PROCEEDINGS

of the

4th International Conference of Engineering & Business Education and
1st SAFRI Journey to Excellence Conference

20 - 23 November 2011
WELCOMING MESSAGE

TO DELEGATES OF THE ICEBE AND SAFRI’S J2EX CONFERENCE

Greetings and welcome to the 4th International Conference on Engineering and Business Education and the 1st International SAFRI Journey to Excellence Conference. This conference is a joint initiative of the Cape Peninsula University of Technology, Hochschule Wismar and SAFRI, the Southern African Initiative of German Business. Previous ICEBE conferences involved mainly universities and focused predominantly on academic paper sessions and workshops. But this year SAFRI brings an exciting new dimension to proceedings. With its strong track record of promoting entrepreneurship and supporting business opportunities SAFRI has helped create a platform for academia and business to effectively engage on the central conference theme of preparing our students to succeed in the 21st Century knowledge economy.

This conference comes in the wake of a global economic meltdown which will have serious socio-economic consequences for developed and emerging economies alike. In particular the specter of growing unemployment remains a major challenge. It is widely accepted that small medium and micro enterprises will provide the majority of new jobs worldwide and will be vital to the continuing growth and success of any economy. Entrepreneurs will have a key role to play and universities will be challenged to equip their students to make a meaningful contribution in these uncertain times.

The conference programme has been structured to allow maximum interaction between educators and entrepreneurs. Besides the paper sessions which form the backbone of any academic conference there are a number of plenary sessions and workshops which we hope you will find both entertaining and enlightening. Network opportunities abound.

It is our hope that conference participants will use these opportunities to reflect, discuss, debate and to think out of the box and explore future scenarios and strategies to help address the many challenges that lie ahead for both educators and entrepreneurs.

Let us also use this opportunity to thank the organizing team of Nico Beute (CPUT), Regina Krause (Wismar) and Nina Mapili (SAFRI) all ably assisted by Anneke de Klerk, for their sterling work in making an international conference of this nature possible. And to the many others who worked in the background, from the editorial team and reviewers to those who provided logistic support, a sincere word of thanks to you all.

We hope that conference participants will also take time to experience the beautiful city of Cape Town, recently awarded the title of World Design Capital 2014.

Join in, share ideas, forge networks … and enjoy! Let’s make this a conference to remember!

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Vice-Chancellor, CPUT

Prof Norbert Grünewald
Rector, Hochschule Wismar

Prof Dr. h.c. Juergen E. Schrempp
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The Editorial committee of the 4TH International Conference of Engineering and Business Education and SAFRI’s Journey to Excellence Conference (ICEBE and SAFRI J2Ex), is upholding the following principles and editorial procedures:

- The Editorial committee consists of invited senior subject specialists from a broad spectrum of local and international universities and research institutions

- In order to ensure a high standard, all manuscripts of the proposed conference papers are sent for evaluation to those members of the Editorial Committee, who are specialists in a particular ICEBE and SAFRI J2Ex session

- The ‘Evaluation Form’ is completed by the evaluators and forwarded to the chairperson of the Editorial Committee, reflecting the rating on a 10-point scale of the quality and contents of the intended paper; how well it would fit into the forthcoming ICEBE and SAFRI J2Ex conference; the standing of the presenter; and his/her ability to present a paper

- Upon receipt of at least 2 evaluators the evaluations are compared. If the review of the evaluators differ substantially, the paper is sent for review to additional evaluators

- After considering the evaluation of all reviewers the paper is either accepted, rejected or sent back to the author for improvements in line with the recommendations made by the reviewers, if the manuscript is submitted for the second time, the manuscript is sent for approval to the reviewers who made the recommendations.

The peer-evaluated and refereed papers are collated in a proceedings document to be distributed at the conference to all delegates upon registration.
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4th International Conference of Engineering and Business Education

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1st SAFRI Journey to Excellence Conference

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Organised by

Cape Peninsula University of Technology, Cape Town, South Africa
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These Proceedings are a collection of original selected papers, which were accepted after the abstracts and full papers submitted were refereed by a panel of local and international peer evaluators, each a specialist in his or her own field. Every effort has been made to include only those papers that are of a high, scientific standard. The organizers and publishers do, however not accept any responsibility for any claims made by the authors.
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The place of the University of Technology in serving industry, business and society: a delicate balance, a steady hand...
ENTREPRENEURSHIP EDUCATION
NEW DEGREE PROGRAMM “STUDENTS IN COMPANIES”

NORBERT GRÜNWALD, REGINA KRAUSE
Hochschule Wismar, University of applied Science: Technology, Business and Design, Germany

ABSTRACT:

Everyone knows internship at university that is a system of on-the-job training for a special period of time, similar to an apprenticeship. Student internships provide opportunities for students to gain work experience in their field, determine if they have an interest in a particular career, or gain credits. Since 2009 Wismar University has been offering a degree programme which combines academic studies and work called "Students in Companies".

This highly innovative educational project allows holders of secondary school diplomas to start a mixed career, studying at Wismar University and work in a company. The goal of the model is to prepare young students to be highly qualified, so that they can meet the actual needs of the current labour market, considering the observed lack of entrepreneurial competences among the graduates in the market.(4)

Within this model Wismar University wants to create a synergy between university and company by permitting a group of students to be employed as “working students” by local companies while at the same time achieving a degree at the university, e.g. in Computer Sciences or business management. There already exists so called dual study programmes that focus on work experiences during studying. Unlike the dual study programmes the holders of the programme introduced by Wismar University will be able to simultaneously work in a real business environment, gaining practical work experience, while being able to take real responsibilities.

This paper describes the backgrounds and the approach of this model and shows first results.

Keywords: Entrepreneurship, student work experience, work based learning

1. BACKGROUND

Since its reunification (1990) Germany has consisted of 16 states, so called Bundesländer. Wismar University is located in the North-Eastern part of Germany in the Bundesland of Mecklenburg-Western Pomerania. Mecklenburg-Western Pomerania belongs to the area of the former socialist part of Germany and twenty years after its foundation has not yet solved all problems in the sense of welfare and economic progress. The unemployment rate is still too high and salaries in some branches are still under the federal average.

From 1990 to 2009 more than 180,000 young people left Mecklenburg-Western Pomerania, with 100,000 being young women aging between 18 and 29. These potential mothers are missing now. Young and well qualified people especially have been moved to the western states due of better living and working conditions. One of the main reasons for leaving the district, among others, is no opportunity of finding appropriate apprenticeships and working places because the economy fell down also after the reunification.

Another problem is the demographic change. In 1990 the birth rate in Mecklenburg-Western Pomerania decreased dramatically as in the other former socialist states. Only the half of the expected children was born during the first years after the reunification. These children are missing in the schools and the vocational training a few years later. Moreover, they would be the
future parents who provide the children of the next generation, but they are missing. The population of Mecklenburg-Western Pomerania is decreasing and aging dramatically. Since 1990 the population has decreased by 14%. At the moment about 1.65 million people live in Mecklenburg Western Pomerania. The forecast for 2030 is a decreasing down to 1.45 million.(12 %).(1)

In 1990 Mecklenburg-Western-Pomerania belonged to the state with the youngest population until 2008, unfortunately the average age then increased from 36 years to 45 years. That means the portion of people of 60 years of age and older will increase from 22% up to 36% by 2030. In addition the life expectancy is constantly increasing. Whereas the average age of men was 68.8 years and of women 77.6 years in 1995 – these have increased already in 2008 up to 75.1 years for men and 89 years for the women.

Because of the demographic change the number of employable people will be decrease from today 1,058,000 down to 781,000 in 2030. This amounts to 277,000 less than today for a population of today 1.65 million people. In addition there will have more older working people than younger and the number is increasing, and also the forecast of working people between 20 and 40 less than 30% of the working population in 2030. That means that in the future more people will be retiring than starting to work, which can be verified by the number of school leavers. Whereas in 2008 20,806 pupils left the school it reduced to 13,180 in 2009 and 10,700 in 2011. That means that almost the half of young people is available for the vocational schools and universities this year.

Actually the shrinkage and the aging are not really unusual for Germany and many other countries in Europe. But it is now also being observed in other countries, especially in Eastern Europe and in the Mediterranean area.(1)

Out of the demographic change there rise a number of consequences for Mecklenburg-Western Pomerania that has to be considered. Because of the aging and decreasing society the financial support given by the EU and the federal government will be also decreased. This impacts all areas of the society: economy, education, sciences, social area, police, justice and culture. To solve this problem is not just a task of the policy, but the challenge has to be faced by the policy, economy and society as a whole.

In case of education there are some consequences of this development:
- There is need find new ways to convince school leavers to stay home and learn or study here
- that means that companies and universities have to be more to attractive young people

Although under the influence of the economic crisis a lot of companies are seeking to employ qualified staff. In 2009 more than 5,000 qualified staff members were missed in Mecklenburg Western Pomerania. Especially in getting engineers whole Germany has big problems. One aim of the government is therefore to foster the investment in education and lifelong learning. The industry need to change the working conditions in that way to be become more competitive and attractive for young people.

Another consequence of keeping school leavers in the country is to improve the partnership between industry and universities. In Mecklenburg-Western Pomerania study about 40,000 students at six universities.

2. **WAYS OF CONNECTING THEORY AND PRACTICE**

There are number ways to become an academic engineer in Germany:
• Students could leave the secondary school after 12 years and immediately enter the university.
• Students can leave secondary school after 10 years and start a technical apprenticeship, with a company, and study at a vocational school.

After three years the students become qualified members of staff in mechanics (vocational degree). Students who to become an engineer (academic degree) they can go to university to study for a bachelor of engineering degree. The precondition is to fulfil the admission requirements of higher education and this career pathway takes in total up to 7 years.

Second way is the so called dual study programme, which has been offered for a number of years at Wismar University. There are five in total so called dual study programmes in Mecklenburg-Western Pomerania. It is a combination of a bachelor degree and an apprenticeship. Students enter into a bachelor programme as full time student. In the same time he/she enters in a vocational training programme. So, they study at the university and learn a profession in one way. All, university, company and the vocational training centre have to regulate the programme. First year student goes to vocational training and works in the company. Second and third year he/she studies at the university. Afterwards study and vocational training will be combined. Wismar University has been offering three of these five study programmes (mechanical engineering, ship engineering, civil engineering). The students undertake two careers in one way – very hard to manage for students as well as for the partner organisation such as the university. Although this programme lasts only 4-5 years it demands a lot of discipline and cooperation from all sides to reconcile. The student has to manage his/her university and vocational education. The university and the vocational organisation – mostly the chamber of industry and commerce – have to manage the dates of examinations. Because these dates are fixed at the university as well as at the vocational organization there are always conflicts in organising the programme. Next problem is the question of the status of the student, whether he/she is a student or an apprentice. In Germany this is a very important aspect in respect of the health insurance and tax. A state university gets a special amount of money for every student who is admitted for university but not for an apprentice even he/she is a student.

New approaches of integrating work-based knowledge have focused on how learning can be transferred from theory into practice easier and more cost effective. At Wismar University there has been developed a fresh approach that concentrates on different forms of knowledge transfer as people move between different sites of learning in university and workplaces.

The business sector as a whole in Mecklenburg-Vorpommern is characterized by small companies: 95% of organisations employ less that 25 people; only 1% of companies have over 100 employees. The county’s economy is lagging behind the rest of Germany due to the decline in traditional industries such as fishing and the loss of large and long-standing companies. According to the survey that Wismar University conducted in 2010, entrepreneurial skill gaps with graduates were reported. The research showed that participants attributed the problem-solving-orientation with the highest and the risk-acceptance with the lowest significance. In general graduates from Wismar University are well equipped with entrepreneurial skills. Nevertheless more efforts are needed for improving on didactic and methodological approaches in education. (3)
3. A CO-OPERATIVE DEGREE PROGRAMME DESIGNED BY WISMAR UNIVERSITY AND LOCAL EMPLOYERS TO ADDRESS SKILLS SHORTAGES IN THE INDUSTRY

Companies and academia need converge in the design of a single programme to produce a new way to meet the difficult challenges of creating synergies between different and sometimes divergent design logics, knowledge orientations and interests. The new approach is a new study programme that arose from discussions between companies and the university management. Here the idea of undergraduate-level recruitment was raised as a cost-effective alternative to companies’ traditional graduate recruitment schemes.

This degree programme, the first to be developed in Mecklenburg-Vorpommern, was established as a demand-led partnership between Wismar University and regional companies. The programme operates on the basis that learners/students are employed for the period of studying and spend a certain time next to the study in the company. The degree programme reflects education, professional and company requirements. It includes the company-specific knowledge and skills, generic skills for employability and academic knowledge for progression to an academic degree. The new programme therefore blended company, educational and professional considerations into a single programme.

The programme operates on learning at university and company and earning money. Students are trainees in a company (mostly paid by the company) and at the same time they are in full-time study. In parallel to their study they spend working time in the company as was agreed in the contract between student and company.

In general this programme aims to build awareness of business and business environments and to provide students with skills to progress their career. It also aims to ensure that students acquire sound academic study skills.

Companies recognized this programme as about investing in their workforce. However big or small the business is, if you develop your staff in whatever way, recognize the skills and learning that they have, this can really be a powerful way for recruiting suitable staff. In time of an increasing lack of well qualified staff every company are demanded to calculate new staff not only from the stage of a graduate but also in the stage of a school leaver.

It is essential to recognize that this is a partnership between one company and the university. The university listens to the needs of the company and has been able to adapt parts of the degree programme to integrate those needs.(2)

4. VALUE OF THE PROGRAMME

The new programme enables students to gain ‘working knowledge’ of work practices, social relations, appropriate behaviour, values and attitudes. Also the teaching of principles provides students with the reasons that underpin the rationale for the professional subject and the company of its work processes. At university students are offered the opportunity to work on case studies, engage with simulations of sector-specific problems and dilemmas, as well as undertaking a mix of practical tasks, research activities and discussions. The pedagogic idea is that students use the content of the study programme to illuminate and explore company practices and vice versa. A central strategy of the programme is to form of knowledge how to involve students gaining access to the company, for example: vision and mission statements, policies, corporate strategy, policy guides and wordings, business statistics and forecasts. Students are also required to access
the human resources of the organisation, by communicating with technical colleagues or
marketing colleagues. Moreover, it is assumed that essential skills will be developed as students
undertake research, engage in a professional manner with company colleagues and compose
presentations and reports for the class. They develop general knowledge and specific applications
and entrepreneurial skills. For the student this is about supporting them to recognise and
understand the key theoretical concepts as they play out in the case study and then to use those as
a comparator for what is going on in own workplace. The value of these is that they bring
workplace knowledge into the classroom. If students are placed in a central company team, then
they are likely to gain a ‘big picture’ of the company what is also very helpful in gaining working
experiences.

5. MENTORSHIP

The access to company resources and students on the programme vary in accordance with the
nature of the mentors. There are two mentors one from the university and one from the company.
Their ability to enact their role as supporting students is significantly affected by the
configurations of their personal qualities, commitment and their company/university experiences
and contacts. Wismar University is a University of applied sciences. That means that every
professor must have at least five years working experiences before entering university. A lot of
our professors have been involved in businesses next to their profession such as their own
companies, institutes or are in leading positions. That’s why from the university perspective a
professor from the main subject of the study programme is the mentor for the student.
Opportunities were developed and formalized for the mentorship role so that all mentors are
equipped to support the students in gaining access to company resources and in undertaking their
university assignments and coursework.(5) The challenge is to ensure that both mentors are
visible points of contact for all those involved in the programme; a university liaison person is
particularly important if mentors to take an administrative role in relation to students. At Wismar
University this person is settled in the Robert-Schmidt-Institut, an institute of the entrepreneurial
university Wismar.

6. FIRST IMPRESSIONS GIVEN BY STUDENTS AND MENTORS

The programme is very young, although a complex evaluation is not yet possible.
Nevertheless participating students and entrepreneurs were asked about their impressions.

Student perspective: All of the students commented very favourably on the opportunity to learn
next to earning money. Another important aspect is the relatively short period of time it takes to
attain qualifications whilst also acquiring valuable work experience. In addition longer and paid
placements offer depth experience in the company and the opportunity to get take over after
graduation.

Mentors perspective: The programme took account of employers’ needs within the framework of
academic and professional programmes even though there were some difficulties in getting the
two worlds to meet. The university mentors were impressed by the way that some students
managed to straddle workplace and academic demands in innovative ways.

7. CONCLUSION

The new programme has been running at Wismar University since 2009. It took great efforts and
a lot of manpower to introduce this new way of blended learning into the university. In the same
way there is still a lot to do in encouraging companies in this programme and to convince them
from the added value the programme provides. The students feedback show that they are on the pathway in preparing them for the labour market which nowadays require students have to be equipped with practical experience, entrepreneurial skills and managing competences already during the study. Otherwise they may lose the connection to the innovative labour market. It has to point out that the opportunities to learn from workplace during studying (however structured) are maximized if all parties to the process are clear about its purpose and their roles and responsibilities within it.

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ENHANCING COMPETITIVENESS AND ENTERPRISE DEVELOPMENT NEEDS THROUGH ENTREPRENEURIAL SKILLS TRAINING FOR SMES IN THE SOUTH AFRICAN MOTOR BODY REPAIR SECTOR.

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University of Johannesburg, Johannesburg, South Africa

ABSTRACT

The aim of this paper is to explore the potential of entrepreneurship education as a leverage tool in enhancing both competitiveness and enterprise development within small and medium enterprises (SMEs) operating in the Motor Body Repair (MBR) sector of the South African automotive industry. An exploratory survey was carried out to ascertain enterprise development needs and competitiveness requirements of these SMEs. The research established that curricula followed in auto body repair training do not consider entrepreneurship education as an important aspect. Major focus of auto body repair training is on repair and replacing of motor vehicle bodywork that would have been damaged in an accident or from vandalism. The research in addition established that enterprise development is affected by poor infrastructure, lack of funding, use of poor and old equipment and limited access to markets. Competitive requirements noted were the need for certified multi-skilling training offered by Original Equipment Manufacturers on new vehicle maintenance technologies, acquisition of recommended repair equipment from Original Equipment Suppliers and the need to integrate entrepreneurship education in the auto body repair curricula. The implications of entrepreneurship education in the auto body repair curriculum would enhance efficient business and financial management, creativity, innovativeness, marketing and job creation opportunities in the MBR sector. For educators’ entrepreneurship education in engineering would prepare students for the ever changing labour markets and encourage them to create new enterprises of their own rather than being perpetual job seekers.

Key words: Competitiveness, enterprise development, entrepreneurship education, auto-body repair

1. INTRODUCTION

Entrepreneurship is multi-dimensional, it includes owning a small business, being innovative, acting as a leader or starting up a new company, Gedeon, 2010[1]. Entrepreneurship education inspires students towards starting up, developing and growing new successful business, Gibb, 1999[2]; Hytti et al 2010[3a], and promoting innovation or introducing new products or services or markets in existing firms, through realising and exploiting opportunities, Shook et al, 2003[4]. Skills developed include increased problem-solving and decision making abilities, improved interpersonal relationships, teamwork, money management and innovation, Heinonen, 2007[5]. It provides an efficient and cost-effective method of increasing the number and quality of entrepreneurs in the economy, Matlay, 2006[6].

There are about 2 million SMMEs in South Africa, representing 98% of total number of businesses, employing approximately 55% of the country’s workforce and contributing about 42% to the country’s wage bill, Nicolaides, 2011[7]. 87% of these SMMEs are survivalist, mostly owned by blacks, hence the need for entrepreneurship education to enhance small enterprise growth and sustainability. SMMEs as business outfits contribute significantly to the economy and have a strong potential for economic growth. In addition they tend to be innovative, productive and generator of employment, Oosthuizen et al, 2007[8]. Japan, Korea and Taiwan are countries that have shown high economic growth rates, high employment rates and equitable income distribution as a result of the well structured SMMEs, International Development Research Centre (IDRC), 1996[9].

Local Economic Development programmes have been introduced across South Africa over the past decade to support the development of SMMEs, Nel et al, 2005[10]. SMMEs come into existence through small
business development policies, concept of incubators, [10] and the setting up of the National Strategy Framework which seeks to develop and promote SMMEs activities in job creation, income generation, and economic growth, Chalera, 2007[11]. Small enterprise development is important for a vibrant economy where there are a large number of participants as opposed to few dominant players, [9]. SMMEs -broaden competition-, hence consumers benefit from choice of a wide variety of services, better quality and reduced costs.

The study explores the potential of entrepreneurship education as a leverage tool in enhancing both competitiveness and enterprise development within SMMEs in South African MBR sector and it also evaluates the intervention measures for enterprise development of auto body repair SMMEs based in townships within Greater Johannesburg.

2. RESEARCH OBJECTIVE

The research objectives of this study are:
1- To investigate the potential of entrepreneurship education as a leverage tool in enhancing competitiveness in small, medium and micro enterprises operating in the South African Motor Body Repair sector.
2- To develop successful, Enterprise Development, intervention measures, from both primary and secondary data, for township based SMMEs operating in the MBR sector.

3. LITERATURE REVIEW

Jones et al, 2004[12] defined entrepreneurial education as “a process of providing individuals with the ability to recognize commercial opportunities and the insight, self esteem, knowledge and skills to act on them”. Main focus of entrepreneurship education was reported by Mwasalwiba, 2010[13], as attitude, values, intentions and behaviour, opportunity recognition, personal skill, new business and managing existing firms.

Gibb, 1999 [2] and Hytti et al [3b] identified three different learning outcomes from entrepreneurship education as: comprehending entrepreneurship, developing entrepreneurial skills and starting up and managing a new business. Mwasaliba, 2010 [13] reported that increasing entrepreneurial spirit, culture and attitudes are major objectives of entrepreneurial education followed by new business start up and job creation.

Entrepreneurial education can be tailor made for specific groups, Kirby, 2004[14]. The different training areas are:-giving awareness about entrepreneurship; developing competencies of new enterprise formation; self-employment or economic self-sufficiency and focussing on small business survival and growth. The impact of entrepreneurship education is quite varied; Policy makers and politicians see it as playing an economic role in creating more new ventures and more jobs, [13]. Employers expect an innovative graduate, while students value satisfaction with the course, competence in the job market and the realisation of their careers. Society expects improved business performance, innovations, and business start-ups by graduates, positive attitudes and intentions to act, general awareness and interest in entrepreneurship. The impact of entrepreneurship education on students from higher education’s perspective, is improvement in, analytic role, supportive role, reflective role, catalytic role and environmental awareness, [7]. The research will establish if any of these Higher Education roles and functions are being imparted to students in the MBR sector. If they are being imparted what impact have they brought to SMMEs in the MBR sector?

SMMEs employ more labour per unit of capital and require less capital per unit of output, Harper, 1984[15]. Ntsika, 2001[16] highlighted national challenges faced by local SMMEs such as non-supporting legal and regulatory environment, market access, limited access to finance and limited business premises, lack of access to resources and technology, poor infrastructure, and bureaucratic hurdles. Entrepreneurship education can help overcome these hurdles through improved attitudes and eagerness to succeed. Ehlers, 2000[17], identified advantages enjoyed by SMMEs located in residential areas, such as growth potential, cost advantage and personal convenience. Factors that support these advantages include closeness to market and low running and advertising costs, since the majority of them are family-based operating in the precinct of captive market, Romano et al, 2000[18].
The South African motor body repair sector is characterised by SMMEs shown below.

<table>
<thead>
<tr>
<th>MBR Body</th>
<th>Membership</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMBRA</td>
<td>1000</td>
<td>Registered SMMEs and recognized by the South African Insurance Industry through the panel system</td>
</tr>
<tr>
<td>NAAASP</td>
<td>1400</td>
<td>More of the informal sector scattered throughout South African Townships, represents inerests of previously disadvantaged groups</td>
</tr>
<tr>
<td>SAARSA</td>
<td>200</td>
<td>Most of its members are based in Cape Town</td>
</tr>
</tbody>
</table>

**Table 1:** Membership and Activity Profiles of the MBR sector Representatives

Key:

SAMBRA - South African Motor Body Repair Association

NAAASP - National Association of African Automobile Service Providers

SAARSA - The South African Repairer and Salvage Association

The number of employees in the motor trade, distribution and servicing sector showed a continued and sustained growth, for the year 2006 to 2008 as shown below. Harper, 1984, [15] established that small businesses, like those found in the MBR sector, are more resilient to depression, they offer steadier level of employment than large corporations. Their services and location are diverse and their owners are likely to stay in business and maintain at least some activity and employment in unfavourable conditions.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive assemblers</td>
<td>33.7</td>
<td>32.0</td>
<td>32.3</td>
<td>32.7</td>
<td>32.4</td>
<td>31.6</td>
<td>31.8</td>
<td>34.3</td>
<td>37.9</td>
<td>38.4</td>
<td>36.0</td>
</tr>
<tr>
<td>Component manufacturers</td>
<td>70.0</td>
<td>67.2</td>
<td>69.5</td>
<td>72.1</td>
<td>74.1</td>
<td>75.0</td>
<td>75.0</td>
<td>78.0</td>
<td>78.0</td>
<td>81.0</td>
<td>81.5</td>
</tr>
<tr>
<td>Tyre industry</td>
<td>9.1</td>
<td>6.7</td>
<td>6.6</td>
<td>6.5</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>6.8</td>
<td>6.5</td>
<td>6.9</td>
<td>7.0</td>
</tr>
<tr>
<td>Motor trade, distribution &amp; servicing</td>
<td>170.0</td>
<td>175.0</td>
<td>180.0</td>
<td>182.0</td>
<td>185.0</td>
<td>191.0</td>
<td>194.0</td>
<td>198.0</td>
<td>198.0</td>
<td>200.0</td>
<td>200.0</td>
</tr>
</tbody>
</table>

**Table 2:** Number of Employees in the domestic automotive sector: June 1998 to June 2008

**Table 2:** Source, adapted from, Barnes 2000:9,[19]

Capital structure of SMMEs is influenced by, [18], culture, entrepreneurial characteristics and entrepreneurs’ prior experience. Small business’ structure is normally determined by the owners’ perceived advantages and responsibilities that are defined by type of business protection sought, operating costs, the way taxes apply, age of business, turnover and how other businesses relate, Norton, 1991[20]. The technical structure of repairs found in the MBR sector is segmented into three sections namely normal repair, minor structural repairs and advanced structural repairs, Retail Motor Industry, 2005[21].

4. RESEARCH METHODOLOGY:

The research methodology included relevant literature review, (secondary data analysis), and an exploratory survey on thirty eight received responses by auto-body repairers, (primary data), including face to face interviews that were done with small business owners, workers and MBR course providers. A questionnaire was developed and circulated within SMMEs in the MBR sector, operating in the Greater Johannesburg Region, Gauteng, South Africa. Sixty two questionnaires were circulated and 38 were returned, giving a response rate of 61 %. Non probability sampling was used, Bryman et al, 2007[22]. The sample of thirty eight respondents is adequate according to De Vos et al 2005[23], and it contained the most characteristics, representative of typical attributes found within SMMEs operating in the MBR sector. Structured interviews were conducted with twenty four small business owners.

The questionnaire covered entrepreneurial training and its impact, technical, business and capital structure with a focus on enterprise development needs. Technical structure focussed on type and value of equipment used, technical competency of the workforce, nature of repairs undertaken and if workers and and owners have any previous experience in motor body repair work. Business relationships included how customers get attracted to these SMMEs, nature of their referral work, immediate upstream supply chain partners including
credit terms. Small business structure was investigated on issues including age and size of business, ownership structures, cash management, any financing, profit margins and methods used to estimate charges on customers. Capital structure questions addressed business ownership, debts, sources of funding and working capital cycle.

