected directly to a data projector. For a mobile presentation you will need two machines: you will be able to move freely about the classroom with your Tablet PC, but you will need a second computer (does not have to be a tablet, but a tablet will work) in the Public role that should be connected directly to the projector.

5.4. Video camera

An integrated camera (webcam) of a laptop was used as the video camera in taking coverage of the lecture sessions.

5.5. Data projector

This was used in projecting presentations on large screens during lecture sessions.

5.6. The course self tutor

The course self-tutor is a soft copy of the course material. It runs within a browser, can be used without access to the Internet. This motivates students to learn at their own pace and convenience even if they lack Internet connection.

5.7. Evaluation process

The BL model was employed for First & second semesters of Business Management and manufacturing Engineering students (2010-2011). To evaluate the progress, questionnaires were prepared and administered to coordinate students’ response to business and management model of learning at the original case study environment as well as analyzed students’ performance using their end of semester examination results to ascertain the impact of the model.

6. RESULTS AND ANALYSIS

6.1. Analysis of results from questionnaires

The evaluation conducted with the questionnaires put emphasis on the inclusion of multimedia in course delivery. Students were asked to assess the following areas: The content of the multimedia provided, The usefulness of the multimedia made available, Whether multimedia improved understanding of course concepts discussed, Whether the provision of multimedia made the course easier and interesting, The role it played in encouraging students to spend more time on the course and Whether multimedia enhanced the ability of students to appreciate the course concepts. Students’ response to questions takes the following forms; strongly disagree, disagree, agree and strongly agree. The data collected from students has been presented in the tables below.

Table 1. Multimedia inclusions impact on course delivery for the first semester (management students)

<table>
<thead>
<tr>
<th></th>
<th>Materials are of the right content</th>
<th>Availability of videos proved useful</th>
<th>Improved understanding of course concepts</th>
<th>Learning the course has become interesting</th>
<th>Synchronizing concepts discussed with course content</th>
<th>Spent more time in learning course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>Students</td>
<td>27</td>
<td>30</td>
<td>42</td>
<td>35</td>
<td>32</td>
</tr>
<tr>
<td>Percentage</td>
<td>23</td>
<td>25</td>
<td>35</td>
<td>29</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Agree</td>
<td>Students</td>
<td>74</td>
<td>75</td>
<td>65</td>
<td>71</td>
<td>74</td>
</tr>
<tr>
<td>Percentage</td>
<td>62</td>
<td>63</td>
<td>54</td>
<td>69</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Disagree</td>
<td>Students</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Percentage</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>Students</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Percentage</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
Figure 3. Graphical representation of Table 01

Table 2. Multimedia inclusions impact on course delivery for the second semester (management students)

<table>
<thead>
<tr>
<th>ags</th>
<th>Materials are of the right content</th>
<th>Availability of videos proved useful</th>
<th>Improved understanding of course concepts</th>
<th>Learning the course has become interesting</th>
<th>Synchronizing concepts discussed with course content</th>
<th>Spent more time in learning course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students</td>
<td>Percentage</td>
<td>Students</td>
<td>Percentage</td>
<td>Students</td>
<td>Percentage</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>26</td>
<td>28</td>
<td>38</td>
<td>33</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>23</td>
<td>32</td>
<td>28</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Agree</td>
<td>74</td>
<td>77</td>
<td>69</td>
<td>74</td>
<td>78</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>62</td>
<td>64</td>
<td>58</td>
<td>62</td>
<td>65</td>
<td>63</td>
</tr>
<tr>
<td>Disagree</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Percentage</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 4. Graphical representation of Table 02

Table 3. Multimedia inclusions impact on course delivery for the first semester (Engineering students)

<table>
<thead>
<tr>
<th></th>
<th>Materials are of the right content</th>
<th>Availability of videos proved useful</th>
<th>Improved understanding of course concepts</th>
<th>Learning the course has become interesting</th>
<th>Synchronizing concepts discussed with course content</th>
<th>Spent more time in learning course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students</td>
<td>Percentage</td>
<td>Students</td>
<td>Percentage</td>
<td>Students</td>
<td>Percentage</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>24</td>
<td>28</td>
<td>38</td>
<td>34</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>23</td>
<td>32</td>
<td>28</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>Agree</td>
<td>76</td>
<td>77</td>
<td>69</td>
<td>73</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>64</td>
<td>58</td>
<td>61</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Disagree</td>
<td>12</td>
<td>11</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Percentage</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 5. Graphical representation of Table 03
Table 4. Multimedia inclusions impact on course delivery for the second semester (Engineering students)

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Students</th>
<th>Materials are of the right content</th>
<th>Availability of videos proved useful</th>
<th>Improved understanding of course concepts</th>
<th>Learning the course has become interesting</th>
<th>Synchronizing concepts discussed with course content</th>
<th>Spent more time in learning course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>27</td>
<td>30</td>
<td>38</td>
<td>34</td>
<td>30</td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6. Graphical representation of Table 04

For first semester, (management students), Total 120 students responded to questionnaires. Table 01 shows the numbers and Figure 03 shows a graphical representation of the outcome of the survey conducted. Analysis revealed that, 53-65% of the students were in agreement to the assertions that multimedia inclusion was playing a vital role in assisting students appreciate the course concepts, 22-34% of students strongly indicated that the inclusion of multimedia was very useful and 3-6% were in disagreement while 4-10% were strongly in disagreement of these assertions. However, there was a general acceptance of multimedia inclusion in the course delivery.