5. RESEARCH FINDINGS

5.1 DEMOGRAPHIC INFORMATION

All 38 respondents have their auto-body repair business situated in the Greater Johannesburg Region, Gauteng, in South Africa. 84% of the respondents are within the age group of 25-55 years, all respondents were male and 87% are Africans. 82% had Matric, with 62% having attended a formal auto body repair course in a Vocational training college. The age of the SMMEs investigated ranged from 1-8 years old.

5.2 IMPACT OF ENTREPRENEURIAL SKILLS TRAINING

Growth of SMMEs in the MBR sector in South African townships can be attributed to entrepreneurial drive of the owners to participate in the economy, Sylvie et al, 2006[24]. All respondents want to grow their businesses with autonomy and satisfaction, Benz et al, 2008[25]; Van Gelderen et al 2006[26], being singled out as the major entrepreneurial motivation. Respondents were happy to be self-employed with the major aspect being decisional freedoms they enjoy, and this concurs with Lange, 2010[27]. The research established that they are no entrepreneurial courses offered in the MBR curriculum.

Only 7 respondents had attended entrepreneurial introductory courses. The conduct of their business was found to be better than those who had not attended any entrepreneurial training. They exhibited better management techniques—their workers were motivated and showed loyalty, their businesses were diversified in that they introduced other business activities like car washing and selling of automotive products such as engine oils, batteries and tyres. They showed good leadership, decisiveness, persistence and greater determination to succeed, a finding that concurs with Pretorious et al, 2005[28]. They exhibited better market knowledge and this was noted as the strongest predictor of entrepreneurial progress.

The table below compares subjects taught in MBR and Entrepreneurship.

<table>
<thead>
<tr>
<th>MBR Curriculum ,City and Guilds, 2010[29]</th>
<th>Entrepreneurship Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basics of vehicle body fitting</td>
<td>Resources marshalling and finance</td>
</tr>
<tr>
<td>Vehicle panel preparation / repair techniques</td>
<td>Marketing, salesmanship and franchising</td>
</tr>
<tr>
<td>Skills in applying fillers and foundation materials/ colour matching and spray painting</td>
<td>Idea generation and opportunity discovery</td>
</tr>
<tr>
<td>Vehicle resistance spot welding techniques</td>
<td>Business planning, legal issues</td>
</tr>
<tr>
<td>Skills in repairing minor paint defects</td>
<td>Managing growth and negotiating skills</td>
</tr>
<tr>
<td>Vehicle refinishing processes/techniques</td>
<td>Organisation, team building and</td>
</tr>
<tr>
<td>Removing at fitting trim and plastic material components</td>
<td>New venture creation and communication</td>
</tr>
<tr>
<td>Rectifying motor vehicle body misalignment</td>
<td>SME management and family business</td>
</tr>
<tr>
<td></td>
<td>Risk, rationality and problem solving</td>
</tr>
</tbody>
</table>

Table 5.1 Comparison of subjects offered in MBR and Entrepreneurship curriculum

Universities and Further Education and Training (FETs), as centres of knowledge creation and dissemination, can play a pivotal role in coming up with new curriculum for the MBR sector, Etzkowitz et al, 2000[30]. The new curriculum must seek greater entrepreneurial character among students, [7], giving them ability to find out opportunities, Casson et al, 2007[31] and transform a simple idea into a workable reality, Foss et al, 2010[32]. Success cases of entrepreneurial training have been witnessed at University of Johannesburg in the courses National Diplomas in Marketing, Retail, Business, Sport Management, Small Business Management and the Certificates in Marketing and Sales,[7]. These courses expose students to real entrepreneurial practicals when students work under Direct Selling Associations (DSA) companies, during their two year internship programme. Another success case was reported by Van Vuuren et al, 2010[33] in their study of three segments of entrepreneurs, totalling 450 respondents. They statically proved that the respondents’ business performance indicators, their performance motivation and business skills increased after some entrepreneurial training programmes.
This paper recommends that entrepreneurship skills be further imparted to students through incubation services as a specific type of outreach activity,[14], including business centres and entrepreneurship clubs, Co et al,2006[34]. Other methods, Keogh et al, 2004[35], include games and competitions, setting of real business ventures, workshops, presentations and study visits, these have been found to be appropriate for nurturing entrepreneurial attributes among participants , Bennett, 2006[36].

5.3 BUSINESS OWNERSHIP AND FINANCING

Ownership patterns were as follows; 18 are independent, 7 are family, 5 are in partnerships and 8 are owned by immigrants.

Financing for work in progress and capital is a problem for all the SMMEs. None reported access to nationally available financial schemes. Daily activities are ordinarily financed from personal loans and deposits from clients. The respondents were not at liberty to reveal their profit margins and financial savings. About 77 % of the respondents indicated that they experienced difficulties in debt collection since most customers were not insured. The businesses studied employed approximately 143 people an average of about 4 employees per SMME.

5.4 ACCESS TO WORK AND THE PANEL SYSTEM

No work is received from the insurance industry. The cars repaired are either on third part insurance which does not cover for any repairs or are not insured at all. This is supported by information gathered in the secondary data, which indicated that most of the SMMEs in the South African townships are operating marginally due to lack of business, Cape Argus, 2009[37] and Businessowner, 2010[38]. Most cars in South Africa are older than their warranty age which normally runs from 5 to 10 years, Motoring South Africa, 2004[39]. The majority of of these cars are found in townships due to low incomes patterns. This is the nature of the captive market in the motor body repair sector.

The South African Insurance Association (SAIA) has excluded these SMMEs from a panel system which categorises the MBR sector according to location and size of premises, skill of personnel and adequacy of equipment. MBR workshops have been classified in three grades namely; normal repairs, minor structural repairs and advanced structural repairs [21].The insurance industry channels all its damaged vehicles to registered panel-beating shops that are on the panel system’s register,[39].

5.5 MARKET ORIENTATION

80 % of SMMEs owners do not appreciate the value of marketing and keeping ahead of competition, showing lack of entrepreneurial skills. They are not up to date with both environmental and technological factors that are more important for their business’ growth and sustainability. Absence of strong vision for growth, lack of technology capability for new vehicle repair and very meagre resources for operating capital have stifled growth and made it difficult for the SMMEs to make inroads into the lucrative automotive body repair market. There is non-uniformity on the way customers are charged. All businesses charge an extra percentage over and above the quoted material. The component of labour costs was not clearly captured. This suggests the need for further training on business costing in-order to avoid cases of either undercharging or overcharging customers.

5.6 SUPPLY CHAIN

In 2000 the Automotive Industry Development Centre, (AIDC) initiated the Motor Industry Supply Chain Competitiveness Improvement Program (MISCCIP) which drew together all key automotive players but notably excluded the MBR sector. There are no supply chain management networks or strategies set up for the MBR sector, with the effect that spares sourcing becomes expensive and at times lead time experienced in procuring the necessary spares and repair equipment becomes prohibitively long and costly.
Strategic alliances with suppliers as reported by Teng et al 2005[40], reduces costs and increases competitiveness. This is a business development model that would be appropriate for the survival of the MBR sector. Supply chain organisation can be used to efficiently procure spares and repair equipment for the MBR sector, Ketchen et al, 2004[41]. Cooperative relationships along the supply chain were identified by Golicic et al, 2003[42] to be most suited for SMMEs sector. This would improve entrepreneurial activities and overall business competitiveness in the MBR industry through reduction of supply chain costs.

5.7 INFRASTRUCTURE

90 % of the SMMEs do not own the premises they are operating from. Rental costs pattern could not be established, since owners were not free to disclose their financial information. Some of these SMMEs operate in undesignated open spaces and have had problems with local municipal authorities.

5.8 TRAINING

About 70 % of the interviewed population indicated that they had some training in auto body repair work, with most of them having received on the-job training. Lack of formal training might have a negative effect on the quality of work. The concept of multi-skilling could not be established. The need for entrepreneurship education in the MBR sector is quite apparent and is the ambition of training centres such as Service Through Integrity (STi) based in Cape Town, Mutual and Federal, 2010[43]. STi caters for underprivileged learners. It works as an incubator for growth of new ventures to be owned and staffed by its graduates. It supports entrepreneurship objectives. There are very few colleges offering auto-body repair training. New graduates are trained in-house and then sent for trade tests, where they obtain recognised NQF qualifications. These graduates do not interact with other students and academics, and they lose out on entrepreneurship knowledge such as learning to work in a team and networking, which are key instruments for entrepreneurial activities as reported by Nabi et al, 2011[44].

6. LIMITATIONS OF THE PAPER

The sample size of respondents was too small, hence these results can not be generalised. Lack of proper training colleges made it difficult to get first hand information from auto body repair course providers. While success cases of entrepreneurship have been noted in the paper, it will be necessary to revisit the few entrepreneurs who attended an entrepreneurship course after a period of say one or two years to find out how they are doing.

7. RECOMMENDATION

To realise the impact of entrepreneurship education and training in the whole economy it is recommended that both economic and institutional frameworks that do not support entrepreneurial activities be addressed. Specific sector frameworks like the panel system within the MBR sector need restructuring in-order to promote new business opportunities. Finance was singled out as the major enterprise development need. Small businesses are operating on shoe-string budgets, severely affecting their cash management and growth opportunities. The need for state of the art equipment was quite clear. Khula Enterprise, which is dedicated to improving access of finance to small businesses, should set up dedicated lines of credit specifically meant for the motor body repair industry. This can be achieved through partnership with other Government Departments and the private sector. This in turn would enable these SMMEs to be registered on the panel system.

Local FETs colleges must develop appropriate short courses that include multi-skilling and entrepreneurship education for the auto body repair sector. The short courses must include new vehicle maintenance technology, which was indicated as a major deficiency suffered by small businesses in the MBR sector. These strategies if implemented will reduce operating costs for small business in the auto body repair sector, thus enhancing both their profitability and growth sustainability. Skills training and education is of major concern in the MBR sector. Currently there is very limited training offered with most graduates going through on job related training.
There is a need to develop a supply chain framework for the aftermarket demands that will ensure a stability and low cost accessibility of both spares and repair equipment. The framework will have supply chain metrics that can be used to monitor bottlenecks as well as costs associated with the distribution of spares within the MBR sector. The supply chain framework will address the more important acquisition of repair equipment which is badly needed by the small businesses in the auto body repair sector.

8. CONCLUSION

The research highlighted the need for entrepreneurship education and improved enterprise development needs for SMMEs operating in the MBR sector. The usual problems of poor access to funding, lack of knowledge and information, lack of equipment, training and development can be solved by putting in place a comprehensive strategy for SMMEs in the MBR sector. Entrepreneur courses must be tailor made to suit the needs of specific sectors and must be taught together with institutional business requirements found in specific sectors.

Prohibitive institutional frameworks, like the panel system must be restructured to accommodate new entrants without compromising on quality and service delivery.

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THE ROLE OF PROJECT MANAGEMENT EDUCATION IN ENHANCING SELF-EMPLOYMENT: STUDENTS’ PERCEPTIONS

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Cape Peninsula University of Technology, Cape Town, South Africa

ABSTRACT

Human capital is both a key driver of economic growth and a means to promote overall development. In order to enhance human capital in South Africa, tertiary institutions have seen a tremendous increase in students’ enrolment over the past few decades. But, in spite of the need for skilled labour, tertiary education graduates are increasingly faced with unemployment, which poses a serious obstacle to the economic growth of the country. This paper is an outcome of the survey that investigated the role of project management education in enhancing graduates’ self-employment. The study was descriptive in nature and used a survey questionnaire to answer questions pertaining to the extent to which project management education is important in enhancing self-employment endeavours. Data was collected with the use of a self-administered structured questionnaire. Collected data was analysed using the statistical software for social science (IBM SPSS Statistics version 19) for descriptive statistics in the form of tables and charts. The study found that project management education may either enhance individual entrepreneurial ability, thereby increasing the likelihood of choosing self-employment or increase opportunities for paid employment, both of which reduce unemployment. The results of this study suggest that graduate unemployment can only be eliminated if students are provided with the right skills and knowledge to match the requirement of the employment market. Moreover, the study suggests that graduates should be assisted financially at the initial stage of their self-employment activities.

Key words: project management, education, self-employment

1. INTRODUCTION

Human capital is both a key driver of economic growth and a means to promote overall development [1]. Education is traditionally viewed as an investment for the future [2]. In addition, the acquisition of education improves the future earnings and overall success of individuals [3]. However, research shows that successful entrepreneurs are typically not academic achievers [4]. Surprisingly, absence of formal education for entrepreneurs could indicate that education is not an entrepreneurial requirement but a hindrance where too much education might suppress the entrepreneurial talent of an individual [4]. In contrast, education may either enhance individual entrepreneurial ability, thereby increasing the probability of choosing self-employment, or may increase opportunities for subordinate employment, thereby reducing the likelihood of becoming an entrepreneur [5].

Higher education of self-employed people, in general should improve the growth opportunity of their firms [2]. This is because higher education improves the ability to comprehend market opportunities, resulting in better exploitation of the market demand. According to [4], if entrepreneurs want to enter a technology-driven business, they will definitely benefit from a technical education in order to make sound business decisions. Project management is rapidly becoming a way of doing business [6]. Accordingly, most organisations are currently doing their business through project management in order to provide faster and timely responses to the evolving market demand. This study investigated the acquisition of project management skills as a way of enhancing the prospects of graduates’ self-employment.

2. LITERATURE REVIEW

2.1 RATIONALE FOR EDUCATION

Education is described as the most important factor in increasing human capabilities and attaining the desired goal of economic development of any nation where skilled labour translates into productive labour [7]. In addition, education is used as a proxy for the skills level of workforce participants [8]. Furthermore, education
plays a critical role in absorbing modern technology in less developed countries and in capacity building for self-sustaining growth and development [9]. Moreover, education is an investment, which leads to higher wages, and reflecting the increased levels of productivity resulting from human capital accumulation [1]. According to [10], the acquisition of knowledge and skills has direct benefits for the well-being and freedom of individuals. Education is viewed as a measure of a nation’s human capital investment, which has a significant impact on self-employment as education provides the skills needed for establishing and learning a business [11]. Furthermore, there is a positive correlation between education and business establishment, as approved by [12]; [13]; [14], who indicated that education can enhance entrepreneurial skills, competencies, as well as attitudes towards self-employment activities. In their study, [15] state that individual with high level of education can earn a premium income as entrepreneurs while those with lower level of education are better off as employees.

Tertiary education increases the probability that a person will choose self-employment over salaried employment [16]. In addition, individuals with more than four years of tertiary education are almost three times as likely to be self-employed in comparison with high school graduates [16]. Furthermore, higher education is a fundamental tool to improve the knowledge of society as a whole and a necessity in the current environment, where knowledge-based employment is increasing [17]. According to [18], success of any economy will depend on the level of education of its workforce and on the capacity of people to exercise their skills individually and collectively. [15] stressed the contribution of education in business ownership by arguing that human capital acquired through education is one of the most important individual drivers of the performance of business owners and the ensuing business size.

2.2 THE NEED FOR PROJECT MANAGEMENT SKILLS IN ENHANCING SELF-EMPLOYMENT

The process of establishing a new business has all the characteristics of a small project, which requires effective project management skills to plan and control the entrepreneurial process [19]. Project management is a powerful business tool for businesses of any size since it remains the science of getting the job done [20]. Entrepreneurs use project management skills to co-ordinate and manage the input of all stakeholders, namely clients, investors, suppliers, manufacturers and distributors [19]. In addition, entrepreneurs are faced with multiple challenges when implementing new businesses. Therefore, it is very important to ensure that innovative ideas and opportunities are not handicapped by ineffective project management [19].

Project managers utilize project management techniques to plan and control the progress of their projects [4]. [4] has outlined a number of project management techniques that form an important part of the entrepreneur’s portfolio of management skills namely:

- Work Breakdown Structure (WBS) to quantify the scope of work and subdivide the scope into manageable work packages.
- Critical path Method (CPM) to graphically illustrate the logical relationship between activities while determining the duration of the project.
- Gantt Charts, which present graphically the scheduled information and assign activities to the person, department or company responsible for each and every activity
- Procurement schedule, which graphically links the materials and equipment requirements to the schedule, and to highlight any long lead items that could cause a delay to the schedule.
- Resource histograms, which graphically link the resource requirement to the schedule, and to highlight any overloads and underloads that may require resource smoothing.
- Earned Value (EV) to graphically present the integration of the planned man-hours, the earned man-hours and the actual man-hours against the schedule.
- Quality Control Plan (QCP) to link the specification and level of inspection to the sequence of work.
- Organisation Breakdown Structure (OBS) to graphically overlay the temporary project team structure on the functional organization structure, which is usually presented as a matrix structure.
- Configuration management to manage scope changes, which includes: logging the proposed changes, approving the changes and implementing the changes.
• Document Control to plan and control the flow of documents, which includes: establishing a list of documents to be controlled, collating the documents, storing the documents, issuing the documents with a transmittal note, and withdrawing old documents.

Co-ordinating new ventures may require a certain amount of leadership and project management ability. More importantly, if the entrepreneur needs to involve other people, who may be suppliers and contractors; and if the new venture needs to raise capital (4). [21] notes that managing projects is a significant function of an entrepreneur as this is extremely essential for his or her business success. From the very first day an entrepreneur decides to start a new business, he has projects from day one be it writing a business plan, setting up his or her office, marketing the business and delivering the product to the client. In his model, [22] has proposed a link between project management and entrepreneurship (Figure 1), stressing that entrepreneurs need project management skills in opening a new venture from idea generation to initial operation of the venture.

![Figure 1: Link between project management and entrepreneurship (Source: [22])](image1)

In each of the phases (Figure 1), project management skills and knowledge are needed for an entrepreneur to succeed in his endeavours. For instance, in the business concept, an entrepreneur must not only perform a feasibility study of his or her idea, but also draft a business plan, which focus on financials, competition, market demand and other factors [22]. In addition, the entrepreneurs understand proper project management planning, which includes understanding all stakeholders’ role, their expectations and requirements, setting realistic time, cost and quality delivery, and project risk analysis [22]. [21] remarks that if your projects are not planned, tracked and managed then you cannot build your business.

[23] argues that project management is one of those skills that successful entrepreneurs seem to be born with while the rest of people have to learn. Project management skills make business start up and business development a lot easier. Entrepreneurs face three common elements present in any project, which are scarce resources, time constraints and budget limitations. Therefore, self-employed people will need to learn how to manage those constrained elements in order to make start up business successful.

After the feasibility study and business planning have been completed, the project manager who is also entrepreneur needs to think about the project from idea to initial operations, as well as post project completion activities, thus ensuring and sustaining business operations (Figure 2).

![Figure 2: A schematic diagram depicting business launch to business operations (Source: [22])](image2)

For the project aspect, the project manager needs to identify all requirements for launching the business. This will mean defining success factors, financial requirements and funding alternatives, timeline, resources required, legislation, budget for the launch, communication with stakeholders, and procurement strategies. All these activities are undertaken throughout the project management process from idea generation to project completion in order to provide information that will help decide whether to continue with the venture or not [22]. For the business aspects, the project manager needs to plan for operation readiness by identifying all
things needed once the business is in operations. These are financial control, human resources, policies, operational processes, as well as marketing and business development, among others. It is in the final project delivery (Business launch) phase, where all activities necessary to produce required deliverables are performed. According to [22], such deliverables are crucial for the successful launch of the new venture and to start initial operations.

[6] assert that project management is no longer a special need management as it has become a standard way of doing business. Thus, entrepreneurs who are well equipped with project management skills stand more chance of successful businesses as projects constitute average of one third of the turnover of the small and medium enterprises [24]. According to [25], projects in Small and Medium Enterprises (SMEs) occur in both operations, providing tailored products to customers and in managing innovation and growth.

3. METHODOLOGY

3.1 STUDY DESIGN AND METHODOLOGY

This study adopted a quantitative approach and used a survey-based research methodology. A questionnaire survey was self-administered to investigate career intentions of project management students and the impact of education in influencing graduates to undertake self-employment endeavours.

3.2 RESEARCH POPULATION, SAMPLE AND SAMPLING METHODS

A stratified random sampling technique was adopted to draw a sample size of 152 units from a population size of 174 units to obtain data from respondents. The study population comprised of project management students at a selected university in Cape Town (Table 1)

<table>
<thead>
<tr>
<th>Level of study</th>
<th>Group</th>
<th>Population size</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Technology (BTech)</td>
<td>Full time</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>Bachelor of Technology (BTech)</td>
<td>Part-time: First semester</td>
<td>83</td>
<td>69</td>
</tr>
<tr>
<td>Bachelor of Technology (BTech)</td>
<td>Part-time: Third semester</td>
<td>42</td>
<td>37</td>
</tr>
<tr>
<td>Master of Technology (MTech)</td>
<td>Part-time</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>174</td>
<td>152</td>
</tr>
</tbody>
</table>

3.3 DATA COLLECTION AND ANALYSIS

A quantitative survey-based study using self-administered structured questionnaire was adopted during this survey. Data was collected over a period of three weeks from the 15th of May to the 8th of June. Questionnaires were distributed before the beginning of lectures and were collected by the researcher after the lectures. With regard to masters’ students who have completed their course work and are, therefore, not attending classes, questionnaires were sent to them and returned through email.

The data gathered was presented and discussed in conjunction with available literature. All primary data was analyzed using the statistical software for social science (IBM SPSS Statistics version 19), which helped to analyse data, compile appropriate tables, and examine relationships among variables and perform test of statistical significance based on research questions [26]. In addition, responses to open ended questions were analysed using Microsoft word document, which summarised data into tables.
4. RESULTS AND DISCUSSION

Descriptive statistics are presented in figures 3 to 6, which show the responses to questions pertaining to the role of project management knowledge and skills in enhancing self-employment activities.

Figure 3: Project management program provides relevant knowledge and skills to employ myself after graduation

<table>
<thead>
<tr>
<th>Frequency and percent</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral or Undecided</th>
<th>Disagree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>37</td>
<td>51</td>
<td>14</td>
<td>2</td>
<td>105</td>
</tr>
<tr>
<td>Percent</td>
<td>35.2</td>
<td>48.6</td>
<td>13.3</td>
<td>1.9</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 4: Project management knowledge and skills will enable me to open and run a successful business

<table>
<thead>
<tr>
<th>Frequency and percent</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral or Undecided</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>31</td>
<td>54</td>
<td>15</td>
<td>4</td>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>Percent</td>
<td>29.5</td>
<td>51.4</td>
<td>14.3</td>
<td>3.8</td>
<td>1.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
According to figures 3; 4; 5 and 6, a majority of respondents, namely 83.6% (35.2%+48.6%) strongly agreed or agreed that project management course provides relevant skills and knowledge required to enter self-employment endeavours. In addition, 81.4% (29.5%+51.9%) of respondents acknowledged that project management skills and knowledge will enable them to open and run successful business, while 81.9% (26.7%+55.2%) of respondents either strongly agree or agreed that graduates who possess project management skills have more chance of success in self-employment. Lastly, 78.9% (26.0%+52.9%) agreed that project management and skills are critical in establishing a new business venture. These findings are consistent with previous results, which noted that people who are well equipped with project management skills have more chance of successful businesses as projects constitute an average of one third of the turnover of the small and medium enterprises [24]. In addition, [21] state that if projects are not properly planned, tracked, and effectively managed, then the business cannot be built. Thus, for one to start and run a successful business, one
has to possess project management skills, which is in line with the argument by [23] that project management is one of those skills that successful entrepreneurs seem to be born with while the rest of people have to learn.

To emphasize the importance of project management education in influencing career intention, respondents were asked to indicate their motives in selecting project management course (Table 2).

<table>
<thead>
<tr>
<th>Category</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To acquire knowledge and skills that will enhance work performance</td>
<td>29</td>
<td>27.9%</td>
</tr>
<tr>
<td>2</td>
<td>To acquire knowledge and skills that will enable them to have more employment opportunities</td>
<td>41</td>
<td>39.4%</td>
</tr>
<tr>
<td>3</td>
<td>To acquire knowledge and skills that will enable them to open and manage their own business effectively</td>
<td>34</td>
<td>32.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>104</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The summary in Table 2 indicates motivations for choosing project management among students. Respondents’ feedbacks were grouped into three categories of motivation for choosing project management, namely: to acquire skills that will enhance their work performance (27.9%); to acquire skills and knowledge that will enable them to have more employment opportunities and career enhancement (39.4%); and to acquire knowledge and skills that will enable them to open and manage their own business effectively (32.7). These results confirm findings illustrated in figures 3; 4; 5 and 6. These results underline the importance of acquiring project management knowledge and skills in effective project, as well as business management. The study found that project management skills are required within any career choice, be it in salary employment or self-employment endeavours since those skills enhance individual, as well as team performance in both projects and business operations. Hence, the current and future success of businesses depend on the how effective one can manage a project. Accordingly, project management has become a standard way of doing business [6]. Thus, individuals who have acquired project management skills have more chance of securing a successful career than those who lack project management skills, which is true as projects constitute an average of one third of the turnover of the small and medium enterprises [24]. Therefore, since management by projects has become the standard way of doing business, this study suggests that companies will only succeed in the current competitive market if their human resources are equipped with project management knowledge and skills.

In order to find if the intention for self-employment was a result of skills and knowledge acquired, respondents were asked to indicate whether project management qualification can assist in overcoming unemployment (Figure 7).
The results in Figure 7 show that 88.9% of respondents acknowledged that project management education is an important factor in reducing unemployment. The reasons that were provided were that project management education provides skills and knowledge that are required in various disciplines, thus offering more employment opportunities for project management graduates. In addition, respondents reported that project management skills and knowledge can enable individuals to open and run their own companies effectively, which conform with the study by [22] who argued that entrepreneurs need project management skills in opening a new venture from idea generation to initial operation of the venture. Equally, [21] asserts that if your projects are not planned, tracked and managed effectively then you can't build your business. Project management education is, therefore, an important aspect for a successful business management. The results of importance of project management education in reducing unemployment are summarized in Table 3.

Table 3: Reasons why a project management qualification can assist in overcoming unemployment

<table>
<thead>
<tr>
<th>Reference</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>You can get a job anywhere if you have qualification of project management</td>
</tr>
<tr>
<td>2</td>
<td>Project management skills and knowledge shine a light on the often disastrous hurdles a new business faces</td>
</tr>
<tr>
<td>3</td>
<td>Everything is about projects these days and if you don’t get a job you will have the knowledge to start a business</td>
</tr>
<tr>
<td>4</td>
<td>One will be able to come up with business ideas, project management will assist you in putting together all the relevant documents and then you will be able to employ people and delegate duties to your team</td>
</tr>
<tr>
<td>5</td>
<td>The course makes you think about outside the box more in entrepreneurial direction</td>
</tr>
<tr>
<td>6</td>
<td>With project management you could create jobs by starting a business and successfully managing individual projects to ensure the business succeeds</td>
</tr>
<tr>
<td>7</td>
<td>Individuals will learn skills that will give them the confidence and competence to start their own business and employ other people</td>
</tr>
</tbody>
</table>

As it can be read in table 3, most project management students have a common understanding that project management education equips them with skills and knowledge, which are required in any discipline, thus creating more employment opportunities. Furthermore, project management education provides skills and knowledge that can enable one to create and manage effectively own business, which in turn result in job creation for other people. Hence, the importance of project management education in alleviating unemployment has been acknowledged. Figure 7 indicates that 11.1% of respondents denied that project management can assist in reducing unemployment. The common reasons shared by respondents on that regard was that work experience was very critical in the project management field and that the lack of work experience may hinder individuals to penetrate the field of project management. Specifically, respondents argue that one needs to specialize in a field already and supplement it with a project management qualification. Perhaps, these reasons could be relevant to full time students who have not yet entered the employment market and who indeed lack work experience. However, the majority of respondents expressed confidence that project management qualification will open up excellent career opportunities.

This study sought to find out if the level of qualification can influence an individual to enter self-employment endeavours. In that regard, statistical test for independence was performed to establish the relationship between the level of study and statements pertaining to the role of project management skills in successful self-employment activities (Table 4).

Table 4: Factors influencing individuals to enter self-employment

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent variables</th>
<th>Pearson Chi-Square (X2)</th>
<th>Statistical significance (P-value &lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study level</td>
<td>To open a successful business, one needs to have project management skills</td>
<td>11.226</td>
<td>0.024</td>
</tr>
</tbody>
</table>
Graduates with project management knowledge and skills have more chance of success in self-employment activities (14.830, P=0.005). Project management knowledge and skills are critical in establishing a new business venture (11.181, P=0.025). Project management knowledge and skills will enable me to open and run a successful business (13.245, P=0.010).

The study considers education as one of the factors that play an important role in influencing individuals to self-employment. Highly educated people may have more expertise and ability to undertake self-employment activities. [11] argues that education provides the skills needed for establishing and learning a business. According to [27], individuals with high level of education can earn a premium income as self-employed while those with lower level of education are better off working as employee. Thus, highly educated people may be inclined to self-employment owing to such likelihood of earning more income. In addition, [16] asserts that individuals with more than four years of tertiary education are almost three times as likely to be self-employed in comparison with high school graduates. Conversely, highly educated people may have more opportunities over well paid jobs, which may limit their involvement into self-employment endeavours. As [2] put it forward, if the general employment in the economy is improving, higher educated people may even cease to operate as self-employed and go to work for other companies as employees. However, if the economy’s employment level is poor, then self-employment becomes a more attractive alternative for people with any level of education [2]. Accordingly, this study found that education is positively associated with graduates’ successful careers in self-employment.

The findings of this study indicated that there was a relationship between the study level of respondents and statements that links project management education to self-employment activities. Table 4 shows the discrepancy between MTech and BTech students with regard to statements that one has to have project management skills in order to open a successful business (Chi-square= 11.226, P=0.024); graduates with project management knowledge and skills have more chance of success in self-employment activities (Chi-square =14.830, P=0.005); project management knowledge and skills are critical in establishing a new business venture (Chi-square= 11.181, P=0.025); project management knowledge and skills will enable me to open and run a successful business (Chi-square= 13.245, P=0.010). The reasons for differences in opinions between MTech students and BTech students could be related to the fact that masters’ students have acquired more in-depth knowledge and skills at the master’s program level, which enables them to strongly link project management education with the opening and running a successful business. These results confirm the earlier assumption that a higher educated individual is more likely inclined to self-employment than a lower educated one.

5. CONCLUSION AND RECOMMENDATIONS

The economic development and growth of a nation depends on its ability to provide human capital to its population through adequate education. This study recognises the role of project management education in providing human capital, which is needed for establishing and running a business. The study found that the provision of project management knowledge and skills play important role in reducing unemployment in two ways. Firstly, project management education provides skills and knowledge that are required in various disciplines, thus offering more employment opportunities for project management graduates. Secondly, project management skills enable individuals to open and run their own business effectively, leading to job creation for other people. Since projects constitute a big source of revenues for companies, students need to be provided with project management modules at undergraduate level irrespective of the field of study. This will strongly benefit those who will not have the chance to join the bachelor program in project management. In addition, project management education should not be limited to tertiary level of education but should also be extended to lower levels of education. This is because lots of small business failures occur owing to ineffective resources management. In order to enhance effective resources management skills amongst matriculates who do not join tertiary institutions, learners should be provided with skills and knowledge in project management. This will help them to succeed once they have undertaken self-employment activities.
REFERENCES


A STUDY OF STUDENT-ORIENTED AND TALENT-EDUCATED “PACKAGE”

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Hebei University of Economics and Business, Shijiazhuang, China
*Shijiazhuang University of Economics, Shijiazhuang, China

ABSTRACT

In rapidly developing modern society, university students faced with society’s challenges become aware it is insufficient for them to have only book knowledge obtained at university to meet career requirements moreover competence acquired at school was limited in so far as employment or career development. This paper argues fostering students’ professional competence at university should focus on professional comprehensive competence, taking into consideration the needs of both students and society. Based on the professional core quality model and four classifications of work posts, this paper attempts to discuss and design a talent-educated “package”, which is believed viral necessary. Meanwhile it emphasises that it is of importance for a university to reform current education concepts, content and methodology to offer a forceful resource platform for the smooth implementation of the “package”.

1. BACKGROUND

In the 21st century, skills have become No.1 resources in the social development and core element in individual success, organisation development and social progress. The degree to which one gets in education, to much extent, decide or reflects one’s comprehensive capability in terms of knowledge, character, skill, experience, intelligence and physical condition. Chinese higher education, as the main place of fostering excellent human resources, undertakes the mission of educating tens of millions with specialised skills and a large number of top-notch and innovative skills. However, by observing China’s higher education, it is observed the drawbacks in conventional education have become more obvious, especially in the market-oriented economic system. Students with high academic degrees but less capability are norms. Employment opportunities for university graduates have divided, indicating today education does not meet the skills of a market-oriented economy. Hence high education faces the pressure and challenge of further reforms in educational ideas, content and methodology. Being student-oriented and wins social needs as a target, universities need to on professional competence training to speed the process of student adaptability to society to efficiently promote graduates’ sustainable development [1].

Research problem

A study of student-oriented and talent-educated “package” and resource conditions for its implementation

The general objective of the research is to establish a student-oriented and talent-educated “package” and to promote students’ comprehensive professional competence. The specific objectives are:

- To conducts an analysis of the professional competence of university students from the a society perspective of and construct a model of sustainable and professional core competence;
- to design a student-oriented and talent-educated “package” and,
- to analyse resource conditions of implementing such a talent-educated “package”.

2. THEORETICAL FRAMEWORK

The research was carried out based on the human capital management theory (HCMT), formed in late 1950s and early 1960s, and initially advanced by American economists Theodore W, Schulz and Gray. S, Becker. The former is acknowledged as the founder of HCMT from to his great contribution in this area and thereby obtaining a Nobel Prize for Economics in 1979. Schulz who believed human capital brought about modern economic growth refers to a worker’s accumulated knowledge and skill plus work ability, and thus is regarded as capital with economic efficiency [2].
The core of HCMT is 1) capital should include “material” capital embedded in products and human capital derived from workers; 2) the return of human capital investment tends to exceed that of material capital investment; 3) human resources with knowledge and skills as well as certain investment can be regarded as the most important of all resources; 4) human competence and quality is derived from human investment and human capital forms, via means of human investment. From the perspective of currency, human capital reflects various expenses to cover school education, in-service training, and insurance and labour transfer in its promotion; 5) whether for individuals or for society, investment in human capital has unlike advantages [3].

HCMT believed that education played an important role in raising labour productivity developing an ability to deal with changing economic situations promoting economic development, but on the other hand, without it, it was impossible to enjoy the prosperity of a modern economy and achieve sustainable development. It could be said modern education was the key element in human capital and a significant approach in fostering individual professional competence [4].

3. METHODOLOGY

This research was conducted by through a literature study, inductive reasoning, deductive inference, and qualitative analysis. By using literature study, up documents and data relevant to the barriers to university graduates’ employment and to their competence needed for employment have reached. Inductive reasoning was employed to analyse and estimate common features embraced by graduates in employment competence. By using “Pareto Law”, the core quality model of sustainable development in professional competence was thus deduced. Based on the human capital theory, this paper attempted to explain professional competence was fostered through educational investment; it then makes a qualitative analysis of qualifications required by various work positions before; it establishes a talent-educated package. Finally, guided by the system theory, its operation resources conditions and workability was analysed and discussed. This paper uses relevant survey data from a questionnaire conducted among 263 graduates intern, all from the Human Resource Management.

Professional competence refers to knowledge and skills necessary in certain occupation and its forms through the interaction of human qualities. There usually include general professional competence, specialised skills and comprehensive ability. General professional competence is type of basic ability necessary in various occupations, referring to the abilities of learning, literacy and language, mathematics, physical co-ordination. Specialised skills indicate the application of specialized knowledge and skills to solve problems and assess results [5]. Professional comprehensive ability tends to suggest an ability to adapt oneself to society and professional development. Generally speaking, general professional competence and specialised skills were necessary for workers; comprehensive ability facilitated workers to achieve continuous, stable, co-ordinated development, be seen as a type of guarantee ability.

4. RESULTS AND DISCUSSION

4.1. PROFESSIONAL CORE COMPETENCE MODEL

Chinese higher education was likely to lend emphasis on students’ specialised competence and general professional competence but often ignored their professional comprehensive competence with the resulting of them poorly adapting themselves to society and at work. This paper aimed to study and establish, based on professional comprehensive competence, a professional core quality model for university students. Professional comprehensive competence refers to profession-crossing specialised capacity, ability to use methods, social competence, and individual capacity, see Figure 1.
profession-crossing comprehensive competence | processing Information  
| computer skill  
| language (including foreign language)  
ability to use methods | getting information  
| making plans  
| making decision  
| innovation  
social competence | communication  
| team spirit/coordination  
| adaptability  
individual capacity | self-management  
| professional quality  

**Figure 1.** The components of professional comprehensive competence

Figure 1 Indicates that professional comprehensive competence covers four aspects including 12 abilities, of which one supposed to play important roles in people’s professional careers development.

From the relevant survey of data concerning barriers to university graduates’ employment, it was learnt that communication ability 80.9%, specialised skill 61.9% and adaptability 58.1% were in the top three in the employment competence [6], see Figure 2.

<table>
<thead>
<tr>
<th>What do you think is the necessary main competence in employment? (multiple choices):</th>
<th>Number of students</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. communication</td>
<td>191</td>
<td>80.9%</td>
</tr>
<tr>
<td>B. specialized skills</td>
<td>146</td>
<td>61.9%</td>
</tr>
<tr>
<td>D. adaptability</td>
<td>137</td>
<td>58.1%</td>
</tr>
<tr>
<td>E. work experience</td>
<td>118</td>
<td>50.0%</td>
</tr>
<tr>
<td>G. innovation</td>
<td>111</td>
<td>47%</td>
</tr>
<tr>
<td>F. book knowledge</td>
<td>95</td>
<td>40.3%</td>
</tr>
<tr>
<td>A. a practical skill</td>
<td>71</td>
<td>30.1%</td>
</tr>
<tr>
<td>H. others</td>
<td>8</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Valid number of questionnaires: 232

**Figure 2.** The perspective of undergraduates about employment competence


Figure 2 indicates communication, specialised skills and adaptability as the main employment competences required by university students. Seeking a job was process of self-marketing, requiring a work to successfully convey advantages or strengths would be the employers or interviewers then try to make them appealing in which communication ability was crucial. After success in work seeking, the new employee was required to adapt themselves to post as soon as possible, adaptability played an important role. Chinese students had common weaknesses in hands-on abilities and application of knowledge as higher education overemphasising book knowledge learning; enterprises often put work experience first when employing candidates. Faced with this demand, students were required to adapt as soon as possible through constant adjustment, self-study, initiative and creativity.

In 2009, a questionnaire has presented to their 22 enterprises asking personnel offices (human resources department) if they were satisfied with university graduates. The results, in general, was non-optimistic. Those who felt unsatisfied with graduates or “hard to tell” accounted for 9.1% while only 4.6% of those investigated felt satisfied with graduates. Most, 77.2%, thought the graduates’ professional competence was “just all right”. Furthermore, their comment on graduates’ work attitudes was worse. Those who felt “just
satisfied” totalled 59%; those who were satisfied and unsatisfied 18.2% respectively; those who felt “hard to say” are 4.6%. In answer to the question about what factors they took into account when choosing candidates, professional skill, work attitude, education background, general management ability and specialised knowledge were on the top five in the list of factors, see Figure 3.

<table>
<thead>
<tr>
<th>Main factors taken into account by your enterprise in hiring graduates (only choose 3 items)</th>
<th>Choosing frequency</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>C . specialized skill</td>
<td>14</td>
<td>63.6%</td>
</tr>
<tr>
<td>E . work attitude</td>
<td>11</td>
<td>50%</td>
</tr>
<tr>
<td>H . education background</td>
<td>8</td>
<td>36.4%</td>
</tr>
<tr>
<td>D . general management ability</td>
<td>7</td>
<td>31.8%</td>
</tr>
<tr>
<td>B . specialized knowledge</td>
<td>7</td>
<td>31.8%</td>
</tr>
<tr>
<td>F . potential ability</td>
<td>6</td>
<td>27.3%</td>
</tr>
<tr>
<td>A . basic knowledge</td>
<td>4</td>
<td>18.2%</td>
</tr>
<tr>
<td>G . interpersonal relationship</td>
<td>4</td>
<td>18.2%</td>
</tr>
<tr>
<td>I . university prestige</td>
<td>1</td>
<td>4.6%</td>
</tr>
<tr>
<td>J . social resources</td>
<td>1</td>
<td>4.6%</td>
</tr>
<tr>
<td>validit number of questionaires</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3:** Main factors taken into account by enterprises in hiring graduates

Source of the data: Jia Hongyan, Research Report on Human Resources Management Teaching System on the Competence-oriented Basis, 2009

Figure 3 indicates that the enterprise focused on professional skills, work attitude, and general management ability in hiring graduate candidates. As it is said, specialised skills belong to the range of specialised professional competence; while work attitude and general management skills refers to a range of professional comprehensive competences.

The data in Figure 2 also shows communication and adaptability Nos.1 and top 3, belonging to professional comprehensive competence, apart from professional competence. Both Figures 2 and 3 indicated either students or enterprises, to some degree, believed that professional comprehensive competence played a vital role in a university graduate’s career development after graduation, in agreement with Pareto Law. Hence, professional comprehensive competence had become a core competence element in career sustainable development after graduation.

Vilfredo Pareto, an Italian economist, believed that in any group of “thing”, the majority accounted for 20%, the rest, although accounting for 80%, was a minority. This view, also named as the “2 to 8 Principle”, is internationally accepted and widely applied in the management field, believing that 80% of created wealth and value result from human’s 20% key behaviour[7]. Based on Pareto Law and the post competence model in human capital management, our attempt to build a sustainable-professional-competence core quality model for university students, see Figure 4.
Figure 4 suggests the core quality model of sustainable professional competence for university students consisted of general professional competence, professional comprehensive competence and professional competence. The first and the last are the foundation for the core quality of sustainable professional competence, essential for employment. However, in their entire career, a person may have different jobs in different industries, different organisations and different positions. Therefore, it was insufficient for a worker with necessary basic skills to be their new job perhaps with different requirements. Facing such challenge, worker had to constantly upgrade and adapt to new requirements in which sound communication, wise decisions, innovation, team spirit, self-management, language and ability, obtaining and processing information played important roles. All belonged to a range of professional comprehensive competences. As a result, professional comprehensive competence was crucial for university graduates and career development. It could be taken as competence guarantee for sustainable development, and should become an important skills-educated objective at universities.

4.2. THE CONSTRUCTION OF A TALENT-EDUCATED “PACKAGE”

Professional practice and educational training was the prerequisite for the formation and development of professional competence. Higher education could be regarded as preparation for one’s career, a crucial period for fostering students’ professional competence. With regard to Chinese universities, although much exploration and attempt had been made in talent-educated models, students were usually obvious to correctly choosing and studying courses, seldom associating them with their futures. It was time a “package” be constructed to fit in or assist today’s subject syllabus, helping student to rationally choose courses, doing them good in fostering professional comprehensive competence.

Based on the core quality model of sustainable and professional competence and different classification for professional posts by human capital management as well as students demand for future professional development, a talent-educated package was designed, see Figure 5.
From Figure 5, it can be seen a many varying in different industries and organisations are roughly classified into four types: management, technology, social affairs and operation. Management posts often refer to leadership posts, or posts with administrative responsibility such as CEO or managers of company or enterprise, head of government organisations; technological posts, posts requiring specialised or professional skill and competence such as teacher, engineer, accountant. Social affairs posts mainly suggest work according to fixed procedures or systems, for example, office clerk, secretary, lab assistant, proof-reader, jobs within supplementary property; operating posts are often occupied by workers on the production lines or service industries i.e. for insurances, drivers, waiters, salespersons.[8].

This skills-educated “package” did not include common professional competence and specialised professional competence as each specialty/subject at university had its own basic and specialised courses. It was unnecessary to list them here. The package was designed based on the four classifications of posts presuming a post taken a university graduate might be one of them no matter in what they majored. Students could plan potential work and choose a course from the package, integrating with specialty courses, thus a career/post-oriented package syllabus. Since different classified posts had different requirements for core professional competence, each course’s set-up differed. Inspite what post a student is would take, a different post classification package syllabus was supposed to be formed on the basis of specialty courses.

5. RESOURCES CONDITIONS FOR IMPLEMENTING TALENT-EDUCATED “PACKAGE”

Efficiently implementing student-oriented and talent-educated package called for updating and reorienting today’s higher education concepts and methodologies. Updating education concepts means embracing contemporary education ideas of “student-oriented”, “competence-oriented”, “social need-oriented” and “career-oriented”[9]. “Student-oriented” meant education should emanate the needs of student needs, caring for different demand, putting them first in a skills-educated model. “Competence-oriented” took fostering students competence, especially innovative awareness and ability, as an essential objective of education. “Social need-oriented” required educators to maintain a close watch on social and economic development requirements for skills and choose a corresponding skills-educated strategy. “Career-oriented” targeted the employment of students after graduation, focusing on cultivating students’ professional competence.

Updating education methodology meant transferring teaching methods from a knowledge-teaching-orientation to method-teaching, fostering learner autonomy in exploiting and obtaining
knowledge; transferring teacher-oriented to student-oriented, stimulating student interest and inspiring confidence to arouse their study initiative through various teaching methods and activities. Creating a dynamic study atmosphere in which free exploration, independent thinking, individuality development and innovation were encouraged; was required. Transferring from knowledge-learning-oriented to both-knowledge-and-practice-oriented, establishing off-school practice based on cooperation between academics and businesses, encouraging students to take part in social surveys and service various academic exchange and scientific researches, to expand vision and fields beyond the classroom and knowledge application and comprehensive competence was vital.

6. CONCLUSION

Professional competence played important role in individual employment and was also the basis for individual development and creativity. Higher education made critical contributions to student professional competence. University education therefore should be student-oriented, stressing a student’s continuous, stable and co-ordinating development after graduation, and fostering sustainable professional competence. The student-oriented and talent-educated package was just designed from the point a student’s whole career life development, beneficial to the realisation of an overall and co-ordinating development.

7. REFERENCES


CRITICAL PROJECT ADMINISTRATOR FUNCTIONS; A SURVEY OF REQUIRED COMPETENCIES FOR EFFECTIVE PROJECT ADMINISTRATION.

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ABSTRACT

The growth of management-by-projects as a way of business in the manufacturing industry and the increase in infrastructure development in South Africa attracts a relook at the way projects are managed. There is an unprecedented demand for qualified project managers across the industries in South Africa, this has attracted the academia to provide short courses in project management. Numerous Project Management Associations have been established to define standards and expectations for a qualified project manager, but no such association is in existence for project administrators. One critical element of projectification is hitherto ignored, and this has not been considered of importance enough to be given a focused treatise. The research findings establish that Project Administration is different from other forms of administration, and needs a focus that relates closely to the expectations of the job. Whilst it is part of project management, it is not project management and is the support service from which the wheel of project management turns from. The day to day operations of the practitioners were interrogated, and a list of critical subjects are proposed for the offering of a three year National Diploma in project administration as entry qualification into the field of project management. Of particular interest is the need to write a book specifically in generic project administration, which is not in existence at the present moment.

Keywords: competencies, project administration and skills

1. INTRODUCTION

Key functions of a project administrator

The ever-changing environment and the dynamic competition landscape puts challenges on the organisations as they strive to keep up the pace [1]. Organisations across industry show a significant turn towards projectification – management-by-projects in a quest to respond to the need to maximise the benefits from scarce resources [2] ad improve efficiency by cutting down costs whilst they increase profitability [3]. With different forms of leadership, strategies and industrial types, the establishments have to adjust to the new conditions all the time, consequently flexible and organization-specific requirements varying from organization to organization are used [4]. Thompson, Strickland and Gamble [5] postulate that the structure of the organization should fit in with the strategy, hence specific organizational structures fit in the organizational requirement dictated to by circumstances. Thus the type of project, the structure and strategic thrust of the business determine the organizational structure [6] and the expectations of the cross-functional project support office.

As projectification increases, the demand for qualified project managers increases, and inevitably the need for efficient, relevantly qualified project support office staff increases too. This necessitated the study on the required skills for an effective project administrator. The intensiveness of knowledge on effective means of operations and skills requirements [7] have drastically shifted the skills demands in projects.

Projects, as unique one time and temporary undertakings require effective skills to produce something that has not been produced before [6]. The project in a sense is an integration of human resources, material resources, technical skills, knowhow and procedures, combined together to form a complex work-systems meant to produce a unique product or service. Critical in this work system is the role played by the little talked about project administrators who sit at the centre of all activities during the crucial project execution phase. The non-static environment compounded by unprecedented technological advances and customer expectations exert pressure on the firms and demand that these organizations utilize people with certain competencies.
2. OBJECTIVES OF THE RESEARCH

The primary objective of this study was to identify the competencies required by a graduate of Cape Peninsula University of Technology with a National Diploma in Project Management from the Department of Management and Project Management to enter the workplace. It was hypothesized that any graduate in the department would not be a project manager at entry point, but would start as a project administrator. From the functions of this individual in projects, project administration can be defined as management of information in an organization. The functions of a generic administrator are, namely; collection of data, processing of data into information, storage of data and information and eventual distribution of the information.

The use of the title project administrator in reference to the employees who work in a project office is not universal. The title varies from organization to organization and some of the titles commonly used are; site clerk, office clerk, project clerk, junior office manager, office manager, site admin clerk, assistant clerk of works, document controller, site administrator, and or project administrator. The study essentially seeks to identify the daily duties and occupation of such an employee from the employee’s perspective.

Secondary objectives emanating from the primary objective would be; identification of the competencies and type of training necessary to perform the day to day duties of the project administrator at entry level. Such competencies will therefore be used to design courses and syllabi that will be deemed ideal for the industrial needs at entry point. The study program would therefore be ‘recurredicated’ in accordance with industrial needs and improve the competencies of the department in providing job-relevant programs. The course itself is generic, but seeks to address industry specific competencies and education requirements which should rhyme with industrial changes and needs affected by the need to compete using new skills knowledge and advancement in technology.

3. RESEARCH METHODOLOGY

Project management in construction and other technically biased project environments is matured and can assist in the study of requirements for the entry level graduate. The research approach was exploratory based on information collected from office bound employees at the project sites. Firstly; the respondents were assured that they were not at risk if they provided information. Secondly; they were advised not to enter any names on the forms or any form of identity on the research tool. Thirdly; no questionnaires were left behind, all tools were collected on completion by the respondents. The average number of office bound employees per site was five, most sites had more than one company operating. Not all employees were able to fill in the questionnaires as some were inevitably busy in meetings or other urgent undertakings. The researcher quickly noticed that people at a project site are very sensitive about their time, and most do not have much time to spare. There was unwillingness to fill in the questionnaires during their short lunch break.

To extract the information from the respondents this exploratory research used an open-ended questionnaire administered directly by way of personal interviews. Seven questions were asked, the first question related directly to the biographical information and included amongst other things, the job title and the qualification used to get the position in project administration. Of particular interest, though not part of the study, was that all employees at that level were youth in their early twenties. All respondents recorded having a diploma in as many varied fields as engineering, business and related disciplines. The identification of the duties was considered crucial for the proper identification of the necessary competencies as perceived by the respondents. The open-ended questionnaire sort to identify and record key knowledge areas as required to function as an effective project administrator.

4. SAMPLING FRAME

The research visited 19 sites, 15 of which were engineering projects and the other four were event management organizations. In all instances permission was sought from the project manager, site manager, contracts manager, or works manager however the title given. This was deliberately intended to avoid
unnecessary resentment or problems with the management as these interviews took place during work time. 65 respondents were interviewed.

5. TARGET POPULATION

Cognizance was taken of the fact that these clerks do not have senior positions and have pressure from people perceived to be senior to them. The target population therefore, was all people whose duties involved sitting and working from the office wherein everyone comes to, either as a reception or as central project office. In all 65 people were approached, given the forms to fill in and the forms were collected at the same time. The questions had been pre-tested and confirmed to be easy and straightforward with no need for explanation.

6. RESEARCH QUESTIONS AND FINDINGS

Below are the open-ended questions used to gather the required data, the data provided was too wide possibly because of the different functions performed due to the different nature of the industries surveyed. Computations of different answers grouped into similar answers in response to the questions asked are graphically presented below.

**Question 1**
*List the five most important things you do on a daily basis in the project office.*

Because of the varied nature of their duties and the job divisions depending on the type of project and the size of the operations, more duties were identified. These duties were summarized into ten categories of roles that are performed by the administrators. Figure 1 below shows the first six according to the frequency or how often they were stated.

![Figure 1](image)

The main part or the second part of the questionnaire focused mainly on the issues relating directly to the purpose of the research. The request was specifically for the job-activities that relate directly to the competency expectations for the position of project administrator. Cognisance should be made of the fact that the respondents came from different industries, and what is recorded is the generic requirements or daily activities across varying industries. Apart from the activities shown in the diagrams above, other activities were recorded, such as; handling of petty cash, data capturing, taking minutes, requisition forms, and preparation of documents for presentation at project meetings.

**Question 2**
*List the five most important templates you use in your office daily.*

A template is a predesigned document or form which requires specific information or data to be supplied in a prescribed format. To standardize the reporting system and data and information gathering and storage, templates serve as a standard tool for the purpose. Figure 2 below illustrates the most common templates in a project office.
Together with the templates used for the purposes as listed in the graph above, are other templates that were mentioned by the respondents. Among these are; requisition forms, contract forms, petty cash forms, sick notes forms, quality control forms, accident report forms, daily labour costs forms, overtime forms. A substantial amount of the work of a project administrator revolves around the use of templates. The project office makes extensive use of these forms for the purposes of standard in recording, this makes it easier to collate data and information for office use. Many other forms were indicated in the responses, but the list is a summary of those that were frequently mentioned in the order of frequency.

**Question 3**

**List five most common problems in the project office that you have to attend to daily**

The iron triangle of project management is time, cost and quality. (TCQ), this question sought to identify how these relate to the duties of the administrators. Figure 3 below seeks to identify the what the project administrators perceived as the critical or frequent issues in their daily work.