For the second semester (management students), of implementation 120 students were surveyed. Table 02 shows the numbers and Figure 04 shows a graphical representation of the outcome. From the responses gathered, 28-33% of students gave strong indications that the inclusion of multimedia was playing a vital role when it comes the study of the course, 22-34% of students strongly indicated that the inclusion of multimedia was very useful and 3-6% were in disagreement while 4-10% were strongly in disagreement of these assertions. However, there was a general acceptance of multimedia inclusion in the course delivery.

For first semester, (Engineering students), Total 120 students responded to questionnaires. Table 03 shows the numbers and Figure 05 shows a graphical representation of the outcome of the survey conducted. Analysis revealed that, 54-65% of the students were in agreement to the assertions that multimedia inclusion was playing a vital role in assisting students appreciate the course concepts, 21-34% of students strongly indicated that the inclusion of multimedia was very useful and 3-6% were in disagreement while 5-10% were strongly in disagreement of these assertions. However, there was a general acceptance of multimedia inclusion in the course delivery.

For the second semester (Engineering students), of implementation 120 students were surveyed. Table 04 shows the numbers and Figure 06 shows a graphical representation of the outcome. From the responses gathered, 29-35% of students gave strong indications that the inclusion of multimedia was playing a vital role when it comes the study of the course, 45-50% were also in agreement of the inclusion. While 3-7% were in disagreement and 9-13% of the students strongly indicated their disagreement to the inclusion but on the whole, the appreciation of the course due to the multimedia inclusion gradually gaining grounds and students became more interested in the course.

Analysis of results revealed that performance of students was better for the period of application of the BLM because the number of students who had higher grades increased compared to that of the previous semester; also more students were satisfied with BLM model. There was 12% to 14% increase in satisfaction level of all students then the previous surveys.

The increase in satisfaction level of students at the test case environment showed a dramatic improvement due to the following reasons:

- Adequate preparation before the implementation of the platform
- Students having the skills required to use the platform
- Availability of the internet access
- Provision of feedback systems to monitor student’s progress

6.2. Systematic transition from “F2F” to “BL”

Before attempting to integrate BML into the teaching and learning process, it is essential for Colleges and Universities to have adequate support and solid infrastructure; it is mandatory to identify the specific needs of the students first. A capable Information Technology (IT) group must then be employed to configure and manage the infrastructure. While this was a huge problem a few years ago, it may not be so in today’s highly-wired environment, but it must be considered during the planning phase of the transition. Prior to enrolling in online coursework, lecturers as well as students must be made aware of the computer and technology requirements, especially with regards to operating systems, web browsers, required software and tools.
7. CONCLUSION AND RECOMMENDATIONS

7.1. Concluding remarks

BL which has become an established, proven and effective way to deliver quality instruction gives educators and students a technology-based and richer, more rewarding learning experiences. While there are a variety of BLMs, there is not a single best approach. The combination may be influenced by many factors including the course instructional goals, student characteristics, instructor experience and teaching style, discipline, developmental level and online resources [10]. In this work a BLM was developed at the UMT campus. The model involved the blending of instructional technology and traditional F2F instruction in the teaching and learning process and it involves recorded lecture videos, a course self-tutor, online sessions and face-to-face interactions. The model was applied in the teaching and learning process of two courses. Analysis of results revealed that employing instructional technology promises great successes when adequate preparation is made. This application of the BLM in the test case environment (UMT) which showed an average improvement of 64% in the performance of students. But, if the application is done without adequate preparation, it can result in worse outcomes contrary to the notion of automatic success when instructional technology is used.

Although, there are numerous accounts of reported application of instructional technology resulting in tremendous successes, the best model is the one that works best for students and teachers in their particular environment and that addresses their specific needs at the time.

7.2. Recommendations

• The BLM to be used should be developed to respond to local, community or institutional needs rather than using a generic approach taking into account the learners’ needs.
• Students’ learning maturity and readiness for BL with its demands for independent learning must be considered.
• Student expectations, especially their ideas that fewer face-to-face classes mean less work and the need to develop more responsibility for their learning and time management skills must be taken into account.
• Consistent and transparent communication around the new expectations is needed in order to help students understand the BL process [16].
• Careful consideration of the role of the teacher in the blended model to be implemented should also be given a critical look.
• It is also important that the institutional building blocks are in place including institutional readiness, sufficient technical resources; and good communication and feedback channels with students.
• Regular evaluations and publicizing of results should also be done to ascertain the performance of the blended model being implemented [16].

8. REFERENCES

The 6th Balkan Region Conference on Engineering and Business Education

The 5th International Conference on Engineering and Business Education

The 4th International Conference on Innovation and Entrepreneurship