The most common problems in the office are ironically; pressure from stakeholders relating to meetings, most probably because the administrators would be expected to take minutes. Some of the problems mention, apart from what is shown in the graph are; people do not report their whereabouts on the site, project managers refusing supplied material because it is not correct, subcontractors not performing to standard, contractors without correct drawings, and general demands from other stakeholders who do not make prior
arrangements for their requirements. Essentially this component related specifically to human relations and customer service given the structures of the organizations.

**Question 4**

**List five critical knowledge areas or competencies in the project office**

There are both rationalistic and interpretive or phenomenon-graphical perceptions about competencies, a competency is a strength (Katz, 2001:160 - 164) and a source of competitive advantage.

![Knowledge areas in order of frequency](image)

In rationalistic approaches human competencies comprise of specific sets of attributes (Thompson, Gamble and Strickland, 2006:87) pertaining to the knowledge and skills needed and used in the performance of certain work functions. The interpretive approach assumes that people’s experience constitutes competency, and a competency is knowledge based and resides in people as intellectual capital. The responses based on the experience of the administrators were as recorded in figure 4 above. Besides those that are indicated in the graph above, some of the knowledge areas identified are; telephone and language skills, communication planning, quick thinking, good filing, punctuality, and accuracy, the this order.

**Question 5**

**List the five most common requests / demands from the project manager every day.**

From the company visits conducted, the project office is fairly busy with many stakeholders coming in and out. In this time-compressed environment, the administrators have frequent specific demands from the project manager and other project team members.
The to-do list was long and further compounded by the activities in the office, the researcher interpreted this to be a sign of the critical importance of project administration as a support function. Figure 5 above lists the first six according to their frequency in the research findings, and there are other items commonly demanded for by the project manager. The list on requests from the stakeholders, as reported by the respondents in the order of importance, included among others; taking minutes in the project progress meetings, preparing documents like graphs and tables for the progress meetings, calculating daily labour-overtime costs, and communication with stakeholders.

**Question 6**

*List five academic subjects that you think an office employee in projects must know.*

Because competencies and skills are knowledge based, and knowledge is acquired either through formal education or work experience, this question sought to draw from the administrators what they perceived as proper skills to provide competitive competencies. The response focused mostly on the following aspects; calculations, software MS Project, Excel, JDE, MS Outlook, Kronos, verbal and written communication skills, power point and accounting skills.

7. **LIMITATIONS TO THE STUDY**

One serious omission was a question referring specifically to the types of computer packages and software commonly used in these project offices. The respondents occasionally mentioned these computer packages though there was no special request, this shows the importance of such software in the daily administration of the project. With so much advances in the use of computers in project environment, the research has not capitalized on this very important component of the project office. Further to this, future research in this area will focus on the expectations of the project managers from the project administrators.

8. **SUMMARY OF RESEARCH FINDINGS**

A critical finding of the research was the need for specialized training for prospective Project Administrators. The requirements, though closely related, are not identical to those of other administrators. The project environment is highly charged with activity and they work under tremendous pressure, most of their work is not routine, it depends largely on what problem is at hand. The researcher considers the following summarized skills and competencies as unique and specific to project administrators, and as such necessary for an effective administrator. The competencies are recorded and numbered according to order of importance as illustrated in table 1 below.
Table 1 Overall competency requirements for a project administrator

<table>
<thead>
<tr>
<th>Calculations</th>
<th>Accounting</th>
<th>Calculations</th>
<th>Accounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kronos</td>
<td>Drawing graphs and tables</td>
<td>Power point &amp; MS project</td>
<td></td>
</tr>
<tr>
<td>JDE</td>
<td>Procurement</td>
<td>Filing and data coding</td>
<td></td>
</tr>
<tr>
<td>Drawing up templates</td>
<td>Contracts</td>
<td>Excel and MS Outlook</td>
<td></td>
</tr>
<tr>
<td>Minutes taking</td>
<td>Progress meeting reports</td>
<td>Stock control</td>
<td></td>
</tr>
</tbody>
</table>

9. RECOMMENDATIONS

From the research findings the researcher recommends inclusion of certain course components or removal of certain modules from the current diploma and introduction of a new National Diploma In Project Management. The recommendations are illustrated in table 2 below.

Table 2 Recommended course structure derived from study

<table>
<thead>
<tr>
<th>CURRENT first year</th>
<th>PROPOSED first year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project Management 1</td>
<td>1. Business Calculation [Project Management 1]</td>
</tr>
<tr>
<td>2. Management 1</td>
<td>2. Management 1</td>
</tr>
<tr>
<td>3. Communication</td>
<td>3. Communication</td>
</tr>
<tr>
<td>4. Administration Management 1</td>
<td>4. Administration Management 1</td>
</tr>
<tr>
<td>5. Financial Accounting 1</td>
<td>5. Financial Accounting 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CURRENT second year</th>
<th>PROPOSED second year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project Management 2</td>
<td>1. Project Administration [Project Management 2]</td>
</tr>
<tr>
<td>5. Marketing</td>
<td>5. MS Projects 1, 2, and 3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CURRENT third year</th>
<th>PROPOSED third year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Project Management 3</td>
<td>2. Procurement [Project Management 3]</td>
</tr>
<tr>
<td>3. Management 3</td>
<td>3. Project Related Computer Packages</td>
</tr>
</tbody>
</table>

Business Calculations should be added to the current syllabus; calculating time sheets, project costs, extension on graph preparation and interpretation. This should be added to the existing syllabus below.


10. PROJECT MANAGEMENT 1B Project Administration

Project Document Management System PDMS

To this should be added office skills, time management skills, contract management skills, and customer relations. The rest may be maintained as is until there is new information from the industry. The current syllabus is put below in italics.

The other competencies are not taught directly under the Project Management modules, but reside in the other competencies within the department. Among these would be software packages like Kronos and JDE which may be taught as a new subject, suggested herewith as MS Project. Power point, excel and MS Outlook are already offered in the End User Computing modules. But, added to these should be use of computers to draw graphs and tables.

The new course in the university; National Diploma in Project Management is unprecedented, and being the only one we know to date, the university will make a breakthrough. It is accepted however that like any new course, it needs constant reviews to keep in touch with industry changes. The aim of this course is to place effective well trained and knowledgeable graduates into the industry with pride. The university has to live up to its mission and vision, and lead in many respects through continued research.

11. REFERENCES


CONSIDERATIONS ON THE LONG TERM INFLUENCE OF THE
ENTREPRENEURIAL INNOVATIVE RESEARCH AND
EDUCATION ON THE GDP GROWTH IN THE EMERGENT
ECONOMIES.

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ABSTRACT

The present paper shows how the international productivity and competitiveness of a country depend
on the rapid accumulation of knowledge based on the entrepreneurial innovative education and on the
real transfer of the new technologies and positive experience.

Although there is no explicit relationship between the investments in education and the GDP variation
the paper shows the existence of an influence of the education and scientific research on the
economic growth of a country.

We made a long term evolutionary analysis of the GDP and we showed that the investments in
education and research made four-five years ago are implicitly reflected in the GDP growth.

By studying the investments evolution in education and research the paper demonstrates the existence
of a similitude between the previous shape of the investments' curve in education and research and an
ulterior shape of the GDP's curve.

Keywords: Entrepreneurial Innovative Research, Education, GDP growth, Emergent economies.

1. RESEARCH INVESTMENTS ANALYSIS

The international productivity and competitiveness of a country depend on the rapid accumulation of
knowledge, on the effective transfer of technologies and also on the positive experience. Peters L. Daniels
tried to find a dependence ratio between the research, development and innovation expenses (RDI) and the
worldwide exports variation [1].

The study was done, by Peters L. Daniels, for three categories of countries:
- heavily industrialized (USA, England, Canada, France, Germany etc.);
- recently industrialized (South Korea, Thailand, Malaysia);
- developing countries (Argentina, Chile, Columbia etc.).

According to the conclusions of this study, which was elaborated based on the statistic data between 1978 –
1988, there is shown that there is no explicit relationship between the RDI expenses and the exports
variation and the GDP variation, respectively.

However, two interesting phenomena were noticed. First, many of the heavily industrialized countries (USA, England, France, Switzerland and Belgium) registered huge exports falls, despite the great RDI investments. Yet, three of the most dynamic countries in Eastern Asia (Singapore, South Korea and Japan) gained immensely from exporting, after investing in RDI [1]. Although this observation is difficult to generalize, it still suggests the obvious influences of the high technology transfer on the exports growth. It is possible that the quoted study didn’t consider other possible analysis factors, too.

In any case, this discrepancy also suggests other types of influences, which could explain the decrease of the Western Europe and North America export potential.
Let us define the GDP and RDI a dimensional variation indices, as follows:

\[ \partial \text{PIB} = \frac{\text{(PIB)}_f - \text{(PIB)}_i}{\text{(PIB)}_i} \]
\[ \partial \text{CDI} = \frac{\text{(CDI)}_f - \text{(CDI)}_i}{\text{(CDI)}_i} \]

in which the indices mean:
- \( i \) – at the beginning of the analysis period;
- \( f \) – at the end of the analysis period.

Let us calculate, by means of these relations and of the statistic data in [2, 3, 4], the GDP and RDI variations, in the period between 1987–1997, for a group of ten countries, among which Romania, too. In figure no. 1 there is presented the GDP variation, in correlation with the RDI expenses variation, in the case of these countries, along a decade. (1987–1997).

**Figure 1:** GDP variation, in correlation with the RDI expenses variation.

After a period of 10 years, in the case of the heavily industrialized countries group (USA, France, England, Italy) one can find that, although the RDI allocations (% from the PIB) decreased, the GDP grew, its variation index showing values lower than 0.3. In the case of Germany, although, the RDI allocations fell significantly, however still, the GDP grew remarkably, its variation index being of \( \partial \text{PIB} = 0.5 \). Yet, the Japan and Canada’s RDI expenses grew, when the GDP also grew, \( \partial \text{GDP} \) being of 0, 34 for Japan, and of 0, 25 for Canada respectively. The phenomenon is more significant in the case of New Zealand, to which for a \( \partial \text{RDI} = 0.38 \) it corresponds a \( \partial \text{GDP} = 0.73 \), therefore a significant enough GDP increase. South Korea has a \( \partial \text{RDI} = 1.2 \), that is a high increase of the RDI expenses, to which it corresponds a \( \partial \text{PIB} = 1.16 \) which means a high GDP increase. In what concerns Romania, the index of the RDI expenses variation has a value of \( \partial \text{RDI} = 0 \), to which it corresponds a \( \partial \text{GDP} = -0.46 \). These variations show that, if the RDI expenses fell drastically, the Romanian GDP fell as drastically.

From these calculations and observations, we can estimate that there is no explicit relation of dependence between the RDI expenses and the GDP variation, which means that other analysis and influence factors should also be taken into account. Such an influence factor, according to Fukuyama (quoted in [54]), could be the social capital. As a social factor of influence, he suggests that property and its efficient exploitation...
depend more on the common set of values and on the sociability. *Trust*, for instance, is the factor which forms the basis of the effective relations between companies and keeps the innovative capacity in the interest of the company and in the GDP growth.

Due to such a rationale, there could also be identified other GDP influence factors, with the purpose of finding the explicit relation of dependence, a relation in whose framework the RDI investments have a significant percentage. This requires in-depth research, because innovation as a process is more than a means to rebound the transition and the development problems, by balance of payments. At a first approximation, one can appreciate that *by simply investing in the RDI one doesn't automatically solve the GDP growth problem*. This investment must be associated to the social capital, to the innovative capacity, and also to the other influence factors [4].

From the perspective of these interpretations, *the innovative company* is the one which operates with a complex network of cooperation, which is in loyal competition with other companies and organizations, and which builds a high-performance range of innovative associations and of connections with suppliers and customers.

The innovative productivity index [4] is defined by the relation:

$$\hat{\partial}_i = \frac{(C_1 - C_0)}{(C_1 + C_0)}$$

in which: $E_1$ – RDI expenses per researcher, RON / researcher.

$E_0$ – RDI expenses per invention patent, RON / patent.

The values of the innovative productivity index were calculated for a group of seven countries, among which Romania. The calculated values are represented graphically in figure no. 2. In figure 2 there are presented the evolutions, along the time, of the following development parameters by means of the RDI:

- GDP / per capita, considered as a welfare indicator.
- RDI expenses.
- Innovative productivity index.

One can observe that, in the case of the countries having high values of the GDP /per capita, also correlated with the RDI expenses, there correspond values of $\hat{\partial}_i$ closer to zero.

Usually, $C_0 \geq C_1$ and, therefore, the ideal case is given by $C_0 = C_1$, a situation in which $\hat{\partial}_i = 0$.

Thus, USA, which presents the highest GDP / per capita and allocates high RDI expenses, achieves an index of innovative productivity with values of $-0.77$, up to $-0.83$, while South Korea achieves $\hat{\partial}_i = -0.19$ ….. $-0.5$.

Romania achieves $\hat{\partial}_i$ which are closest to the value of “-1” ($C_1 = 0 \rightarrow \hat{\partial}_i = -1$), which means a very low innovative productivity, reflecting in a modest GDP / per capita, with values between $1120 – 1346$ USD / per capita.

One can make observations of the same type in the case of the other analyzed countries as well. What must be remarked, as being obvious, is that the innovative productivity index has values closer to zero as the RDI expenses / researcher increase and as the RDI / patent expenses decrease. This means that the human factor stimulation, together with an adequate technical-scientific equipment, determines the increase of the income per capita and therefore of the GDP. In the case of these countries, but also in general, even if the analysis parameter number was increased ($\hat{\partial}_i$, RDI expenses, population number, researchers number, patent number, GDP) the dependence relationship with the GDP still remains implicit. This means that one can remark „the presence” of other factors as well supporting these figures and curves. These factors, pertaining more to the socio-cultural environment, must be deeply studied and in the case of the transition countries this research represents a high scientific stake and also a pragmatic one.

In order to understand the functional connection between the parameters which are associated for creating the welfare of a nation, it is necessary to further study the influence of the innovative productivity and of the RDI expenses on the GDP evolution. Even if we managed to point out only an implicit dependence, the results obtained within the framework of this project show that due to the action and to some socio-cultural factors, the innovative productivity and the RDI expenses influence, to a high degree, the GDP variation.
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This shows that more research is necessary which should focus on the Romanian reality, on the psychosociology of the Romanian people, in order to define the transition, and not only as a pragmatic project, but also as a complex innovative-socio-cultural project. The results of these researches could ensure Romania’s success in the process of development and of transition, by directing the society towards an innovative and adaptive culture, so that this should sustain emerging factors and technological influences, corresponding to a rapid growth of the Romanian competitiveness. The GDP evolution analysis, for long periods, shows that the RDI investments, made 4–5 years ago, are reflected implicitly in a GDP growth. By studying the evolution of these two parameters, on a group of four countries [2, 3 among which Romania (figure no. 3), one can observe a similitude between the former shape of the RDI curve and the ulterior shape of the GDP curve. Between 1981–1986, South Korea made investments, in the RDI expenses, of 12.9 billions USD, which determined, in association with other factors, an increase of the GDP of one or two times in 1990, compared with 1986. The same phenomenon is also observed on the other portions of the curve, corresponding to the periods of 4–5 years. France, in the same period, allocated 121.9 billion USD for RDI. In the next period, this presented in 1990, a GDP of 1.14 times higher than in 1986. Also, New Zealand, which with 1.91 billions USD, allocated for the RDI between 1987–1991, obtains a GDP growth of 1.2 times higher in 1996, compared to 1991. In the case of Romania one can observe the reverse phenomenon [5]. Thus, Romania allocated 1.5 billions USD for the RDI, between 1989–1993, which corresponds to a GDP, in 1998, almost equal to the one from 1993. The same phenomenon, much more serious, is also repeated between 1993–1997, having as result an even more significant decrease, up to GDP failure rate, as an effect of an inadequate policy of continually decreasing the RDI investments. In what concerns Romania’s welfare, this decreased drastically, in the analyzed period, while it increased in the countries which constantly invested in the RDI (figure no. 4). In comparison with 1989, in Romania the GDP/ per capita decreased to its half, in 1999, which explains the present high rate of poverty. In a period of 10 years, between 1987–1997, in France the GDP/ per capita grew by 17 %, in South Korea it doubled, and in New Zealand it grew of 1.5 times.

![Figure 3: RDI expenses evolution, in correlation with the GDP evolution.](image-url)
2. THE PRESENT STATE OF RDI SYSTEM IN ROMANIA

The RDI system from Romania is made up of old autocratic structures branching in and influencing the political and governmental structures [6]. These structures work in parallel thus self-feeding their survival interests but they are not connected to the real problems of the reform and of the development process. Therefore between the management of these public institutions and the management of the private sector there are incompatibility conflicts. Just as in the case of the other ex-communist countries, after the Revolution in December 1989, in Romania there decreased the importance given to science, this being considered only a consumer of limited resources. The lack of coherence between the different state structures determined by a faulty understanding of the reform idea triggers the weak connection between the economic policy and the science policy. Until now the political and civil society media still didn’t come to appreciate the role which science could have on the reform. The redefining of the science role, in the transition context, should be based on the reformist idea stating that science and technology represent the key-factors of the economic and social development. By the measures set in the adopted normative acts referring to science, the reformist declarations are juridical consecrated. In order to reach their beneficial effect these measures must be also supported by ample actions aimed at recuperating the specialists and at revigorating the institutions necessary for Romania’s development. In what regards the state of the research specialists one can say that they were subjected to discriminatory phenomena which led to their shifting to other activities, to disinterest for research or to their choosing programs and projects financed from abroad. As one can see in figure 5, the scientific researchers’ number decreased starting with the year of 1995 when there worked 35094 researchers so that in the year of 2009 their number reached only 30645. The decrease of the researchers’ number triggered the considerable diminution of the management quality in the Romanian scientific research. In a study referring to the international cooperation in the post-communist countries, among which Romania, there is shown that the majority of these cooperation are mostly due to the researchers individual initiatives and less to the managers in the scientific research sector [7]. Although the pressure of the hierarchy from the past disappeared, this was replaced either by the manager’s indifference or their abuses. Travelling abroad is the most popular form of international contacts, but this is as well restricted by the lack of funds. At present, an important number of Romanian researchers work in different foreign institutes under long-term contracts.
Also, other researchers’ work is supported by oriented research grants, EU financing or foreign foundations financing. Many of them do not return to the country. Another part of the researchers retire or get unemployed. In 1998 the crisis caused by the lack of experienced specialists was already obvious.

3. CONCLUSIONS.

The research-development innovation systems (RDI) in the transition countries and in Romania too, cannot ensure the promotion of the industrial development, because of some of their weaknesses, among which the most important are the following:

- Extremely low RDI expenses, compared with the industrialized countries;
- The total or almost total absence of the research and development in the enterprises sector, which is, actually, the main innovation factor;
- The public sector RDI fragmentation and its insufficient focus towards the needs of the industrial sector;
- The weakness of the RDI institutes financed by public funds;
- The excessive priority given by some of these institutes to the fundamental research, to the detriment of applicative research;
- The attitude and the mentality of the researchers in these institutes, who are more interested in their career perspectives, than in the needs of the national industry;
- The lack of adequate stimulants favoring RDI.

In Romania there still is an RDI technical-material basis, created before the anti-communist revolution and also an industry of innovation. Despite that, the innovative process was greatly impeded because of the gradual disappearance of the human and institutional protagonists and also because of the modest level of the RDI investments and expenses.

3 BIBLIOGRAPHY


ENTREPRENEURIAL ILLNESS OVER THE YEAR END HOLIDAY SEASON: RELEVANCE OF OCCUPATIONAL STRESS SCALES TO THE SOUTH AFRICAN CONTEXT

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ABSTRACT

Due to the nature of the occupational stress it isexperienced at high for entrepreneurs who are noted to work in highly stress conditions. This is especially when compared to other subsets of the same business and to other industries. Most of the research into neurological stress has been completed on employee groups. In the South African context there is no research published to date regarding how stress (allostatic loading) cause the onset of disease on South African entrepreneurs. The purpose of this paper is to provide an overview of the research findings regarding three leading stress scales, how these findings are relevant to the South African context regarding and how allostatic lo ading causes sickness over the yearend holiday period experienced by entrepreneurs. This paper documents causes and symptoms in this regard. An empirical study is proposed to learn if the application specific technology designed to report on and offer sustained relief from allostatic load symptoms for entrepreneurs is appropriate in the South African context.

1. INTRODUCTION

Entrepreneurs are confirmed as a high risk profile group for occupational stress as their lives are dominated by their work lives (Jamal 1997). This group over associates emotionally, psychologically and financially with their chosen profession and tend to work much harder than salaried employees, professionals and managers (Prottas and Thompson 2006). Entrepreneurs usually spend over 60 hours working and their stress levels is chronic stress results in pathology such as cardiac disease and anxiety / depression related disease (Jex 1998). Studies suggest self-employed workers are less healthy than salaried workers (Jamal and Badawi 1995).

2. OCCUPATIONAL STRESS: THE IMPLICATIONS FOR ENTREPRENEURIAL SUCCESS

Stress is defined as a misfit between perceived demand and perceived ability to manage that demand (Lazarus and Folkman 1984). Stress is typically associated with an alteration in mood, which triggers a cycle of psychological, emotional and physiological change i.e., a deviation from normal functioning (Lazarus and Folkman 1984). Although the challenging nature of new venture creation may act as a catalyst for performance up to a certain point (good stress or eustress), demand that is perceived as too much for the entrepreneur to manage (negative stress or distress) will give rise to strain e.g., ill health (Hobfoll 1988). Occupational stress is likely to be an important variable in multidimensional models of new venture success/failure. Despite considerable academic interest in entrepreneurship, our understanding of why some entrepreneurs fail is limited (Lussier and Pfeifer 2000). Past research has tended to focus on external factors, for example competition, financing, geographic location, marketing, production, and timing (van Steekeleenburg et al. 2000). By comparison, little research has been conducted from a psychological or mental health perspective and personality characteristics of entrepreneurs (Baum et al. 2007). Historically, the study of entrepreneurship has been synonymous with economic health, far removed from psychological health. Baum et al. (2007, p.1) argued that “Despite the belief that the entrepreneur’s personal characteristics are important for new venture success, the psychology of the entrepreneur has not been thoroughly studied.” Given that entrepreneurs own and manage their firms, their personal impact on business performance is much greater than for salaried managers (Morrison 1997). Thus, the association between stress and performance is likely to be stronger for this occupational group. For instance, stress in entrepreneurs may have a negative effect on communication, decision making, morale, and productivity (Jex 1998), which may affect their workers and, ultimately, the business success. Accordingly, occupational stress may be a contributing factor in business success/failure, particularly in the early years (Bradley and Roberts 2004). From the literature review there is however no research of neurological stress resilience of South African Entrepreneurs. Recent neuroscience research has begun to provide insights into the neurological drivers of
behaviour in the business and social environment (Lieberman, 2008; Lieberman and Ochsner, 2001; Rock, 2008; Ringleb and Rock, 2008; Tang and Posner, 2008). In this paper we will draw on neuroscience research to explore these five questions:

1. What is the neural basis of stress resilience for South African entrepreneurs?
2. What are the neural drivers that enhance illness over the holidays?
3. What are the levels of resilience from a neurological perspective?
4. What effect does increasing resilience have on the brain and homeostasis?

3. OVER THE YEAR-END HOLIDAY SEASON

At year end and everyone's supposed to be unwinding, recharging and in getting into a festive mood. The pressure to meet targets at year end is often too much to cope with resulting in illness or even suicide. The suicide rates have shown to peak over the holiday season as well (Tancer, 2008). All too often, small businesses rely on the holiday period to balance their balance sheets for the year. Entrepreneurs need to keep focused on their year-end profit and most often work long, hard days (and nights) leading into the holiday season. There never seems to be enough time at this time of year. And many don’t get enough sleep. Add the rigor of running a business leading up to the holidays can pose a real threat to the energy, vitality, health and competence of the entrepreneur. Entrepreneurs and business people tend to see the holiday as both a threat and reward and the question becomes 'what are the issues that generally create high levels of rewards or threats?’ The answer to this question, we propose, is largely to be found in the social cognitive and affective neuroscience literature. The SCARF model (Rock, 2008) summarizes the neuroscience findings into five domains of threat or reward. The five domains are Status, Certainty, Autonomy, Relatedness and Fairness. These five domains are environmental or business factors that the entrepreneur keeps track of, in a similar way to tracking levels of new business opportunity similar to how pre medical people tracked for food or water. In both cases the person is using the same circuits in the brain (Lieberman, 2008). We propose that entrepreneurs are experiencing high levels of stress and little positive reward (in the SCARF domains), and experiencing high levels of threat by taking holiday as the feel less in control of the business while on holiday. The research that supports this proposition involved and meta summaries of occupational stress models. For example, in one of the most common engagement models, entrepreneurial stress resilience is also indexed by a balanced brain-body state including occupied, effortless, joyful feeling and being flow (Tang, 2009) which we will discuss below as its proposed that the entrepreneurs is not able to cope while not directly in control of their business. Holidays simply take away their control systems and with a lack of stress resilience skills they all too often become ill over holiday periods at year end. Although it's a challenge, successful entrepreneurs know they have to stay disciplined with healthy habits. When an entrepreneur experiences severestress and then these factors are removed they all too often tend to get sick with symptoms like influenza (Van Heck 2007). The high of adrenaline ensures the business performance sustains but once it’s removed during a holiday it can immediately cause the onset of illness. As a result chronic stress is very similar to a neuro-physiological trauma which and can result from everyday events, eg: a relationship breakup, overload at work, road rage, stressful situations or even taking a holiday. Although entrepreneurs performed business activities successfully Fowler, et al. (2000) and Manzey (2000) propose two hypotheses to account for this performance degradation—(1) the direct effects of on the central nervous system and the motor system of the body and (2) the non-specific effects of multiple stressors. Evidence available to date is consistent with both hypotheses and further experiments are required to settle question of how much stress is required for peak performance. Neuroscience has helped us understand the difference between a normal stress response (here we return us to a state of regulation: Homeostasis) and a traumatic stress response (that doesn't result in normalization of your neurophysiology: ‘Allostasis’). The job of a commercial airlines pilot is generally regarded as one of the most stressful. It would, therefore, not be surprising to discover that pilots suffer more health problems than non-pilots. Bourne and Yarouch, (2003) investigated self reported disease outcomes among a large group of active and retired commercial airline pilots. Increased disease rates among pilots were suggested for melanoma, motor neuron disease, and cataracts. However, rates for other diseases were in general lower than those for the general population. As entrepreneurs who are exposed to stress over extended periods of time, they appear to adapt well and to evidence few serious behavioural problems as a consequence of job-related stress The counterintuitive message from this research seems to be that if entrepreneurs are well prepared for the required tasks their performance will hold up well while on holiday. Adaptation to chronic stress might be quite good, if the
stressful situation is not prolonged indefinitely. If adverse conditions do persist, however, and there is no clear end-point to the stressful circumstances, there are at least some indications of possible significant cognitive effects, especially in children (Haines, Stansfeld, Job, Berglund, & Head, 2001). What unique effects emergencies, occurring during chronically stressful conditions, might have are not clear from these studies for entrepreneurs, however, it is also the case that prolonged work stress can have significant effects on a person’s health, especially if the stress creates chronic supra-optimal levels of arousal accompanied by a state of strain in the entrepreneurs. Straining has been shown to put them at some risk regarding health and/or safety (e.g., Andries, Kompier, & Smulders, 1996). High correlations have been found between stressors and psychosomatic complaints, general health, and felt fatigue and boredom at work (Houtman, Bongers, Smulders, & Kompier, 1994).

4. ENTREPRENEURS REALLY CAN’T AFFORD TO GET SICK.

These concerns tend to present as Leisure sickness described by Van Heck (2007) is a very real phenomenon. When stressed-out people can keep running on adrenaline as it boosts their immune systems but at the same time their bodies are releasing cortisol⁴, which shuts down immune function under chronic circumstances. So when one stops stressing, the adrenaline stops reducing but the cortisol continues pumping into the brain. The immune system is now so low that one sneeze in your direction and causing immediate sickness. If one is running on adrenaline then you really have to be quite healthy to stop and relax the holidays. If your immune system is very low you will quickly get sick just from being exhausted. There’s also the theory that ‘leisure sickness’ is all in the mind and that one doesn’t know how to unwind. Jonsson A, Hansson L (1977) in a Dutch survey of more than 1800 people said their symptoms were due to difficulties transitioning from work to non-work and from the stress from travelling. Those who called themselves ‘workaholics’ got sicker on holiday. Electrical activity in the brain, as reflected in EEG patterns, are sensitive to certain abnormal human conditions such as alcohol intoxication and fatigue. Gevins and Smith (1999) reported that both intoxication and fatigue reduced the accuracy of performance in a working memory task and that these effects were associated with changes in spectral characteristics of the EEG. These authors have shown that both human observers, operating intuitively, and computing networks trained on human data can discriminate EEG patterns associated with fatigue and alcohol states from normal alert states with accuracy well over 90%. The overuse and even abuse of alcohol entrepreneurs along with the high level of fatigue at year end indicate further reason for their immune systems not being resilient resulting in the onset of illness over leisure time over the year end break. But Entrepreneurs in the current climate have little or no choice and need to be workaholics just to ensure their enterprise survives (Bradley and Thompson 2004). As a result the taking a holiday requires intense attention to ensure the entrepreneur does not get ill. This has the positive side effect to ensure they have a deep resilience to cope in a recession economy. Taking a holiday is vital to ensure their enough energy for the following year. The NIOSH Report (1999) suggests that getting ill usually causes a whole lot of guilt for entrepreneurs who know all too well about controlling excess alcohol, exercising and sleeping regularly, not to mention getting enough water and eating healthy balanced meals throughout the year. But the truth is that these are ‘nice to have’s when one is keeping a business afloat. We can all cope with difficult times, but if the stress levels are chronic, the brain is going to rebalance those stress hormones at some point and usually finds the opportunity during the holiday. Basically, entrepreneurs need to plan the transition into holiday-mode. Entrepreneurs even need to plan to relax according to Kauffman (2008). For some people its exercise so that you release toxic levels of nor-epinephrine more socializing, or maybe just get away from people and have “me-time”. If it’s just sheer workload then it’s not just about managing your time and perhaps seeking help is a better remedy than getting sick when you take leave? A relaxing activity comes as alike a massive change … like a shock to the entrepreneurs’ brain which has been on high alert for the whole business year. This state of high alert causes cortisol to pass through the blood-brain-barrier⁴ and one will probably get as sick as a dog. Entrepreneurs need to find balance to ensure they not only thrive but survive into next year. Yes eating, sleeping and living a balanced life will help, but with the high demands entrepreneurs’ experience, balance is just a ‘nice to have’ and not a direct business need. This paper will continue to discuss the benefits of employing technology to not only build stress resilience but also to improve cognitive function and neurological health for entrepreneurs. This will begin with an overview of published research in this area and how it relates to entrepreneurial sickness over the holiday season.
5. IDENTIFYING AND MEASURING SOURCES OF STRESS IN ENTREPRENEURS

Although occupational stress has been signalled as an important issue for entrepreneurs, there has been little systematic research on the unique obstacles faced by this profile in South Africa. In particular, research is needed to develop measures of occupational stress that are relevant for these entrepreneurs.

Much of what we know about occupational stress has come from research on salaried workers with predefined jobs in large organisations (Prottas and Thompson 2006; Tetrick et al. 2000). Past research on occupational stress in entrepreneurs has employed generic measures, developed with salaried workers and managers in large organisations. The sources of stress that are relevant for salaried workers may be less relevant for self-employed workers. As such, the leading occupational stress inventories (e.g., Job Stress Survey, Occupational Stress Indicator, and Occupational Stress Inventory) may lack content validity for South African entrepreneurs, and it is possible that past studies have misrepresented the true extent and nature of occupational stress among the self-employed. A review of the literature suggested that occupational stress among entrepreneurs may stem from i) cash flow (Feldman and Bolino 2000); ii) fear of failure and grief over business loss (Shepherd 2003); lack of knowledge/training (Vasumathi et al. 2003); iii) lack of social support (Chay 1993; Rahim 1996; Tetrick et al. 2000); iv) The need for achievement (Boyd and Gumpert 1983; Vasumathi et al. 2003) and control (Kets de Vries 1985); v) paper work and tax (Feldman and Bolino 2000); vi) interpersonal conflict (Akande 1994; Boyd and Gumpert 1983; Feldman and Bolino 2000); vii) responsibility (Boyd and Gumpert 1983; Buttnar 1992); viii) financial risk (Boyd and Gumpert 1983; Feldman and Bolino 2000); iv) sense of distrust towards competitors, suppliers, and government (Kets de Vries 1985); x) time pressure (Akande 1994; Chay 1993); xi) working long hours (Harris et al. 1999; Prottas and Thompson 2006); xii) work-life balance (Boyd and Gumpert 1983; Buttnar 1992; Parasuraman and Simmers 2001; Stoner et al. 1990; Tetrick et al. 2000; Vasumathi et al. 2003); xiii) workload (Chay 1993; Harris et al. 1999; Vasumathi et al. 2003). From this brief review it is apparent that entrepreneurs are a high risk profile to stress related pathology and skills of resilience would be invaluable. This preliminary research was conducted as part of a larger study which aims to identify sources of occupational stress among entrepreneurs and to develop a new measure of occupational stress specific to this segment of the workforce: the Entrepreneurial Stress Scale detailed in the Handbook of Stress in the Occupations (Janice Langan-Fox, Cary L. Cooper 2011) and Cooper, CL, Sloan, SJ & Williams, S (1988) examines the relevance of three leading occupational stress scales. In studies using this scale entrepreneurs were expected to perceive many of the items on the scales as being “irrelevant” to their work situation and to nominate unique sources of stress not captured by existing scales. The research was to identify sources of occupational stress among entrepreneurs and to develop a measurement of occupational stress specific to this segment of the workforce and the Entrepreneurial Stress Scale is proposed. This research model sample (N=40) consisted of 15 entrepreneurs (defined as owning and managing their own business), 10 (employed by an organisation to innovate), and 15 “other” employees. The units New Venture Leadership (n=30), Managing the Growing Business (n=29), Creativity and Innovation (n=23) and Negotiation and Strategic Relationships (n=25) were targeted as there were expected to include the greatest concentration of entrepreneurs. The overall response rate was approximately 37%. Descriptive statistics were run for the total sample combined. Of the total sample, 65% were male and 35% were female with an age range of 22 to 66 years (M=33.98, SD=10.02). Education varied: 7.5% had no formal education, 50% had a Bachelor degree and 27.5% had a Postgraduate degree. A third were single, 40% were married.

6. MEASUREMENTS

(a) Demographic Information Questionnaire:
Participants provided basic demographic information including their age, sex, education, marital status, ethnicity, and income for the purpose of sample description.

(b) Job Stress Survey (JSS: Spielberger et al. 1995):
The JSS measures the perceived severity (intensity) and frequency of occurrence of 30 generic sources of work-related stress encountered by men and women employed in a variety of work settings. Respondents were required to (i) rate, on a 9-point scale (1 = “low”, 9 = “high”), the perceived severity of each stressor by comparing it to a standard stressor (“assignment of disagreeable duties”), with a mid-point scale value of 5, and (ii) use a scale of 0 to 9+ days to report how often each stressor occurred during the past 6 months. The scale focuses on two major components of job stress: job pressure (pressures associated with the job itself) and lack of organisational support (lack of support from supervisory personnel, fellow workers, or...
an organisation’s administrative policies and procedures). As such, the JSS consists of three scales (Job Stress Index, Job Stress Severity Index [average perceived severity], Job Stress Frequency Index [average frequency of occurrence]). The validity of the JSS has been examined and confirmed in several studies (Vagg and Spielberger 1999) for a variety of work settings, although its validity for entrepreneurs has not been established and it is therefore proposed to validate this for the South African context.

(c,i) Occupational Stress Indicator – Sources of Stress Scale (Cooper et al. 1988): This 61-item scale consists of six subscales that measure stress from the following sources: the job itself, managerial role, interpersonal relationships, career and achievement, organisational structure and climate, and home/work interface. A sample item is “Lack of power and influence”. The response format is a six-point scale ranging from “very definitely is not a source” (1) to “very definitely is a source” (6). These scales have good construct and predictive validity.

(c,ii) Occupational Stress Inventory-Revised – Occupational Roles Questionnaire (ORQ: Osipow 1998): The ORQ consists of six 10-item subscales designed to measure the following stress-inducing work roles: role overload, role insufficiency, role ambiguity, role boundary, responsibility and physical environment. The response format is a five-point scale ranging from “rarely or never true” (1) to “true most of the time”. Test re-test reliability for the OSI-R scales ranges from 0.56 to 0.68 and internal consistency reliability (Cronbach’s alpha) ranges from .72 to .89. The scales have good construct, convergent and predictive validity (see Osipow, 1998).

The results were divided into two sections. The first section focused on the quantitative data and compares the responses of entrepreneurs, “other” employees across the three occupational stress scales. The second section focuses on the qualitative data obtained from the group discussions about the relevance of the three occupational stress measures and provides a summary of the themes that emerged from these discussions, including entrepreneurial stressors not captured by the occupational stress scales. In the results, it should be noted that the response scales for the three occupational stress measures varied and included stressor frequency (JSS – “number of days per month” and OSI-R – “rarely or never true” to “true most of the time”), stressor severity (JSS – “more or less stressful than standard”), and whether or not something was a source of pressure (OSI). Results indicated that there were a number of items in all three scales that were irrelevant for entrepreneurs. Overall, the JSS scale appeared to be the least relevant, followed by the OSI and the OSI-R. In general, sources of stress also differed for entrepreneurs versus other employee profiles.

7. DISCUSSION

In review of the current research findings, entrepreneurs completed and provided feedback on the relevance of three leading occupational stress scales. The JSS was the least relevant scale overall, followed by the OSI and the OSI-R in that order. It is noteworthy that frequent stressors such as working overtime were not necessarily perceived as severe stressors by entrepreneurs, suggesting that high workload is the norm for this occupational group. Although a certain level of stress may be energising, a concern with entrepreneurs is burnout; where there is a decline in the stress-performance curve (Seyle 1975). The research findings discussed have identified a number of sources of stress that appear to be unique to entrepreneurs. It is noteworthy that Buttner (1992) found that work-life conflict correlated with the frequency of health problems. In general, the results suggested that entrepreneurs are less likely to experience pressure from aspects of their work that relate to autonomy and fulfilment of their career and achievement needs and preferences. However, there is a trade-off whereby they experience more pressure from aspects of work that relate to factors not under their direct control which is the primary cause of chronic stress-related pathology. The findings confirm that entrepreneurial stress is a cause of chronic illness. The relevance for an instrument to classify Leisure Stress levels over the year-end holiday period is proposed for the South African context. This instrument also has the possibility to be augmented into a global scale instrument for Business Coaches, Psychologists, Occupational Health and Safety (OHS) professionals and doctors working with entrepreneurs who could administer the scale to identify entrepreneurs who are at risk for stress-related illness and disease just before their year end break. For instance, knowledge of entrepreneurs’ scores could be used by their coach to target those who are more likely to benefit from a referral for medical diagnosis or treatment from neurologist, physician (if their symptoms are physiological) or to a (neuro)psychologist if the concerns are cognitive, interpersonal, phobic or emotional. In addition, knowledge of the types of stressors that are salient to entrepreneurs should be useful in tailoring stress intervention strategies to meet their unique needs. For example, stressors that result from insomnia could benefit from the application of
biofeedback according Ebben, MR, Kurbatov, V & Pollak, CP (2009). Other intervention strategies might include stress education coupled with entrepreneurial development and professional training, with the aim of helping entrepreneurs to learn about occupational stress, including its sources, and helping those at risk develop more effective coping strategies and build resilience to allostatic loading so that they do not get ill when taking a holiday. As stress levels are areas over which entrepreneurs can actually exert control, given appropriate intervention strategies (e.g., stress education, coping skills) however the benefits of such a skill set promises to be a difficult competence motivate the entrepreneur to learn until they notice the pending pathology. If stress resilience for entrepreneurs is paramount, given their significant economic contribution, then the current research represents only preliminary exploration of how stress in entrepreneurs retards their ability to sustain economic growth. Further research is needed to explore these issues in more depth for the chronic state of disease and presenting pathology not only relevant to South African entrepreneurs but possibly at to address the global epidemic at hand. Prinsloo, GE, et al (2010) explain how to improve Cognitive Performance During Laboratory Induced Cognitive Stress. An Entrepreneurial Cognitive Performance Laboratory that quantitatively measure the levels of stress in the South African context and how this augments into holiday illness is proposed.

Lastly it is clear from the published research reviews regarding what stimulates entrepreneurial performance under extreme economic conditions in the South African (and global) context that ensure resilience to allostatic loading of the nervous system that ensures year-end holidays are a time for energizing for the year ahead. An initial study to investigate what assists entrepreneurs will be proposed by the author at the Cape Peninsula University of Technology, Cape Town, South Africa in 2011 as part of 4th International Conference on Engineering and Business Education (ICEBE) and the 1st International SAFRI Journey to Excellence Conference [Journey to Excellence (J2Ex) Programme].

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INCREASING COMPETITIVENESS OF SOUTH AFRICAN COMPANIES THROUGH INTERNATIONAL DEVELOPMENT PROGRAMMES WITH SPECIAL FOCUS ON THE RENEWABLE SECTOR

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ABSTRACT

A possible route for small, upcoming businesses to become more competitive is through exposure with established companies that are well-versed in the use and implementation of the latest technology and management skills. By participating in international developmental programmes where this company-mentoring aspect is emphasized, the required management competencies, which are often in short supply in most of medium-sized companies in SA, can be further developed. International exposure and insight into governmental policies and institutions, which support businesses in other countries, can enhance the competitiveness of SA companies. South Africa has embarked on a massive renewable energy implementation programme that aims to have 42% of its energy requirements derived from renewable sources by 2030. The implications in terms of capital and human resource development are huge, estimated at ZAR 18 billion per annum for wind and solar photovoltaic alone. The absence of local operational feed-in renewable systems has been identified as an ideal opportunity to support the development of young South Africans, given our impending venture into this market. This paper discusses an international developmental programme that has been developed and implemented with financial support from the Bavarian government in Germany. Although targeting critical engineering management issues, the programme includes aspects of German culture and networking, intended to grow and sustain networks between the two countries.

1. INTRODUCTION

A management developmental programme for South Africans, financed by the Bavarian Ministry in Germany, is used as a case study to discuss ways for increasing the competitiveness of South African companies through international development programmes. The programme provides support for seven to fifteen young, middle-managers of local companies to attend a 3-month training programme in the Bavarian region of Germany. In addition to providing management and allied skills within the renewable energy sector, the training aims to foster cross-cultural business relations between Bavaria and South Africa. Participants are mentored by suitably selected professionals during the course of their stay. The programme is oriented toward the specific technology and business interests of the participants, as identified within the applicant’s application. The first part of the programme covers general technical management and is covered over a 4-week period. During the second phase, the participant is immersed in a 7-week industrial placement project at a company within Bavaria, once again within the technological area selected during the application process. During these individual industrial placements, a mid-term evaluation is completed by the participants for the purposes of strategic intervention and programme quality assurance. The third and final part of the programme is 3-day experience exchange process, covering the overall transfer of skills and knowledge, individual action-plan comparisons and an evaluation of the overall programme.

2. RATIONALE

Developmental programmes have human development as the primary focus and are often sponsored by developed nations as a way of enhancing the competitiveness of companies from developing countries. In these programmes, company representatives, usually from small to medium technologically-based businesses, are exposed to the latest technology relevant to the industrial sector of that company. The sectors of solid waste management, construction, transport and renewable energy have been identified as areas in...
which German skills and experience can be used to develop middle managers from developing countries. For many such countries, access to these technologies are near impossible due to factors such as cost and the dearth of relevant skills within specified technological areas, making programmes such as these the only viable opportunity for potential candidates to gain the required expertise.

The programme participants are placed in industry where they receive firsthand experience in foreign business acumen – German in this instance – providing the additional opportunity to build and secure business relationships. The placement programme is tailored such that the incumbent actively participates in a range of activities; from system design to actual product deployment. This exposes the candidate to the range of services provided by the company, an essential and often deficient skill within management. Being located in the hub of the European business community allows candidates to attend international trade shows where they are introduced to new technologies and given the opportunity to network with international role-players and experts in their business fields. The availability of an on-line platform (Global Campus) for all participants and lecturers of the programme facilitates further linkages and exchanges beyond the formal contact period of the programme. Besides gaining technical expertise through industry placement, one of the major objectives is to give technically educated participants more knowledge in the area of management. This aspect has been identified as critical because the lack of management skills and other so-called “soft skills” often leads to the downfall of small-to medium-sized companies.

3. OVERVIEW OF MANAGEMENT TRAINING PROGRAMMES

The programme consists of three parts conducted over a period of three months. The training is organized within the framework of the export promotion and business co-operation scheme of the Free State of Bavaria. It comprises a four-week training module on cutting-edge management subjects (including a number of excursions to market-leading Bavarian companies and institutions), and a challenging seven-week industrial placement at companies and institutions in Bavaria, where participants integrate conceptual learning with hands-on experience. This intensive training programme provides practical business experience and helps to establish and consolidate business contacts.

The renewable energy management training programme has been selected as a case study in this discussion, with a similar training structure being used in the other sectors. The programme reported on in this case was the 3rd implementation and was conducted over the period August to October 2011.

Table 1 gives an overview of the content of the 4-week management programme developed for South Africans candidates. The programme was financed by the Bavarian Ministry and constitutes the first phase of the 3-month programme. The different management strategies can also be reflected upon during the placement.

Table 1: An overview of the Management training phase

<table>
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<tr>
<th>Monday</th>
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<td>Welcome &amp; Opening</td>
<td>Opening at the Ministry Participants working context;</td>
<td>International and Cross-Cultural Management</td>
<td>Management of Joint Ventures</td>
<td>Renewable energy: an overview</td>
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<td>Marketing</td>
<td>Human Resource &amp; Leadership</td>
<td>Fair Renexpo ; Global Campus (Internet Platform for participants)</td>
<td>Management of Medium Sized Businesses</td>
<td>Governmental policies &amp; incentives in the field of renewable energies</td>
</tr>
<tr>
<td>Excursion: PV systems; Geothermal power plant</td>
<td>Teamwork</td>
<td>Project Management</td>
<td>Project Management</td>
<td>Convincing Presentations</td>
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To ensure that the needs of the participants are best met, the number of candidates per programme is limited to approximately 12. This allows for optimal interaction between the mentor/course leader and candidate.
The smaller the group, the more interaction and networking takes place within the group, but this has to be weighed against the cost per candidate ratio and the availability of suitable industrial partners [1][2].

The selection of suitable candidates for the programme is facilitated by an in-depth market analysis to ensure that the developing company gains maximum benefit. Through their participation within the programme they should be able to market new products and enter into joint ventures to strengthen their resources and growth potential. The participant’s experiences and expertise ranged from small company owners within the energy sector to middle managers within large established companies. In addition, participating companies are provided with access to governmental industry support programmes and interventions. These programs are intended to support companies through joint marketing strategies. The mere fact that participants are away from work for a few months gives them time to reflect on future developments and opportunities for their own companies. The programme is not only targeted at the private sector, but actively promotes participation from public institutions. Where this occurs, the programme coordinators proactively identify areas where collaboration will enhance the implementation of initiatives that are currently undertaken within the host country. An example of this is the intended renewable energy feed-in tariffs (REFIT) and cogeneration feed-in tariffs (COFIT) policies, which have been running in Europe for many years. The original REFIT framework in South Africa was recently abandoned (August 2011) in favour of a tender-based bidding framework known as the Independent Power Producer (IPP) Procurements Programme (IPPPP). Exposure to working feed-in frameworks such as the German model gives new participants valuable insight into the dynamics involved in this market.

4. QUALITY ASSURANCE AND SUCCESS

The programme includes a number of mechanisms to ensure sustainability and overall programme efficacy. The normal participant feedback processes are used after each module as one would expect in a training programme of this nature. Since the programme receives substantial funding and buy-in from the state and industry, emphasis is placed on reports and feedback from both the participants and local industry partners on the experience gained during the practical component. This culminates in a high-level, governmental function attended by local and participant country representatives and officials, where each participant is given the opportunity, together with their host company, to present their work and future collaboration. Participants are required to provide detailed action plans to realize collaborative objectives. The programme organizers are in constant contact with the participating industrial partners and all joint ventures between themselves and participants are recorded for the purposes of programme success and marketing. Access to advanced products and experiences has increased the competitiveness of a number of small companies. To date, a number of collaborative ventures have been concluded between African and German companies as a result of this programme. The success and sustainability of the programme depends on the impact that the training has on the end-user, these being the major factors that are used for overall programme assessment and revision.

5. GOVERNMENTAL STRATEGIES IN THE RENEWABLE ENERGY SECTOR

Governmental incentives for the development of the economy should be based on strategic imperatives and driven by well-defined policies and regulations. It is clear that non-renewable energy sources such as oil, gas and uranium reserves will not last to the end of this century. Renewable energy, cogeneration applications and governmental decrees such as the Renewable Energy Sources Act (Germany) have to be implemented to cater for mankind’s energy demand and in the interest of climate protection. In the renewable energy (RE) sector, incentives to invest in such systems can be in the form of a REFIT framework. In this instance, a fixed amount is paid to an individual power generator over a period of 20 years. This type of tariff is utilized when energy is supplied to the electricity grid by means of distributed electrical supplies such as solar photovoltaic (PV) generators. This makes it easy to calculate the viability or payback period on the investment. With a solid framework in place, the securing of investment capital (either local or foreign) can be made to offset the high capital costs involved. If companies supply electricity to the national grid they are guaranteed a fixed tariff as dictated by the framework.
6. BAVARIA’S REFIT PROGRAMME

A number of European countries such as Germany and Italy have established REFIT tariffs that have been implemented over a number of years. The Renewable Energy Sources Act (EEG) promotes electricity production from renewable energy sources and was implemented in 2000. Wind, solar, biomass, geothermal and water power contributed more than 15% of the German electricity supply in 2009. The act encourages and increases the use of Renewable Energies through feed-in systems as outlined below [3]:

- The act provides compulsory and priority access to the grid for electricity produced from renewable energy sources.
- Renewable energy has a high priority to be purchased, transmitted and distributed.
- A fixed, predetermined, cost-effective fee is paid for renewable energy by utility grid operators. The generation of electricity from landfill, sewage and marsh gas, biomass, hydropower, geothermal sources, wind and solar energy all qualify for the feed-in tariff.
- The operators of these renewable plants will receive a fixed rate per kilowatt hour of generated power for a period of twenty years. This will ensure the cost effective operation of such plants.

The Heat Act of the EEG specifies that 14% of Germany’s heat contribution should be from renewable sources by 2020, achieved through [3]:

- A commitment to renewables by compelling owners of newly erected buildings to use it as portion of their heating demand or to make use of cogeneration applications. This obligation is applicable to the private, industrial and commercial sectors and the state. All types of renewables, combinations in the form of hybrids or climate change mitigation measures such as improving building insulation or using heat from combined heat and power generation (CHP) should be implemented.
- The implementation of such projects being financially supported by market incentive programmes.
- The extension of heating grids with provisions made for local authorities to make use of it.

According to the Bavarian energy policy, a safe, affordable and environmentally friendly energy supply is a precondition for economic wealth and job creation in the area.

7. SOUTH AFRICA’S REFIT PROGRAMME

In South Africa, the White Paper on South Africa’s Renewable Energy was released in November 2003. This was followed by NERSA consultations and by March 2009 Regulatory Guidelines set out:

- a basic structure of a Renewable Energy Feed in Tariff (REFIT) programme
- proposed Feed in Tariff (FIT) for four technologies (in ZAR/kWh)
  - Landfill gas: 0.90
  - Small hydro (less than 10MW): 0.94
  - Wind: 1.25
  - Concentrated solar power (CSP) trough with Storage (6 hours): 2.10

These tariffs are to be increased annually in line with the SA consumer price index (CPI) [4]. Currently they are between 90 cents and R2.10. South Africa will be relying on the private sector for the generation of electricity in the future. These independent power producers (IPPs) will be required to generate 30% of the country’s additional power capacity [5]. ESKOM is adopting three IPP programmes to accommodate the private sector, viz. the:

- Pilot National Cogeneration Programme (PNCP),
- Medium-Term Power Purchase Programme (MTPPP), and
- Multisite Baseload Independent Power Producer Programme.

The MTPPP and PNCP should secure IPP capacity in the short to medium term and, while the Multisite Baseload IPP programme is earmarked for the longer term [5]. In July 2009 NERSA issued a Consultation
Paper, tabling a type of REFIT Power Purchase Agreement (PPA), based on MTPPP and six more technologies were included in the REFIT programme:
- Concentrated solar power (CSP) trough without storage – 3.14
- Solid Biomass – 1.18
- Biogas – 0.96
- PV (large ground or roof mounted) – 3.94
- Concentrating PV – no tariff published on grounds of cost
- Concentrated solar power (central tower) with storage – 2.31

This was addressed at public hearings in September 2009. Electricity Regulations on New Generation Capacity (covering IPPs and REFIT) was initiated on 5 August 2009. On 30 October 2009 NERSA issued its “Decision on REFIT 2” in its Consultation Paper and set FITs for additional technologies. However it did not include a FIT for CSP as the cost was considered too high. The Integrated Resource Plan (IRP1) was quietly published by the Department of Energy (DoE) in Government Gazette No.32837 (Notice No.1243) on 31 December 2009, without any public consultation [6]. The objectives, with commencement from 1 March 2010, included;
- The installation of 1 million solar water heaters.
- 10 000 GWh RE as 4% of the energy mix, viz. 10MWh (the construction of new generation plants based on RE technologies).
- A financial incentive scheme for Energy Efficiency and DSM [6]. This is to be procured through the REFIT, MTPP and ESKOM’s wind and CSP programmes.

Up to 2011 the aforementioned objectives never materialised. A Revised Integrated Resource Plan (IRP 2010), however, was published on 29 January 2010. The latest development is that an Inter-Ministerial committee on energy has been established (February 2010) with the objective of a 20 year new generation capacity development as an integrated resource plan (IRP). The participation of independent power producers (IPPs) was to be included. On 27 September 2010, the DoE published a Request for Information (RFI) for;
- information from developers of co-generation and REFIT projects up to March 2016.
- dedicated small projects (1-5MW) allocated to the REFIT programme.
- preference to projects using local materials, labour, manufacturing and maintenance.
- planned proposed release of RFP in November.

The REFIT framework was proclaimed “illegal” by National Treasury in May 2011, with anti-competition and jurisdiction issues being cited as contributing factors for its demise. The replacement IPPPPP programme was announced in August 2011 and requests an increase renewable capacity of 3,725 GW, shared across wind (50%), solar PV (39%), CSP (5.4%), micro-hydro (2%), landfill gas (0.7%), biomass/biogas (0.3%) and the balance (2.6%) for small projects less than 5MW [7].

The IPPPPP is a tender-based process with the selection of the preferred bidders scheduled for 25 November 2011. It is required that successful bidders begin operation by June 2014. The evaluation criteria for potential bidders will be based on price (70%) and economic development (30%), which includes job creation, local content, ownership, management control, preferential procurement, enterprise development and socio-economic development. It is obvious that a successful bidder would need to ensure that the business plan includes aspects relating to broader economic development that would include human resource development within the engineering sector, particularly in the area of engineering management.

8. CONCLUSION

International development programs tries to directly link the learning material to the participants’ everyday professional life. [8][9]. Focus is placed on the practical application of the acquired knowledge and skills with a view to improve the competency to act, so as to facilitate the ultimate transfer to the life and work situation of the participant[10][11]. The renewable energy market in South Africa, despite a number of false starts, is on the verge of becoming a major role-player in the economy with huge investments expected from the private sector. In order for this sector to grow into a sustainable market, a key investment aspect will be
in the area of human capital, particularly in the areas of engineering management. By taking advantage of foreign developmental opportunities, as highlighted by the German example, South Africa can fast-track its efforts toward becoming a global player in the use of renewable sources.

9. REFERENCES


ABSTRACT

Today, schools, universities as well as the industrial and the business sector have to face great challenges. Schools and universities especially have to teach not only professional knowledge, but they are also obliged – by the technical or business sector – to go far beyond, namely teaching forward-looking skills and competences. Thus, the Robert Schmidt Institute at the University of Wismar analysed the competences which are needed and hence taught. From the analysis ten necessary entrepreneurial competences have been derived that allow students to facilitate future challenges and thus offer more employability. Anyway, these more or less pragmatic competences only sprout shoots and grow if students are open-minded, tolerant and democratic and – this is maybe the most important point – if society is willing to move away from a more traditional way of thinking and adopting a more entrepreneurial way of thinking and acting.

Keywords: Competences, future, entrepreneurial acting, open-minded, democratic

1. THE GLOBAL VILLAGE

If you live on a desert island like Robinson Crusoe and only have the island economy in mind, you don’t have to pay attention to the rest of the world economic market. However, successful business has always been dependent on networks, above all social networks. The Hanse, nomadic clans and Chinese family associations, as well as other positive or criminal associations, to name just a few, were nothing other than social networks whose individual members made products available that were diversified, broadened or bundled together. Globalisation, however, has made the networks even more complex, where the world has become a “global village”, in which every product and every factor of production can be available worldwide. Nevertheless and paradoxically, this globalisation has not led to the same conditions of production as Adam Smith and Karl Marx had predicted. At the top are high-tech clusters, and at the bottom, agricultural regions and the so-called “old industry”: depopulated, with no competitive human capital and torn-apart networks. Innovative regions and networks excel through their systematic accumulation and diffusion of knowledge. The use of knowledge on knowledge – the so-called “axial knowledge” – has become a core competence in innovative networks. “The ability to learn, i.e., to augment existing knowledge with new knowledge and to convert into marketable innovations, determines the size or fall of regions.”

2. CHANCE AND SURPRISE

Technology, which may be regarded as the saviour – but critics view as the destroyer – of the future, consists of more than just things. It is a combination of things, social relationships, ideas and concepts: it is culture. The introduction of a new tool does not guarantee progress. It
depends on whether the market legitimises this technology, i.e. accepts it. “There is feedback between learning, combining and inventing. A society that wants a different life places different demands on technology. It invents new things.” In a few years time we will think differently about energy production, energy efficiency and the sustainability of raw materials than we do today. This is because the engineers had ingenious ideas, because they were educated differently, and the market legitimised these ideas. New technology: this also means chance and surprise. Innovation often occurs when a certain technology is put to an unexpected use. Like with James Watt, who added a condenser to the steam engine, tripling its efficiency and effectively ringing in the Industrial Age. The first microscopes were actually intended for entertainment but eventually became instruments of science. The text message was originally intended for technicians’ control signals. Nowadays, it is almost more important than the telephone. The mobile phone has saved the fishermen of Southern India from poverty by allowing them to exchange information about the supply and demand situation for fish. These are just a few examples of how the users’ imagination can extend beyond that of the engineers.

3. SOMETHING’S ABOUT TO HAPPEN

Something’s happening here but we don’t know what is. This situation makes people feel uncertain. We don’t know anything about the when, the how or the what. We only know that we are living in a society that is changing increasingly fast. Although it’s light out, we feel like we’re in a dark room. Only after a certain period of time, once all our senses have sharpened, can we begin to surmise patterns and orientate ourselves somewhat. However, it is practically impossible now to predict anything concrete, so how can we combat the unknown; how can we combat our anxiety about the future?

4. THE OTHER MENTALITY

“The conflicts between old and new, routine and innovation, bureaucracy of thought and entrepreneurism of thought, have defined development from time immemorial.” However, thought routine, the intellectual bureaucracy, has become part of everyday life on a wide scale. Although the intellect is also being used here, it is only being used in the narrow and traditional corridors of rules and methods, whose observance is strictly enforced. In this system everything is attuned to preservation. It is a bureaucracy, no longer a production: a climate of hostility towards innovation, a so-called “protective posture for the intellect”. Many consider the independence that starts in the mind to be dangerous because it is unpredictable. In many companies, as well as in schools and universities, the predominant climate is almost reminiscent of an intellectual quarantine. Therefore, think tanks and lateral thinkers are either outsourced or carefully isolated within the organisations in order to avoid – or even prevent – dialog, discourse or a dispute.

However, neither companies nor schools or universities exist on their own. The same applies to employees, school pupils and university students. All of them exist in social contexts and have to learn how to get along with one another. Companies, schools and universities have their philosophy, but are these philosophies appropriate for the future, something we know almost nothing about but must prepare for? What can – and how can we – prepare school pupils, university students and employees? Simply more of the same in and along traditional pathways is not – and cannot possibly be – the solution. Instead, a rethinking of education and personnel management is needed. It requires work on personal attitude, the goal of which can be defined as an entrepreneurial mentality or attitude. This mentality is not only important for
people who go into business for themselves, but also for the group of people trying to accelerate or push through innovations within companies – the intrapreneur. Gifford Pinchot defines intrapreneurs as “dreamers who do. Those who take hands-on responsibility for creating innovation of any kind within an organisation. The intrapreneur may be the creator or inventor but is always the dreamer who figures out how to turn an idea into a profitable reality. Entrepreneurs fill the role of the intrapreneur outside the organisation.” 6But can anyone be or become an entrepreneur or intrapreneur? The succinct answer is more or less yes, admittedly with the following addition: if, firstly, they are encouraged and guided in this direction during their education and training and, secondly, the society encourages this kind of mentality and invests in it. Accordingly Adam Smith recognised in his magnum opus “The Wealth of Nations” as early as 1776: “The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labour, and which, though it costs a certain expense, repays that expense with a profit.” 7

5. COGNITIVE MAPS AND THE COMPETITIVE SPIRIT

From brain research we now know that humans perceive their world through cognitive maps. 8These maps condition experience and are conditioned by experience. In this way, they form a kind of pre-construction or anticipation, i.e. a means through which the past influences the future. Other than the student companies that some schools have, the fact is that schools – at least in Germany – children are not sufficiently socialised into self-employment as a career opportunity. The same is true of many parental homes. In terms of structure and self-conception, the German education system is “not very geared to responsibility, risk-taking and self-reliance.” 9Education is focused on the goal of securing paid (dependent) employment, maximum job security. The only alternative is training to become a master craftsman, which falls under the guiding principle of the independent business. Dynamic business societies, such as the USA, Canada, the Netherlands, Israel, Singapore or also, with certain qualifications, the Scandinavian countries, have education systems targeted at the development of entrepreneurial competences, such as the willingness to take risks, self-initiative, self-organisation, networking etc. In short: a “spirit of competition”. In Germany the businessman or entrepreneur still too often has negative connotations: the businessman as an enemy, the businessman as a secret string-puller in politics. As studies by the University of Wismar have shown, the subject of entrepreneurship and the associated attitudes and competences is not given adequate attention in schools. This is all the more regrettable because, in the early stages of education and development, behaviours are trained that determine the individual’s future professional career and capacity for independent thinking and action. 10In this area, schools, as agencies of socialisation, have a far greater influence than, for example, universities, which are not able to influence the interests and abilities of young people until much later. It is clear that the traditional educational institutions are not laboratories where the future is forged but, instead, handed down “institutes of instruction”. “They support young people in the ‘flexible internalisation of predefined standards’ and are oriented towards dependent employment, even though we know that, under the banner of globalisation and individualisation, everyone in the future will be an entrepreneur, i.e. will have to have an entrepreneurial competence portfolio. In this sense, ‘education for courage’, not the ‘courage to educate’, is the order of the day.” 11Here it must be added that courage is also an important part of education: a courage that some parents seem to have lost.
6. THE ENTREPRENEURIAL APPROACH

The development of entrepreneurial thinking and action in its courses is no easy task for the University of Wismar, especially because this means turning the traditional philosophy of education, which seeks to accumulate specialised container-knowledge and is often oriented towards dependent employment, “from its head onto its feet”. The development of entrepreneurial thinking and action through education is more challenging and laborious than the conventional imparting of knowledge, as is still practiced at a number of universities. A learning environment based on independence is the opposite of that which currently constitutes conventional university teaching. “The student is all too often viewed as a learning container that must be filled with academic knowledge, a knowledge, by the way, that has tended to tame, or even eliminate, potential entrepreneurs.”¹² Curiosity, a prerequisite for effective learning, is rarely fostered. The student is viewed as an instrument. This is why the attempt to integrate entrepreneurial thinking and action in all of the courses offered and to foster a competence-based view is roughly equivalent to a Copernican turnabout in university education. Teaching is focused on pure, professional competence, along with the 10 competences considered by the University of Wismar to be forward-looking and correspond, mutatis mutandis, to those of the German Chamber of Industry and Commerce¹³:

- decision-making ability
- innovative thinking (creativity, coherent thinking, ability to recognise and act on alternatives, conceptual and strategic thinking)
- communication, negotiation techniques
- problem orientation (problem-solving and willingness to take risks)
- networking
- identification and evaluation of business opportunities
- team orientation and self-reliance
- ecology and ethics
- intercultural action
- leadership skills

7. THE STUDY CONDUCTED AT THE UNIVERSITY OF WISMAR

A total of 681 courses were examined with respect to their success in imparting the above-named competences. The results showed that, already in almost 40% of the courses, skills and knowledge are conveyed that are suggestive of entrepreneurial competences.¹⁴ With regard to content, the emphases are: problem orientation, innovative thinking and communication. Of these, the strongest emphasis is on problem orientation. At the bottom – lagging far behind – is networking. The findings unfortunately showed that some competences, such as “intercultural action and ambiguity tolerance”, as well as the “identification and evaluation of business opportunities”, received only rudimentary attention in courses. What is the reason for this? One explanation is perhaps the Input-Output Paradigm¹⁵, which is traditionally predominant at many German universities. Learning is defined as top-down instruction under the primacy of the professional competences. “Learning is interpreted on the systematic and progressive elimination of not knowing, i.e., it is based on input logics. In other words: ‘If we fill up the participants with more resources (knowledge, management skills, finance) the output (innova-
8. THE ENTREPRENEURIAL COMPETENCE PORTFOLIO

Knowledge on its own does not make an entrepreneur. The starting point in learning entrepreneurship is the acquisition of a pragmatic entrepreneurial competence portfolio, consisting of professional, business, social, methodical, personal competences and at least environmental. These competences are seen as necessary and sufficient conditions for successful entrepreneurial actions and performances:

9. OUTLOOK ON THE FUTURE

The fact is that employees today possess the most important resources. “In a modern company 70 – 80 % of the work is performed by the intellect of the employees. This resource is small, grey and weighs about 1.3 kg. It is the human brain.” It is the battlefield of the future on which countries, companies and individuals fight, on which everyone competes. The entrepreneurs do not live alone in a global village. This is why companies need, if possible, the best employees, not simply the next; they need people with an open-minded and entrepreneurial spirit, people in fact who have left behind the thought and behavioural patterns of a Neanderthal and recognised that a new age with new and different challenges is dawning. Companies need lateral thinkers who question daily routines; technological and economic upheavals need people who can imagine and create new realities. Knowledge has become the basis of compe-
The predominant techno-economic equalisation means that usually only the best wins, no matter where it is from. The industrial nations no longer have a monopoly of knowledge. Knowledge is free. This is why it’s time to abandon old things, old methods of teaching and learning, as well as old work methods, and to prepare for the “Olympic games of business”. It is about replacing “built to last” with “built to blast”.19 The karaoke of the spirit – the imitation of the familiar – must stop; the protective posture for the intellect must come to an end: in schools, in universities, in companies and, above all, in society. The knowledge competition and the winning of the competition determine not only international but also regional competitiveness and the long-term migration of investment and human capital. Success results from the exploration of the unknown and the realisation of ideas. However, the individual, the university student, must be prepared. He – and the same applies for companies and society – must be open-minded, tolerant and democratic, i.e. he must be willing to share knowledge. Above all, society must be willing, on its own accord, to refrain from its traditional focus and pursue a path towards entrepreneurial spirit.

10. CONCLUSION

Today’s educational institutions must face the challenges of globalisation, especially with respect to educational issues. Here, it is important that a greater emphasis be placed on the aspect of “forging the future”. Numerous educational institutions, however, remain on the level of an institute of instruction and continue to focus on the goal of dependent employment. In this way, they serve neither themselves nor the industry and economy. Pragmatism and “education for courage” must be better incorporated into the curricula. In order to foster innovative approaches even more effectively, the University of Wismar has developed a competence portfolio intended for the promotion of lateral thinking and lateral acting. Here, the University of Wismar recognises that the ability to think and act independently should be fostered early, in nursery school and school, and that self-employment as a career perspective should be viewed in a more positive light. A “spirit of competition” should be more strongly promoted in all educational institutions.

11. RECOMMENDATIONS

Based on the experience of the University of Wismar, the following seven recommendations for Entrepreneurship Education can be drawn:

1. A change in teaching methods is required because a focus on exclusively professional competence does not necessarily lead to a more innovative output.
2. According to Allan Gibb entrepreneurial thinking and action should be developed through learning for, about and through entrepreneurship.
3. The educational programme must be given a more interdisciplinary focus, i.e. a fact must be viewed from the perspective of various disciplines. With their R&D teams – students from various fields of study working together on market-oriented ideas from regional companies – idea puzzles, i.e. use of creativity techniques, and the Idea Regatta, a three-day idea competition within the university on the subject of university and university environment, the University of Wismar is treading one possible path.
4. Throughout the educational programme the competence portfolio must be given increasing attention.
5. Lateral thinking must be supported in order to foster and call for innovative thinking and action.
6. Educational programmes must be assessed under the aspect of their future-orientation.
7. International orientation and networking must be further developed.

12. REFERENCES

SOUTH AFRICA’S CHANGING TEACHER EDUCATION POLICY FRAMEWORK AND ITS IMPLICATIONS FOR BUSINESS AND ENGINEERING EDUCATION

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ABSTRACT

South Africa has a comprehensive policy framework for teacher education. Although the framework’s comprehensiveness is partly the result of detailed structural differentiation of teacher education before 1994, its current structure is largely the result of the efforts of policy makers since 1994.

Prior to 1994 the primary focus in training educators for business and engineering, at the time called technical and commercial education, was in developing teachers for high schools. As technical colleges were resuscitated following their upgrading to technikons, the schools policy framework was simply extended to college educators. Since 1994 the framework recognising educator qualifications has been revised twice, the first implemented in 2003 and the second to be completed by 2013. In addition to general policy revision and realignment of teacher education with the Higher Education Qualifications Framework (HEQF), the single framework for colleges and schools is set to change. Envisaged therefore is a framework for teachers in schools and another for further education and training college (FETC) staff.

Business and engineering education has posed a perennial challenge for teacher education policy makers. A shortage in the number of people with business degrees entering the teaching profession has resulted in the existence of business education programmes exiting since the 1970s. Similarly, the tendency for artisans to seek employment in education later in life resulted in the development of dedicated, in-service-based programmes, those employed in technical high schools and FET colleges. As a result, two separate routes exist for business educators and three for engineering students. Although the proposed frameworks expand the entry possibilities for business and engineering graduates they also create challenges. These include appropriate knowledge and portability of qualifications.

1. INTRODUCTION

South Africa has a comprehensive policy framework for teacher education. Although the framework’s comprehensiveness is partly the result of detailed structural definition of teacher education before the country’s first democratic election in 1994 that heralded structural change, it is largely the result of the efforts of policy makers since 1994.

Prior to 1994, the primary focus in training educators for business and engineering, at the time called technical and commercial education, was in developing teachers for high schools. As technical colleges were resuscitated and evolved into FET colleges, following their upgrading to technikons in the late 1970s, the schools policy framework was simply extended to college educators. Since 1994, the framework recognising educator qualifications has been revised three time, the first was with the implementation of the Council on Teacher Education Policy’s norms and standards for teacher education, the second was with the implementation of the Norms and Standards for Educators (South Africa, 2000) in 2003 and the third, the Minimum Requirements for Teacher Education Qualifications (South Africa, 2011), which was recently finalised.
In addition to the general policy revision and realignment of teacher education with the Higher Education Qualifications Framework (HEQF), the single framework for colleges and schools is potentially set to split with the development of the Draft National Policy Framework for Lecturer Qualifications and Development in FET Colleges in South Africa (South Africa, 2008). Potentially envisaged therefore is a one framework for teachers in schools and another for further education and training college (FETC) staff.

Business and engineering education has posed perennial challenges for teacher education policy makers. A shortage in the number of people with business and engineering related degrees entering the teaching profession has resulted in the existence of business education programmes existing since the 1970s (Smith, 1986, 54-57). It has also resulted in the development of mathematics, science and technology teacher education programmes (Cape Technikon, 2000) and the prioritisation of mathematics and science as teaching subjects through funding mechanisms.

The tendency for artisans and professionals to seek employment in education later in life is an international phenomenon (James & Biesta, 2007). In South Africa this phenomenon has resulted in the development of dedicated, in-service-based programmes, for educators employed in technical high schools and FET colleges.

Currently therefore, two separate routes exist for business educators and three for those teaching engineering related subjects. Business educators can do a four-year Bachelor of Education (B. Ed) or a Post Graduate Certificate in Education (PGCE) on completion of a degree. For the engineering environment these qualifications can also be completed with, with mathematics, science and engineering related majors. Qualified artisans already employed in education can complete a National Professional Diploma in Education (NPDE). Planned revisions will most likely result in further streamlining of teacher education qualifications, if the policy framework for college lecturers and that of the HEQC-based norms and standards are aligned.

This paper provides an overview of the current school and college curricula and the teacher education policy framework that serves it. The paper applies a combination of content and discourse analysis (Henning, 2004), augmented by constructs introduced by Foucault (1979) and Habermas (1984) and own experiences, what Fairclough (2001: 9) called member resource (MR). Foucault has been applied to applicable education policy and related publications, while Habermas provides insights into the analysis of how policy finds expression in practice.

2. OVERVIEW

If the current ruling regime’s post apartheid education vision is encapsulated into a single validity claim, it was the overhaul of the race-based, widely differentiated systems of education and training into a single, inclusive, system of education and training. At the time it was recognised that serious challenges needed to be faced but as stated by the NACWC (2001:27) “the next few years saw a combination of civil society and new governmental policies adopted for the transformation of education and training South Africa”. The process followed at the level of national government was strategic and systematic, and focussed around department restructuring, the promulgation of Acts of Parliament and allocation of resources and funding. The process was and remains highly inclusive. Its focus is on mainstream schooling and was strongly influenced by the inclusive education philosophy as expressed in Education White Paper 6 (South Africa, 2001)

The current national curriculum statement (NCS), the State’s current school curriculum blueprint, lists twenty one subject of which nine subjects contribute towards the development of business people1 and three are engineering2 related. The criteria for the recognition of qualifications for employment in education in South Africa (South Africa: 2000), however, lists a further 139 school subjects and 404 FET college subjects. The document indicating the criteria for recognition of qualifications for the teaching profession more closely indicates the subject range offered at schools and colleges than the NCS. The NCS therefore

1 Accounting, Business Studies, Economics, Hospitality Studies, Consumer Studies and Tourism.
makes provision for a small range of subjects to be offered at schools, while the system as a whole makes provision for more.

The implication of some subjects being included in the NCS and others not indicates that there is a subject group that are regarded as core subjects and others that are peripheral as they can be selected by schools or colleges if learner demand exists. Both the elements of the education system that developed people for the business environment as well as that which developed people for the engineering environments are largely peripheral to the mainstream. With the exception of potential university graduates it is at FET colleges, technical high schools, and special schools where people are developed for the engineering environment. The peripheral position is particular to engineering education but also applicable to business education. The reason for the peripheral position can be found in the national curriculum statements, the norms and standards for teacher education and funding mechanisms for teacher education.

3. NATIONAL CURRICULUM

Following the publication of the Schools Act in 1996 the Department of Education introduced what was promoted as a post-apartheid curriculum (Bengu in NACWC, 2003). Curriculum 2005 was based on the principles of the outcomes based education philosophy and allied with constructivist education principles. The curriculum was to be introduced incrementally, starting with ten years of compulsory general education, the general education and training band (GET) covering school grades R (reception) to 9. The new curriculum was to be completed by 2005 and called curriculum 2005.

Curriculum 2005 was the school level element of the National Qualifications Framework (NQF) introduced as a result of the promulgation of the South African Qualifications Authority (SAQA). The NQF was a framework into which all forms of learning were to be accredited and placed. While the NQF’s noble intentions and its implementation remain a vision, it was and is the post apartheid government’s blueprint.

Curriculum 2005 made provision for the development of business and engineering knowledge and skills by including two new learning areas, namely Economic and Management Sciences (EMS) and Technology. While technology incorporated content previously included in subjects like woodwork and metal work, EMS was a completely new subject including principles of business, accounting and economics, while also including socialist resourcing principles. Later, in 2002, Curriculum 2005 was revised by means of the publication of the Revised National Curriculum Statements (RNCS), again in 2006 as the National Curriculum Statements (NCS) and in 2011 as the Curriculum and Assessment and Policy Statements (CAPS).

The NCS process did not merely mean a the revision of the GET band, it also introduced a curriculum framework for the further education and training (FET) band, school grades 10, 11 and 12. During the revision process the relevance and continued existence of EMS in the GET band was questioned and only retained after a strong case was made by curriculum advisors responsible (Schreuder, 2009: 23-24). The primary business subjects, business economics, economics accounting and typing, was revised to form the business, commerce and management (BCM) grouping with the subjects Business Studies, Economics, Accounting and three new business related subjects.

The NCS revision resulted in the separation of Technology from Mathematics and Science field in the FET band and the development of a new field, namely Manufacturing, Engineering and Technology. The current CAPS revision plans to remove EMS from the foundation and intermediate phases of the GET band.

Mathematics and science remains and continues to be promoted as development routes of engineers in both the GET and FET bands in the mainstream school curriculum but the range of other engineering subjects was not. Their continued existence was the result of the insistence of curriculum personnel still in their posts, consolidated into four electives, namely electrical technology, mechanical technology, civil technology and technical drawings. Technical high schools and special schools, schools aimed largely at producing artisans, the second also for learners with special educational needs, continued to work within the parameters of the previous curriculum framework and maintained and revised their curricula despite an apparent vacuum.
4. FURTHER EDUCATION AND TRAINING (FET) COLLEGES

Technical colleges, renamed FET colleges in 2005 and commonly referred to as colleges, were resuscitated in the late 1980s as the major route for skills related education in the country. Its curricula, which had been revised in 1993, were not affected by changes in the school curriculum at all. College continued to operate within its 1993 curricula and only had its curricula revised in 2008.

Since its resuscitation in the late 1980s technical/FET colleges have offered a range of business and technical courses, structured into general studies, business studies and engineering studies. The former was responsible for the training of hairdressers and some forms of applied art, while engineering studies developed artisans for the traditional trades like the motor, electrical, mining and plumbing trades. The period since 1994, however, has been a time of instability for colleges, as the establishment of the National Committee on Further Education and Training, the Green Paper on Education and Training, the Education White paper 4 and the promulgation of the FET and Skills development Acts created questions around the nature and structure of the FET institutional framework (NACWC, 2001: 26-39).

In business education a three semester N1-N3 (National Certificate) series of programmes were introduced, followed by a range of three semester N4-N6 programmes. The N1-N3 were virtual clones of the existing school curriculum, reduced to semester subjects, and included subjects like Office practice, Mercantile Law, Accounting, and Computer Practice. The N4 to N6 programmes, similarly were clones of Institute for Administration and Commerce (IAC) courses, private examining body that existed at the time. After a comprehensive revision in 1993 the N1 to N3 were replaced by a one year National Intermediate Certificate (NIC), followed by a matriculation equivalent National Senior Certificate (NSC). The NIC/NSC were not merely replacing the N1 to N3, by including languages, they overcame the N3’s major shortcoming that had required students to take two official languages in addition to the N3 in order to gain a school leaving certificate. N4 to N6 programmes were redesigned to reflect the specific needs of college graduates at the same time as the NIC/NSC revision.

In 2007, with the introduction of the NCV, both the existing technical and business programmes were replaced with the NCV’s wide range of programmes. While the replacement of the N1 to N3 business was widely welcomed, the phasing out of the N4 to N6, and the national diploma that could be attained after eighteen months work, removed the opportunity for college students, and school matriculants to get short post school qualifications. While the removal of colleges post school offering had financial implications for colleges and reduced the post-school options open to school leavers, the introduction of the NCV also resulted in the phasing out or artisan training. The phasing out of artisan training had potentially greater negative implications for the economy as a whole. The phasing out of both post school programmes and artisan training was retracted in 2010, pending the development of replacement qualifications.

5. NORMS AND STANDARDS

While school curricula was being revised to meet the country’s post1994, through the Norms and Standards for teacher education, a teacher education policy was designed intended to be simple, providing for a single framework for the profession as a whole.

The criteria for employment in education based on the Norms and Standards (2000) included twelve categories of what was called unqualified educator, three of which were related to business and engineering. They were posts for technical subjects, technical drawing and posts for training in the hotel and catering industry (South Africa, 2000: 32). Furthermore, posts for technical colleges were evaluated differently to those of mainstream educations and a different list of subjects was regarded deemed applicable (South Africa, 2000).

The country’s Norms and Standards for Teacher Education (2000), soon to be replaced by the Higher Education Qualifications framework’s Minimum Requirements for Teacher Education Qualifications (South
Africa, 2000) is a comprehensive framework that determines the entrance requirements, qualifications and outcomes that frame qualifications for the teaching profession, as well as structural indicators for providers. The Norms and Standards replaced a variety of different qualifications offered by universities, technikons and colleges of education. The Norms and Standards makes it possible for business and engineering graduates to qualify as professional educators, for education students to major in business and engineering related subject areas and for educators qualified in other areas to qualify to teach business or engineering related subjects.

The Norms and Standards of teacher education replaced the norms and standards published by the Council on Teacher Education Policy (COTEP) in 1995 (South Africa, 2000: 8-10), colloquially known as COTEP. It also resulted in the incorporation Colleges of Education, the providers of primary school teacher education, until then under direct provincial state control, to higher education. The transformation process was facilitated by the incorporation of colleges of education into higher education institutions in 2001.

When the Norms and Standards was introduced employment at high schools required that a teacher to have a four year qualification issued by a university, while employment in primary schools only required a three year qualification. The preferred, and most popular route for high school teacher, was a degree, followed by a post graduate higher diploma in education (HDE(PG)). A HDE (PG) could be followed by a Bachelor of Education, Master of Education and a Doctor of Education/PhD.

The Norms and Standards revision resulted in little more than a name change from HDE in the case of universities and National Higher Diploma in the case of technikons, to a Post Graduate Certificate in Education (PGCE) for both universities and technikons/Universities of Technology graduates.

As a result the majority of maths and science teachers were university graduates with an HDE (PG).

Unlike the situation with maths and science teachers, the teaching profession never managed to attract sufficient numbers of business graduates, and, as a result specifically designed commercial education programmes (Smith, 1986). The programme had various names including Higher Diploma in Education (Commerce) Secondary Education (HDE (COM) SEC, offered as collaborative exercises between technikons and universities and a National Diploma commercial education offered at technikons.

As an artisanship does not comply with the entrance requirements for teacher education, artisans employed at academic, technical and special high schools, as well as technical colleges, were provided with a specifically developed qualification. Prior to the implementation of the Norms and Standards artisans completed a National Higher Diploma: Education: Technical (NHD) offered by some universities and at technikons. Unlike university graduates who could progress academically and, as a result, career wise, HDE and NHD commence and technical graduates had no options for further studies other than to restart a university degree, thereafter using the degree and NHD/HDE as access to further studies.

When the Norms and Standards was introduced most maths and science teachers, and a small percentage of business teachers, were university graduates. The majority of business teachers and technical teachers, however, had terminal qualifications and, as a result, limited career possibilities with no vertical qualification route. Since 2003 teacher in both the business and engineering environment should be a university graduate (either traditional or university of technology) with either a Bachelor of Education, or a degree or university of technology diploma with a Post Graduate certificate in Education. The exception remains artisans, most of whom teach engineering related subjects and hairdressing.

The consolidation and streamlining of teacher education qualifications through the implementation of the Norms and Standards, aided by the incorporation of colleges of education into HEIs from 2001, created new opportunities for teacher education, including the possibility for graduates of colleges of education and those who completed technikons/university collaborative qualifications to progress beyond their initial qualification. The streamlining, however, initially excluded artisans from framework as the Norms and Standards did not provide a route for artisans. In 2003 the requirements of the National Professional Diploma in Education (NPDE), designed for un- and under-qualified primary school teachers was adapted in 2000, which made it possible for the development of a qualification for the FET band.
6. THE PROPOSED HEQF ALIGNED NORMS AND STANDARDS

Currently both the school curricula and norms and standards for teacher education have either been revised or are under revision. The development framework for FET college lecturers is also in the final stages of completion and headway is being made on the development of curricula for technical and special schools.

Teachers at high schools will be expected to have a four year Bachelor of Education, while the qualification for university graduates may once again undergo a name change, this time to an Advanced Diploma in Teaching (ADT). Artisans employed in education will be expected to follow an in-service-based series of programmes, starting with a Diploma in Education that leads into a Bachelor of Education. Artisans with therefore, for the first time, have a straight academic route into post graduate education qualifications.

7. CONCLUSION

Revisions to South African education as a whole since 1994 resulted in structural changes, both in the environment in which education is implemented, as well as the environment in which educators are developed. The revisions caused an amount of confusion and disarray, but that is to be expected from any form of broad based structural revision.

To some extent the revisions have had differing effects on business and engineering education but in other respects the revisions have had the same effect. On the one hand, engineering education was advantaged through the prioritisation of mathematics and science, while that status was not afforded to business education. Business educator and the technical elements of engineering education was placed at a disadvantage because its subjects were not placed on the State’s education student’s funding schemes for teacher education. Furthermore, the provision of technical element of engineering education and business education is based primarily at FET colleges is primarily found at FET colleges, technical schools and special schools and curriculum revision in these sectors did not happen until relatively recently. As the focus of teacher education was on the new mainstream curriculum the disadvantage was reinforced by providers of teacher education.

With the latest revision of the mainstream school curriculum, as well as the curriculum revisions at FET colleges, as well as those for technology based subjects and the curricula at special schools, the revision and alignment of the while further education and training band is almost complete. For both business education and the technical element of engineering education a major challenge that remains is the promotion of the social status of the institutions where the bulk of business and engineering education is provided. South Africa remains a country where an academic education is perceived to be preferable to that of a business or technical education.

8. BIBLIOGRAPHY


3 The Name change indicated in the latest Norms and Standards document is under discussion and the name PGCE may remain in use.


“ENTREPRENEURIAL POTENTIAL OF STUDENTS AT WISMAR UNIVERSITY”

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ABSTRACT

Wismar University was an entrepreneurial university and supported entrepreneurship in all areas. To guide this process and to select the right tools, it was necessary to understand the entrepreneurial potential of students, as well their potential for them to set up their own businesses.

In 2010 the Robert-Schmidt-Institute (RSI) initiated and supervised a bachelor thesis, which examined the potential, motivation and inhibitions of student start-ups. For the survey a total of 152 students from all three faculties - Engineering, Business and Design, was interviewed. The findings indicate the available entrepreneurial potential at Wismar University. In addition, it portrayed the motivation students required for start-ups during study.

With the results, the RSI showed the potential to design suitable offers for the students of all faculties in order to continue and increase entrepreneurial spirit across the campus. In this way students enjoyed even greater entrepreneurial competence to take to the companies they join after graduating.

1. INTRODUCTION AND OBJECTIVES

The entrepreneurial Wismar University endeavours to teach their students exceptional technical as well as entrepreneurial skills. This method, to connect technical and entrepreneurial skills in teaching, aims to improve career prospects and prepare students better for future professional requirements. This method is based also on the definition of European key competences.

In 2005 the Commission of the European Communities sophisticated eight different key competence. “Key competences are those which all individuals step for personal fulfilment and development, active citizenship, social inclusion and employment. By the end of initial education and training young people should have developed the key competences to a level that equips them for adult life, and they should be further developed, maintained and updated as part of lifelong learning.” (Commission of the European Communities, 2005, p.13)

There are many themes, such as critical thinking, creativity, initiative taking, problem solving, risk assessment, decision taking and managing thought which are found in all eight competences. (Commission of the European Communities, 2005) There are several reasons, why such competences are vital. For example, society and the economy, in particular in countries with fewer raw materials, rely on greater knowledge. On the other hand in the course of globalization, it is more important than ever to prevail over competitors and to be well positioned in the business forum.

Key Competences
Many competences interlock or overlap.
1. Communication in the mother tongue
2. Communication in foreign languages
3. Mathematical competence
4. Digital competence
5. Learning to learn
6. Interpersonal, intercultural and social competences, civic competence
7. Entrepreneurship
8. Cultural expression
Entrepreneurial thinking and acting is promoted as a strategic task in all the University’s faculties. This is reflected in courses where students acquire interdisciplinary skills as well as encouraging students to learn from their own entrepreneurial experience. To control the process and to select appropriate modules, it is essential to understand the intentions and entrepreneurial potential the students possess. With this knowledge on one hand and realisation of necessary competences for successful start-ups on the other, it is possible to discover real student needs. Furthermore, Wismar wants to reduce factors which act contrary to their goal. To elicit up to date information the RSI initiated, then supervised, a bachelor thesis to which examined the potential, motivation and problem-solving of student start-ups.

The goal was to discover student intensity in economically independent activities. What encouraged them, and what prevented them from seeking entrepreneurial experience. The results were used to develop entrepreneurship education at Wismar and to assist integration with the business community.

It was important for the university to work closely with regional business people as students had practical solutions and ideas to assist the local economy in all areas.

2. TARGET GROUP

Wismar University has three faculties Engineering, Business and Design. Together they offer more than 40 degrees to students. During the survey (2010) the university had 3,579 students enrolled in full-time study (direct students) another 2,237 were part-time, correspondence or online students.

The survey focused on full-time students, as the rest had either a profession or already had made a career choice. Of particular interest was the students pursuing a start-up during their studies as a secondary career path.

3. SAMPLE SELECTION

At the start of the survey it was assumed an entrepreneurial activity (if in the field of study) as more useful and interesting in later semesters, as students already had basics expertise. Therefore, the survey concerned students in the 4th or later semesters. During the survey it turned out many of lower-year students already had enterprises or worked in a freelancing capacity. For this reason, students of all year groups were included in representative survey.

A total of 152 students (about 4.5% of the total number of students) was interviewed through a questionnaire (multiple choice). The students were from all faculties and included bachelor as well as master students. As the survey was for a bachelor thesis, interview time was restricted. The available number was sufficient for the sample selection process as sampling selection was based on the percentage distribution of students among the three faculties as shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Distribution of Faculties in Sample Selection</th>
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<tbody>
<tr>
<td>Faculty</td>
</tr>
<tr>
<td>Technology</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Design</td>
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4. QUESTIONNAIRE

The questionnaire (multiple choice) was developed in co-operation with the RSI and divided into four thematic blocks. The first block covered general information about each interviewee. A second block
examined attitude to a start-up and professional experiences (perhaps entrepreneurially). In the evaluation, four sub-groups were formed:

1. **Activists**
   - Students who had their own business during studies or were freelancing.
2. **Openers**
   - Students who theorised about opening their own business.
3. **Refusers**
   - Students who did not want to start up their own business.
4. **Indecisioners**
   - Students who had not yet given the matter thought.

Some questions, question on motivation for start-ups, focused only on the first two groups. The third and largest block, involving questions on motives and barriers for student start-ups during and after studies, while fourth and last block sought special requests for support, services and offers at the university by students interested in start-ups.

With consensus among several professors from all three faculties, the questionnaire was prepared between May 26 and June 16, 2010. It was handed to students at the start of semesters, filled in by participants, and then collected. This approach made it possible to clarify any queries. Completing a questionnaire took 15 minutes, participation was voluntary.

**5. RESULTS**

To assess the survey, results should be compared with statistics from beyond the university and the region. According to the Federal Statistical Office the number of entrepreneurs among employees in Germany was only 10.9% during 2010.

In 2008 the Institute “Mittelstandsökonomie” at Trier University conducted a survey with 37 German Universities. Survey results: 5.7% of the students were Activists and 7.3% were Openers, accepting that Openers in this case meant, those sure to start their own business after study. At Wismar 152 students took part in the survey; 22 participants (14.6%) were presented as Activists, because they already have begun their own business during study. This high percentage at Wismar University strongly emphasised the need to constantly provide service support, monitoring and initiation of entrepreneurial activities.

Another 49 students (32.2%) did not yet have their own business, but could imagine doing so in their future. This group were Openers.

42 students (27.6%) sought employment and did not want to start their own business. The remainder (25.6%) had not thought about the issue.

The survey showed, 77% of Activists worked alone, only 23% worked in a team. Activists can be seen as a "secret reserve" for more entrepreneurship.

Factors which were frequently discussed were chosen for the interviews. The Activists answered (multiple answers possible) to the question: "... What would motivate you to start-up your own business during your study?"
The highest motivation for Openers was an opportunity to earn more money. The chance to obtain references for a future career was the second most important motive for 67% of Openers. Almost 64% named as a third motive, an opportunity to use practical knowledge gained from study. The RSI of the Wismar University had already developed several new courses that met exactly openers requirements.

Annually an internal Idea Camp at Wismar University was held for students. Once a year on a weekend away from campus, five teams of three students competed against one another. All interdisciplinary teams tackled the same task. They were guided and supported by dedicated experts. An external jury awarded three prizes to teams for the best realistic ideas and most convincing presentations.

Another opportunity for Wismar students was participation in a research and development team. This was an innovative idea, which merged students from different disciplines and faculties. They worked together in interdisciplinary teams for at least one semester on application-oriented tasks. The ideas and tasks were provided by local companies or research institutions, which sought new technology applications or marketing opportunities. The companies supervised the groups and delivered their own know-how, laboratories and production capacity.

In addition, the RSI offered start-up seminars each semester. These could be selected by students from all faculties and disciplines. Participation was also recognised by offering five credits in most disciplines.

Figure 1: Response of activists to the question on motivation to start-up own business.

<table>
<thead>
<tr>
<th>Motive</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>chance of higher additional income</td>
<td>77.6%</td>
</tr>
<tr>
<td>early development of references</td>
<td>67.3%</td>
</tr>
<tr>
<td>transfer of knowledge into practice</td>
<td>63.3%</td>
</tr>
<tr>
<td>own decision about working time and working place</td>
<td>44.9%</td>
</tr>
<tr>
<td>realize own ideas</td>
<td>40.8%</td>
</tr>
<tr>
<td>creating networks on early stage</td>
<td>34.7%</td>
</tr>
<tr>
<td>increase motivation of study</td>
<td>20.4%</td>
</tr>
<tr>
<td>positive influence by private environment</td>
<td>20.4%</td>
</tr>
<tr>
<td>take over leadership</td>
<td>16.3%</td>
</tr>
<tr>
<td>get into a family-enterprise/succession</td>
<td>4.1%</td>
</tr>
<tr>
<td>other</td>
<td>2.0%</td>
</tr>
</tbody>
</table>
In determining the barriers for establishing start-up during study, focus was on the relevant statements of Refusers. Their reasons for rejection (multiple answers possible), broke down as:

### Reasons against an own start-up from the perspective of Refusers

The dominant reason for rejection was that students were afraid that the requirements of study and working in their own business were incompatible. It was also difficult for students to calculate the amount of work. The RSI at Wismar took this into account in developing services and supplies assistance for students. In this way students had a chance to collect entrepreneurial experience while studying. Students still had their individual choice among these offerings, but obtained support to allow these activities to fit with the content and chronological order of their relevant curricula.

For example, participation in a student research and development team could be recognised by credits (ECTS) but only with the coordination and co-operation of the relevant professors.

As many as 135 students answered the questions on how Wismar University supported start-ups and entrepreneurs; 35 students (25.9%) reported they had already taken part in one or more course offered by the university. The seminars (basic and advanced seminars) offered by RSI were used most frequently (32 students). The individual consultations and support for entrepreneurs or young start-ups were also often used by students. But in spite of this apparent good response to of entrepreneurial courses, the RSI was eying growth opportunities.
6. CONCLUSIONS

The expounded results proved outstanding provisionally and will be used by the RSI to develop entrepreneurial thinking and acting at Wismar. On this basis, effective instruments can be developed and barriers removed. In collecting entrepreneurial experience during study the RSI saw a significant gain in student expertise leading to a later transfer of management responsibility in businesses. Entrepreneurial skills were becoming an indispensable factor in economic development, regardless of whether graduates started their own companies or became an employee.

“Entrepreneurship refers to an individual’s ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports everyone in day to day life at home and in society, employees in being aware of the context of their work and being able to seize opportunities, and is a foundation for more specific skills and knowledge needed by entrepreneurs establishing social or commercial activity.” (Commission of the European Communities, 2005, p.18)

Wismar University offered students a variety of courses. Especially, those from RSI gave students an opportunity to experience the real market in interdisciplinary problem-solving processes while studying. The university saw a special interest in entrepreneurship education as a key competence. For this reason the university established an entrepreneurial spirit more than 10 years ago. The survey results confirmed the university had selected the correct path to become entrepreneurial. For this reason and with special development courses Wismar University will enhance activation of entrepreneurial potential.

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RESEARCH AND ENTREPRENEURSHIP ON LOCATION BASED SERVICES AND MUSEUM INFORMATION SYSTEMS

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1. INTRODUCTION

The development of computer technology, mobile devices and sensor technology during the past 30 years has continually affected the creation of new applications based on emergent technologies. Whilst newly developed device types with different technical specifications have surrounded us in our everyday life and private environment, new base technologies have also been established step-by-step.

By combining the advantages of established technologies with these new approaches and furthermore adapting those criteria to the different user needs and application scenarios, including the location of users, we are able to extend existing applications with new mobile components and services.

2. RFID SENSOR NETWORKS AND CONTEXT-SENSITIVE SERVICES ON THE BASIS OF THE OPENBEACON TECHNOLOGY

We decided to use the OpenBeacon[2] technology as the basic technology for sensor networks and context-sensitive services being actively developed by Bitmanufaktur[7]. OpenBeacon is an open source solution in hardware and software for active RFID. It operates in the 2.4 GHz ISM band and each device contains a unique ID. OpenBeacon is designed to transmit and receive radio waves. The advantages of an active RFID system are:

- high range,
- ability to transfer more than just one unique ID,
- cryptographic security,
- full processor on the tag and base station side,
- tags can control peripheral devices.

The OpenBeacon technology consists of two main components – the tags and the base stations. OpenBeacon base stations are tiny network devices to receive and process the signals sent by OpenBeacon tags. The OpenBeacon tags are tiny battery-powered devices to receive and process the signals sent by OpenBeacon tags. They consist of RF24L01 2.4 GHz transceiver and are controlled via a microcontroller (Microchip PIC16F684). The device is powered with one CR2032 coin cell and is expected to run for up to several months without battery change. The 8-Bit RISC CPU with special low-power features provides the opportunity to implement a very sleek and power-saving transmitting routine at minimal costs.

Since 2010 the open source project offers a new generation of RFID tags, so called proximity tags, broadcasting additional information about the tags in their surrounding. This is realised by setting up the RFID tags in a transceiver mode. The transponders scan their neighbourhood by alternating transmitting and reception cycles. They use a specific radio channel to firstly send low-power packets, they then switch into receive mode and listen on the same channel for packets sent by nearby devices [6]. These responses serve as indicator for proximity evaluations. These special tags can be considered as a type of RFID reader. As these transponders are much smaller and also cheaper than an ordinary RFID reader, the option of using the proximity tags to realise the runway use case was chosen.

Every tag transmits six to eight times per second. The tags transmit with four power levels, periodically. The following illustration describes the transmitted protocol:
The OpenBeacon tag sends not only the unique ID, but it could send a multitude of other information. The unique ID, the specific information of an OpenBeacon tag and the packet loss per period can be used for distance and position estimation and for the development of location and context-based services [1].

Location and context-based services as well as mobile information systems and multimedia applications require the same computer, sensor and network components. Not only the hardware components of the different OpenBeacon applications are the same but also their software components. We built a standardised modular toolbox for the different OpenBeacon applications which comprise software modules and hardware components. We employ this toolbox for information systems in different museums like the Jewish Museum Berlin or the Pergamon Museum Berlin.

3. LOCATION BASED SERVICES BASED ON A RFID SENSOR NETWORK FOR AN INFORMATION SYSTEMS FOR THE MUSEUM OF ISLAMIC ART IN THE PERGAMON MUSEUM BERLIN

The main focus of project ‘Poseidon’ is to design mobile multimedia indoor information systems and context-sensitive services based on a RFID sensor network in museums and passive RFID tags. In order to cover a wide range of applications we developed a standard system architecture. The main components of the system are RFID transponders (active and passive) and RFID readers, data collection and management system, a web server, and wireless and cable based network systems (WiFi, UMTS and Internet). The system architecture is illustrated in Fig. 2.
All RFID components, a controlling computer, feedback components (audio and light) and antennas are installed in a shell. Only the shell varies for different applications, e.g. a digital storyteller for the Schahname exhibition the Museum of Islamic Art in the Pergamon Museum Berlin, see Fig. 3.

**Figure 3.** Storyteller of the Schahname Exhibition

The visitor to the museum can collect information (stories) with a bookmark, see Fig. 4.

**Figure 4.** Schahname Bookmark with RFID Tag

The museum creates a private website for each visitor to the museum. The visitor has to register on this website with the code printed on their bookmark (in the example “AQ9BDD”). After registration the visitor has access to all collected stories, see Fig. 5.

**Figure 5.** Website with the Stories
4. “A LA CARTE” INSTALLATION – PERSONALISE INFORMATION SYSTEMS BASED ON PASSIVE RFID TAGS FOR THE JEWISH MUSEUM BERLIN

The same system, technology, toolbox and system architecture was used for the exhibition “Kosher & Co” at the Jewish Museum Berlin. The storyteller was replaced be a plate and the bookmark by a spoon. The visitors to the exhibition “Kosher & Co” collected cooking recipes.

The main idea of the RFID based “A La CARTE” installation is data collection without a typical computer interface. The visitor to the museum received a spoon with an attached passive RFID tag as an entrance ticket and a short description of how to use the spoon for data collection. Additionally, a unique spoon (RFID-) ID and the URL of the “Koscher & Co” website are printed on the spoon. The user can find one media station in each of the ten rooms of the temporary exhibition. The media station consists of a plate, a hidden RFID reader and a hidden miniature computer. The plates have unique labels, for example fish, lamb, grapes, chicken, and pomegranates. The user will see only the plate, and only the spoon and the plate can interact.

If a visitor wants to have more information regarding the objects in the room and the attached recipes they have to place the spoon on the plate. The RFID reader under the plate receives the ID from the spoon and sends the ID with a time stamp to the server. If the transfer of the ID was successful the media station generates an optical and acoustic feedback. Now the visitor knows that they have collected the recipes on their spoon.

There are three recipes of three different categories in each room. The three categories are “5 ingredients”, “5 senses” and “5 minutes”. The “Koscher & Co” context-sensitive software determines which recipes best fit the visitor. The selection of recipes and relevant category for the specific visitor is dependent on their visit of the exhibition. Criteria are for example the visited media station, the sequence and the duration of the visit.

Following the visit to the museum visitors can enter the website. Firstly, they have to log in (by typing the ID found on the spoon). Following that they will see their profile, the category and the collected recipes. The
visitor can continue to visit the exhibition – not in reality but the virtual exhibition. They can for example collect more recipes of their category and additionally also recipes from the other two categories. To do so they have to visit a virtual table with ten plates and have to place their virtual spoon on a specific plate. They can do this on three different tables, one for each category. An empty plate means the attached recipe has not yet been collected, while a plate with food illustrates that the recipe has been collected. This is implemented as a flash game.

![Recipe Image](image.png)

**Figure 8.** Personalised Webpage of “Koscher & Co” (recipe)

Further applications are possible. The visitor research department can analyse the data collected and provide the visitor with more detailed information about the visited artefacts or additional information about other artefacts in the exhibition. The museum can also recommend additional tours through the museum. Staff members can use the data and sensor networks for the management of the museum and the exhibition.

5. **ENTREPRENEURSHIP**

The system and technology are currently used in three companies. The company Acoustiguide [8] develops the general concepts and the content, the company Bitmanufaktur [4] develops and adapts the electronic equipment and the event management company Bureau Q [9] offers the product and interface design as well as adapted solutions such as a RFID-based event management system. “TAGTONET” is one example for the use of their RFID-based event management system. Bureau Q used “TAGTONET” for the “Volkswagen Leasing GmbH” during the “BFP Fuhrpark Forum 2011” in Hockenheim. “TAGTONET” aided in locating and finding the Volkswagen staff members, transferring information about products and services automatically to the customers and collecting contact information from the customers.

In addition, the University of Applied Sciences HTW Berlin established a new Research Institute for Culture and Computer Science (FKI) to extend and support the research in this field. The HTW Berlin will spend more than 4 million € to construct a new building during 2011 and 2012. More than 50 people will work and research at the FKI following the opening of its new building in 2013.
6. ACKNOWLEDGMENT

This paper described the work undertaken in the context of the project POSEIDON hosted by the research group “Information and Communication Systems” INKA [2] in cooperation with the Humboldt University Berlin, the Jewish Museum Berlin, the Pergamon Museum and the two companies Bitmanufaktur and Acoustiguide, and gratefully funded by the European Regional Development Fund (ERDF).

7. REFERENCES


ABSTRACT

This paper focuses on the field of waste management education and practical knowledge achieved by students and professors during an internship in Norway, plus valuable experience exchanged with specialists from Environmental Engineering field, environmental agencies, industry and universities. Today’s situation and the position of the waste management in Romania and its relationship with EU prerequisites are presented. The Romanian waste management is on the verge of major improvement and results achieved added to research from Environmental Engineering students points to a better selective waste collection process.

The case study presented had several objectives: It evaluated waste volume in urban areas against rural areas for three municipalities Brasov, Medias, and Harghita, estimated correlations between waste types percentage according to collection methods applied, it observed waste collection variation and frequency of collection and estimated the generation indicator. It also presented update data/ information on household waste types and compared data on different types of waste form waste management regional plans.

Entrepreneurial skills among students required development and new courses added to the curricula and a hands-on practice was also essential.

The environmental engineering field has developed strong links with the Regional Agency for Environmental Protection, Sibiu, and with all companies involved in the environment and working through that agency.

This university aim is to create a new generation of skilled environmental entrepreneurs to allow them to launch ventures, products, and technology to address society's environmental and natural resources problems. There was a need to develop management, consultancy, engineering and technology professionals eager to refocus their careers in environmental entrepreneurship.

This study was the first practical research into the regional network of waste landfill sites in particular household waste analysis. All official data related so far was based only on theoretical prediction analysis.

1. INTRODUCTION

University education today has become increasingly global and internationalised. Hence, education institutions, especially in English speaking countries, have to compete globally for student intake [1]. The changes since 2000 are real and already have impacted on European institutions so where countries have been admitted into the EU [2]. With many nations having differing legal frameworks and requirements, individual local codes and procedures to govern the practice of engineering, it meant an enormous task to define specific rules for each case [3].

To ensure recognition of professional engineers from different countries using different systems is proving a difficult task. However, in the context of the globalisation of all human activities, particularly engineering services, it was essential well-developed countries made serious efforts to adopt an open-minded approach to establish parameters to permit an ultimate objective of international recognition to be achieved [3].

Globalisation not only affects the educational arena, but also the political, cultural, economic and environmental aspects of Romania. Now, in the EU, Romania exists in an interconnected world where one
nation is closely tied to others. Indeed, to that of the entire planet and its five interconnected systems, economic, environmental, political, cultural and technological [4].

The educational system is an integral link in this chain. It, too must also adjust and adapt to meet the needs of the globalised world and move towards global education or in this case, global curricula [5].

In the light of an increased mobility of highly educated workers at a global level, many educational institutions must prepare to meet and satisfy comparison with domestic and foreign institutions. The internationalisation of degree programmes could facilitate transferability of academic credits to enable courses to be taken abroad and could open doors for foreign students to study in Romania [6].

But classroom lectures delivered by academics may not be the best way to supply entrepreneurship training [7]. More interactive, reality-based and experiential approaches were probably best suited to support entrepreneurial behaviours. Examples included virtual and real business ventures, business plan competitions, interacting with real entrepreneurs and providing contact with role models would benefit prospective entrepreneurs. It was possible to teach time management or problem solving skills in a math lesson, also possible to integrate teamwork and creativity in ship mechanics. Discussions with professors needed launching to convince them to adopt more active teaching methods. The information provision, analysis and recommendations delivered in this approach were likely to secure better entrepreneurship training in this university.

The European Commission notes, however, that measures beyond simple inclusion in the curriculum were required to encourage enterprise. This encouragement should form incentives to promote teaching of enterprise, ensuring directors and teachers were convinced of embarking on enterprise activities and to ensure the lecture environment was favourable to such activities [8].

Historically, university researchers have collaborated with industrial scientists on marketable projects. News coverage at the turn of the 21st century led one to believe this was a current phenomenon. However, science historians have traced collaboration between European companies and university researchers back to the 1800s. Traditionally, industry sought partnerships with universities as a means to identify and train future employees. As global economies shifted, however, companies required the source of access to this created cutting-edge knowledge and technology central to university research. Knowledge creation and technology development requires considerable capital investments, historically provided by government [9].

The interdependent research relationships between universities and companies enabled both to sustain growth in their areas. While companies relied on university researchers for product innovations, faculty gained prestige through increased external research funds. Just as industry required innovative ideas to ensure profits, researchers need additional research money to sustain faculty productivity [10].

2. PARTNERSHIP WITH REPA

"Lucian Blaga" University of Sibiu joined the project "Partnership for a Clean Environment, Low Waste and Sustainable Development in Region 7 Center" as partner, with the Regional Agency for Environmental Protection, Sibiu - REPA and The Norwegian Association of Local and Regional Authorities – KS. The prior objective of that project was to improve waste management at regional level (Center Region) in Romania, focusing on biodegradable, hazardous and construction/demolition waste. The plan was also to move on and not stop at just waste management implementation and transformations of waste collection system, but also to educate Romanian specialists in those fields.

For the first time in 7 Center Region a development project was included, as an education element. The post university courses provided by Lucien Blaga had aim to assure quality staff in the field of waste management, in both public and private sectors. That project produced unexpected results, 90% of participants attending “Modern methods for Environmental Impact Assessments of products and Processes” lectures were specialists from the National Environmental Guard, City Hall and the Local Councils National/Regional Environmental Protection Agencies. The public received information on existing threats caused by actual waste management
problems in Romania and more issues were discussed during project meetings. Environmental specialists from throughout Romania had an opportunity to meet, to learn from Norwegian experiences in this field and to produce solutions that were implemented. Several examples were:

- Creating an association of waste management specialists for consultancy services and information campaign (ex: Waste Management Norway);
- elaborating guidelines regarding separate collection of household waste, composting, electric and electronic equipment waste, hazardous waste from household waste, bulk waste, construction; and,
- strengthening the institutional capacity of local and regional public authorities to be mutually beneficial - successful collaboration usually provides a “win-win” situation;

Waste management guidebooks and brochures for local authorities were published [11]. Another example was meetings organised in the Saliste region under the topic “Home composting”; also enjoyed an excellent implementation. Home/school composting activities and campaigns were organised, selecting the most functional home/school composting system, to reduce disposal biodegradable waste to meet legislative command and elaboration of best practice guidelines regarding landfills. To that project, environmental engineering students joined in voluntarily to help, and learned during the process. The best were selected for practical work in Norway and their results utilised as graduate projects or individual research proposals, such as “Green Roof”. Even if such projects did not bridge significant gaps they became more and more popular with students and graduates who working in small teams, could rapidly appreciate real results or the way to implement ideas. Students from different years and fields of study found this activity interesting and joined “Green Roof” teams as volunteers. Professors played an important role not only as experts, but to write proposals and act as supervisors.

The Ecological Club Bios was similarly founded. It has an aim to provide information, hold lectures and consultancy related to environmental protection and to develop sustainable development concepts for urban and rural areas from the Sibiu region. Its main activities were the ecological rehabilitating of urban areas, sustaining development of rural areas and, protecting mountain ecosystems’ through ecological education. This had been achieved in only two years. It was possible first because of environmental legislation imposed on Romania by the EU and partnership with the Regional Agency for Environmental Protection, Sibiu (REPA). As university laboratory’s activity providing moved easily in the field, measurements, observations and research, it was now possible to implement schemes at "Gura Raului" Water Dam or Water and Sewerage Authority, Sibiu. This was erected with specialists in better equipped laboratories at partner companies and in the private sector, which co-operated in environmental health risk analysis.

Research concerning problems facing developing countries in environmental engineering education indicated a tremendous need for such curricula. It would be particularly beneficial where resources were scarce. The substantial costs of higher education would be reduced by sharing courseware, software, laboratory procedures, methodologies, etc. Such curricula, although appearing uniformed, would permit inspection of local and regional issues and facilitate inclusion of environmentally sound policies and local programmes [5].

3. THEORY TO PRACTICE - CASE STUDY WASTE REGIONAL NETWORK LANDFILL SITES

Entrepreneurial skills needed to develop among students and courses added to curricula hands-on practice was essential. The manner in which waste management in Romania must be improved and results achieved by involving environmental engineering students would lead to a better waste selective collection process. Improvements must occur. Several individual projects had begun especially in household waste composition studies and monitoring. The activities and their achieved results are:

- Evaluate waste amount for urban areas against the rural areas on three municipalities Brasov, Medias, and Harghita. Estimate correlations between waste types percentage according to collection method applied in the region;
- The need for conformation to waste legislation:
  - the implementation of the Convention on Biological Diversity Conservation and protection, Waste Legislation conformation to EU directives related to Community acquis;
  - conformation to national regional and local Master Plans for waste management [12], specifically for Regional Action Plans to initiate and implement appropriate, sustainable and environmentally
acceptable waste collection services by local government for waste management integrated systems;
- waste management sustainable development by changing the actual system and implementing Europeans standards and methodology in order to minimize waste disposal impact on environment as management of waste is a basic requirement of ecologically sustainable development;
- allocation of adequate human and financial resources for ecological education;
- waste regional network of uncontrolled landfill sites is presented in figure 1 and had a tremendous impact on environment by surface or underground water transportation of dangerous waste compounds, which is a direct threat to human health and life quality. This is another unconformity to national and European reglementations;
- difficulties to manage environment problems because of lack of specialists;
- requirement to close uncontrolled waste landfill sites.

![Figure 1. Waste landfill sites in 7 Center Region controlled versus uncontrolled disposal and the transformation that should be done according to EU legislation until 2017 as waste controlled disposal has to be applied](image)

- Elaborating the regional and local waste data collection, processes, analysis and validation system, for waste generation and management data. Observe waste collection variation in frequency of collection services between areas and estimate the generation indicator;
- Meeting with companies involved in waste management regarding waste data reporting methodology
- Update data on household waste types and compare data provision types of waste to Waste Management Regional Plans. Implementation of measurements to determine household waste composition and generation index for urban and rural areas.

### 3.1. RESEARCH METHODOLOGY AND PROCEDURES

Implementing a set of qualitative measures established in Waste Management Regional Plan for Region 7 Center that are more difficult to attain. Until now, only the quantitative measures received funding (construction of landfill sites, sorting stations, transfer stations, closing up uncomplying dumpsites). These are important, but they often fail due to lack of "know-how", experience, professionalism, support from the civil society and information of the authorities.

Measurements are done daily for one-week period for each of these three locations. There are three waste streams, rural area, urban house area, and urban residential area. Comparing method numerical data analyses was done according to WMRP (Waste Management Regional Plan). Two types of data were correlated,
theoretical prediction analysis versus practical observations as presented in figure 2. Data sheets were passed to salubrity operators (ecological deposits and sorting station and transfer waste companies).

\[ \text{Figure 2. Measured results versus waste management master plan (WRMP) values in 7 Center Region} \]

\[ \text{Legend: 1 - paper and cardboard; 2 - glass; 3 - plastic; 4 - metal; 5 - wood; 6 - biodegradable; 7 - others.} \]

Daily online data communication was received together with pictures related to certain activity: sorting, weighting, etc. this activity was accomplished by field surveys and discussions with people responsible for each location. Data analyses show that the entire amount of waste has to be sorted also on contaminated, respectively uncontaminated carton and paper, plastic and wood fractions, it is important to recover energy from waste in order to meet national, regional and local needs for local authorities and private commercial companies. Another important issue arise during measurements, is required to separate waste on textile, construction, demolition versus hazardous waste from household waste, so the basic 7 fractions that were separated from entire waste amount should be assessed. Data analyses show that the entire amount of waste sorted by types can be compared to Waste Management Regional Plan for 7 Center Region. For urban collection, it is a correlation of 5% for types nr. 1,2,3,5 and 7 and big differences for waste types nr. 6 and 3, up to 7-8%.

3.2. REDUCING OF GENERATED WASTE AND PREVENTION

- it is a need for monitor the sort performance using internet and web platform in order to online monitoring of data by municipalities;
- to extend waste salubrity companies activities to take more attention on waste management and collect them by types also share the results;
- update data on waste research concerning waste types monthly, by seasons, and gather data for the entire year;
- contaminated type of waste like paper, cardboard, plastic and wood – can be incinerated and use their caloric properties by cement companies that have such incineration potential;
- to introduce new types of waste that can be collected separately or sorted by types (textiles, constructions, hazardous) in order to be estimated, in such a way the disposal amount of waste will drop and the economic benefits will rise, do not forget the tremendous benefit to environment;
- research can be extended to economic data evaluation, and economic effects quantification of waste type collected by types.

4. CONCLUSIONS

Evaluating actual stage of environmental engineering at LBUS it is necessary to support and strengthen cooperation between enterprises, industrial partners and research units, which would have a direct impact on the implementation of solutions of scientific research to the economic reality.
Concerning waste management it can be said that research and measurements should be repeated periodically and data can be compared in order to determine the influence of social, economical, demographical and technological factors, also legislation on quantity and quality of waste in a certain region.

5. REFERENCES


TO BE ENTREPRENEURIAL AS AN UNIVERSITY – A COMPARATIVE STUDY

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ABSTRACT
The key conditions of setting up an entrepreneurial university can differ from country to country. The paper will compare the approaches of two European universities becoming an entrepreneurial university. Both universities are technical oriented and have close collaboration with the economy. In this paper the reader gets to know about the reasons for different approaches and its impact on university’s development. One main result of the analysis was that there is no general framework for establishing sustainable entrepreneurship at technical universities.

1 INTRODUCTION
“Many European universities still underestimate the potential benefits of sharing knowledge with the economy and society, while industry has not developed sufficient absorption capacity to harness the potential of university-based research. Consequently, the cross-fertilisation with the business community and with wider society remains difficult. This lack of openness to the business community is also seen in the career choices of doctorate holders, who tend to pursue their whole careers in either academic circles or industry, and not as entrepreneurs.” [1, p.4]

2 PROBLEM STATEMENT
The term entrepreneurial university is open to a broad range of interpretations. It covers all types of universities within countries and indicates difference in understanding “university excellence”, university strategy and focus on occupation of their graduates /relations to businesses and industries. It has been associated with entrepreneurship education and student entrepreneurship support, protection and utilization of intellectual property rights by faculty and students of universities, knowledge and technology transfer through licensing or formation of spin-off companies. It is related to the transfer of science and technology innovation to the business sector, contributing to economic development at the regional and national levels.

There may be observed a movement away from a system of previous central or regional public funding characterized by high level of certainty to the current conditions where an increasing part of finance has to be sought from non-direct public sources including research grants, local development monies, fees, alumni, industry and social enterprise, contract research and philanthropy and where the level of funding uncertainty increases [2]. Based on the experience of the US universities it is argued that their funding by the federal states and not by the federal government reinforces their focus to the regional and local business issues. The label of the ‘Entrepreneurial University’ may be frequently associated with the notion of the university as a regional innovation hub (e.g. University of Oxford, University of Cambridge, Massachusetts Institute of Technology). It appears to be widely accepted in this context that successful innovation necessarily involves a highly interactive process of engagement between universities, industry and government. This engagement process has been denoted as the Triple Helix Model of social innovation. [2]

Based on the experience from USA, Asia and Europe [3] universities are considered to be entrepreneurial when they:
- are bold in creating their own autonomy, accepting the fact that their funding by the state will be decreasing in time;
- accept the ‘idea’ of a university which embraces the scholarship of relevance and integration of knowledge and a sharing with, and learning from, the wider community;
- are unafraid to maximise the potential for commercialisation of their ideas to create value in society and do not see this as a significant threat to academic values;
- internally organise to provide a stronger central steer to entrepreneurial endeavour while building on the natural autonomy of individual academics;
- engage actively with the wider stakeholder community as part of an 'organisational learning' strategy;
- promote the creation of, incubators, technology transfer offices and patent protection arrangements, science parks not as ends in themselves but as 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;
- encourage a wide range of interdisciplinary activity with the creation of interdisciplinary departments and R&D centres;
- accept wider responsibility for the personal development of students and staff, particularly with respect to future social, career and life long learning experiences;
- recruit entrepreneurial staff and appoint entrepreneurial leaders as change agents including the opening up of academic posts to a wider constituency via adjunct and visiting appointments;
- build rewards systems well beyond those relating to research, publication and teaching criteria;
- overall, ensure that the concept of entrepreneurship education is embedded in all the faculties, owned by key staff and integrated into the curriculum.

The purpose of this paper is to examine relevance of the concept of entrepreneurial university for a university of technology with direct central public funding which gradually covers less and less its future development needs. The current status of transformation process of the STU in Bratislava compared to the Wismar University (WU) towards the entrepreneurial university is analyzed, lessons drawn and the next steps put forward.

3 THEORETICAL BASIS

In this article, entrepreneurship is understood as an approach to management defined as “the pursuit of opportunity without regards to resources currently controlled” [4]. Entrepreneurship is not solely about business skills or starting new ventures; it is a way of thinking and behaving relevant to all parts of society and within the context of established organizations it is often referred to as “intrapreneurship”. As such entrepreneurship can be taught as a managerial process.

Entrepreneurship education is a process which develops individuals’ mindsets, behaviours, skills and capabilities and can be applied to create value in a range of contexts and environments from the public sector, charities, universities and social enterprises to corporate organisations and new venture start-ups. [5, p. 12].

The main differences between managerial approaches and entrepreneurial approaches in business education [6] might be summarized as follows:

- The managerial approach focuses upon present business activities and their management, analysis of business processes and functions, and their optimization of efficiency and resource allocation;
- The entrepreneurial approach focuses upon the identification of business opportunities and their implementation, analysis of changes in the environment, as well as innovations, coming together in a viable business model to organize production and resource allocation.

Acceptance of the concept of entrepreneurial university in a university of technology will require a fast transition to entrepreneurship education requiring: (1) the implementation of change from a “traditional” to a more “entrepreneurial” approach in study programmes, (2) a broader adoption of active problem solving and participant-centered teaching methods, and (3) the overcoming (if necessary) of resistance within relevant parts of the educational institutions involved.

The framework to be presented for implementing entrepreneurship education and developing more entrepreneurial (technical) universities is drawn from both the evidence base in literature, as well as from our
own experiences and observations at the Slovak University of Technology (STU) and Wismar University (WU). Both universities are engaged in an ongoing transformation process towards “entrepreneurial universities”.

4 RESEARCH DESIGN

This paper analyses key features in the process of transforming the WU in Germany into an entrepreneurial university as compared to those at STU in Slovakia focusing upon entrepreneurship education. Entrepreneurship education can broadly be defined as all activities that aim to foster entrepreneurial mindsets, attitudes and skills and can cover a range of themes such as “idea generation”, “starting-up”, “growth” and “innovation”. Hence, entrepreneurship (education) is not solely seen as (learning how to) “starting up” ventures [5]. Next to that, entrepreneurship education should also go hand in hand with ongoing entrepreneurship research as there is still much to learn about (not exhaustive): how best to exploit technological discoveries and inventions in the commercial world, about the role of universities with regard to start-up companies, and about best practices regarding intellectual property rights. It therefore always requires a multidisciplinary research programme based on reliable empirical data.

The analysis of entrepreneurship education in the universities/faculties under consideration is structured as follows:

1. Role of entrepreneurship education in mission and strategy of the educational institution;
2. Implementation of entrepreneurship policies in the educational institution and their strategic embeddedness in it;
3. Current status of entrepreneurship education (including its institutional infrastructure, outreach activities);
4. Types and sources of entrepreneurship funding and budget allocation;
5. SWOT-analysis of the key aspects of entrepreneurship education and further structural and organizational measures contributing to building framework of entrepreneurship education within an entrepreneurial university;
6. Recommendations on further steps to be taken in building an entrepreneurial university at STU and WU

First the analysis of the STU is given followed up by the analysis of the WU entrepreneurship activities.

5 ENTREPRENEURSHIP EDUCATION AT THE SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA

5.1 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.

The present education of STU students predominantly concentrates upon educating science and technology professionals for engineering, managerial or R&D posts, as well as the transfer of scientific results into practice without any mention of entrepreneurial competencies in the STU faculty development intentions. Nevertheless, further steps towards the entrepreneurial university are taken at the university level as stated below.
5.2 ORGANISATIONAL CHANGES WITHIN THE STU SUPPORTING ENTREPRENEURSHIP

The University Technology Incubator has supported set-up of some 30 technology start-ups up, entrepreneurship trainings and contests since 2005. It has collaborated closely with some STU faculties and the STU Institute of Management and functioned as an Information and Contact Point (Inno Info) of the Slovak Institute of Industrial Property as well.

Since March 2008 all courses in economics and management are taught by the respective departments of the **STU Institute of Management**. It integrated teaching and research resources in management disciplines for the STU faculties; guarantees study programmes in management, especially the interdisciplinary programmes and university-wide programmes, and last but not least it created 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.

Since 2008 the STU Scientific as a 100% daughter company of the STU has been operating. Its aim is valorization of the STU research results in industry, e.g. by supporting creation of spinout companies (4 so far), 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 create favourable conditions for transfer of R&D results of faculties in 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., trying to implement its know–how in technology transfer, licencing and spin-off creation in the relations of STU to Slovak industry.

5.3 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 the in the education of Economics & Management courses prevails the traditional approach to teaching business courses and programmes; e.g. by dealing with issues and questions like (not exhaustive): what is business economics, what are its functions and related processes - including the analysis of the equilibrium in microeconomics and macroeconomics - as well as issues regarding the management of business functions and processes. So, educating business in an integral manner from a general entrepreneurial point of view is still not prevailing at STU. Though traditional teaching methods reign, 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. In 2007 STU as well as its individual faculties have established **Industrial Councils** as advisory bodies to the rector and deans fostering better contacts between businesses and the respective educational body. 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. The activities of Industrial Councils of the STU and its faculties might be more helpful and efficient in promoting the STU – industry business contacts.

In 2007 STU started its “Alumni Club” as an association of STU alumni and friends fostering social, professional, cultural and sports contacts and mutual assistance between STU and its club members. It also promotes publishing and advertising activities, as well as multi-sourced funding of STU.

The STU Office of Career Counselling might consider and encourage the entrepreneurial career of the STU graduates to a larger extent.

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 STU Institute of Management participates in the research project CENTROPE-tt – Tools for Transnational Support of Innovations in the Centrope Region funded by the Central Europe programme within the EU ERDF fund (period from 2009 until 2012). Project is focused on creation and utilization of tools and communication structures which will highlight the local businesses and simplify the access to regional R&D activities for them. These tools enable gaining overview about regional potential in R&D and innovations as well as increase the qualification level within transnational technology and innovation transfer.

The Institute of Management has also 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.

Based on the above, there is a dire 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, learn from them, and avoid unnecessary mistakes. 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 Interdisciplinary Management Studies teaching Engineering, Economics and Management courses relevant for students developing innovative technologically-oriented entrepreneurship. Last but not least, 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.

5.4 TYPES AND SOURCES OF ENTREPRENEURSHIP EDUCATION FUNDING AND BUDGET ALLOCATION

The operation of STU faculties and their educational activities fully depend on state 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 is not sufficient. 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. (Fig.1). Building of Centres of Excellence is based on the EU structural funding.
STU aspires to maintain the status of “university” as defined in the Act on Higher Education Institutions (HEI) in Slovakia granted to the universities achieving excellent results in science and technology and in their PhD study programmes. 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.

6 ENTREPRENEURSHIP EDUCATIONS AT WISMAR UNIVERSITY OF APPLIED SCIENCES, TECHNOLOGY, BUSINESS AND DESIGN

6.1 MISSION AND STRATEGY OF THE WISMAR UNIVERSITY

In 2005 the WU started the project “University 2020 – entrepreneurial, competitive, and future-oriented” as an answer to the state governmental decision to reduce the staff of Wismar University by 20% until 2017. In this project, agreed between Wismar University and state government, the university claims for more autonomy and self-responsibility. In return for being freed from overregulation and micro-management, Wismar University would accept full institutional accountability to society at large for their results.

In the latest “developing plan 2011 - 2015” of Wismar University signed with the state government it was declared, that the three “Unique Selling Points” of Wismar University are

- Entrepreneurially oriented University
- Internationally oriented University
- University with strong focus on Continuous Professional Development

6.2 ORGANISATIONAL CHANGES WITHIN THE WU SUPPORTING ENTREPRENEURSHIP

From 2000 till 2007 the WU ran a successful project called INFEX that stands for or “Information for Entrepreneurs”. It was a project of the Educational Institute of Economy (BdW gGmbH) in cooperation with the WU and the Agency for Technology Transfer and Fostering of Innovations West Mecklenburg GmbH (ATI). INFEX offered a basic and advanced seminar for entrepreneurs as well as individual educational modules for each participant. The seminars were built upon a semester and step by step the students were led through the process of setting up a business and the necessary entrepreneurial competence. The contents were good and reached about 10% of all students. After eight years of a good project the Wismar University thought over again and decided to develop a system, which would reach nearly 100% of students. Entrepreneurship has to become a mainstream at the University system. The responsibility for entrepreneurial education and research has to be shifted into the university; it has to be with the university management. The WU rector (Prof. Grünwald) has been in charge of the new developments. So in 2008 the WU started the Centre for Entrepreneurship, which co-ordinates all entrepreneurial activities for the students. In close co-operation with the European Centre for Engineering and Business Education, the Career Centre and the Business Co-operation manager the Centre for Entrepreneurship they develop a lot of entrepreneurial activities as university-wide entrepreneurship education e.g. interdisciplinary case studies, workshops and seminars, entrepreneurs as guest speakers, creation of student research and development teams, organizing creativity weekends, coordinating student in companies, supporting and exploring the feasibility of students business ideas and encouraging cross-border collaboration.

In 2011 all four units mentioned above joined into one body of the Robert-Schmidt-Institute as an institute for the entrepreneurial university of Wismar. This institute is a focus point for entrepreneurial activities, career consultations and strategic co-operation between industry and the WU. Robert Schmidt was the founder of the WU in 2008 as a private “Engineering Academy”. He was an entrepreneur and academic with a strong focus on interdisciplinary and international education as well as social fairness. His bequeathal is materialized in the mission of the institute bearing his name.
6.3. EVALUATION AND FURTHER DEVELOPMENT OF ENTREPRENEURSHIP EDUCATION AT WU

The Robert-Schmidt-Institute at the WU offers many events focusing on entrepreneurial acting and thinking, entrepreneurship and innovation. The Institute will continuously evaluate their results for further developments.

Regularly there take place interviews with the WU students and staff and with stakeholders from industry to get to know their need and wishes and thus suggestions for further improvement. The aim is to reach with various entrepreneurship activities (including intra-curricular enhancement) nearly 100% of students of the Wismar University.

The evaluations of our activities and programmes should have many functions, such as innovation, optimization, legitimation, prognosis, decision-making and control. We want to strengthen interdisciplinary, interactive and experimental learning methods, learning about good practices from other establishments and develop strategic partnerships and a broad community-based network of entrepreneurs and professional advisors.

Another key element for further development is ensuring that the concept of entrepreneurship education is embedded in the faculties, owned by key staff and integrated into the curriculum together with cross-border collaborations.

Some further steps will be taken to bring together the leading stakeholders in joint search for clearer and wider agreement on the most appropriate concepts of entrepreneurship education to be delivered at the WU. Especially in the North-East of Germany (where Wismar is located) with a lower density of firms, networking makes more of an effort – networking is generating social capital.

6.4. TYPES AND SOURCES OF ENTREPRENEURIAL EDUCATION FUNDING AND BUDGET ALLOCATION

Currently 11 staff members work at the Robert-Schmidt-Institute, two Professors of the Wismar University and nine project-based employees. The different projects run between 2 and 5 years and are funded from the budget of Wismar University, from the European Union and state government. Even if Germany has a lot of third way funding for entrepreneurship there is still a strong need for sustained funding. Funds for innovation and development in the field of entrepreneurship are too narrowly placed into academic pockets.

7 FRAMEWORKS FOR SUSTAINABLE ENTREPRENEURSHIP EDUCATION PROGRAMMES

Based on the SWOT analyses of the STU and WU respectively the following “best practices” for entrepreneurship education is presented as “to do’s” - based on the common observed and compared strengths and opportunities, as well as the observed and compared weaknesses and threats (the latter ones – obviously - to be formulated in a “reverse” manner). Moreover, we use the criteria for “viability of entrepreneurship education” proposed by Pittaway and Hannon [9] as a reference for categorization of the framework as stated below. Together they constitute the skeleton of the framework.

7.1 Educational impact of entrepreneurship education should be recognized and valued within the institution, and then these activities will have a heightened chance of survival [9]. Based on observations at STU and WU:
- Focus on linking technology and entrepreneurship;
- Make the Institute of management or anticipated Faculty of Interdisciplinary Management Studies (STU) and the Robert-Schmidt-Institute (WU) execute the functions of Centre for Entrepreneurship(CIE) with easy access by students and professors;
- Create high visibility within the university as a whole;
- Organize debates within the university in order to make skeptical colleagues enthusiastic about entrepreneurship;
- Make use of any existing entrepreneurship activities (regardless being fragmented and traditional); Pay lots of attention to creating interest with students and (non-participating) teachers in entrepreneurship courses (“marketing of entrepreneurship”).

7.2 Financial sustainability understood as entrepreneurship education being developed and led in such a way that it has its own income. The more established its funding sources the greater chance it has of becoming embedded and ultimately valued [9].
Based on observations at STU and WU:
- Mobilize the (local) commercial (technology) sector (including investment banks and consultancies), as well as (semi)governmental institutions for subsidies, (free) business advisory services, commercial research projects and grants;
- Develop post-secondary/executive education.

7.3 Academic credibility understood as entrepreneurship education building upon results of a research base, being respected by other disciplines [9].
Based on observations at STU and WU:
- Interconnect research and educational activities;
- Draw a fine line between an academic approach and practical use;
- Be internationally focused;
- Stimulate teachers to cooperate and interconnect with colleagues at other (and perhaps competing) universities.

7.4 Human capital, i.e. persons engaged in the activities should be the core staff of the university otherwise the human capital may be transitory and activities may not be embedded. There are tangible elements (including contracts, roles and salaries) and intangible elements (skills and abilities of the people managing and developing the entrepreneurship education activities) [9].
Based on observations at STU and WU:
- “Teach the teachers” on entrepreneurship. Especially those with limited or none business background;
- Use existing knowledge of management and business within the institution and promote an “entrepreneurial spirit” among teachers;
- Create a training programme for enthusiastic and non-enthusiastic (sceptical) teachers;
- Do not let entrepreneurship programmes, ideas and activities depend too much upon individual staff.

7.5 Structural embeddedness understood as the degree to which activities have become integrated, e.g. by establishing an organizational unit into the day-to-day activity of the institution and more difficult to remove (due to bureaucratic inertia). [9].
Based on observations at STU and WU:
- Create and embed a Centre for Entrepreneurship within the entire university (see 7.1);
- Create an operational and managerial structure ready to follow (possible) fast growth;
- Do not allow entrepreneurship education to be isolated study programmes;
- Create an ECTS-system rewarding students to participate in the entrepreneurship programmes.

7.6 Infrastructures understood as the appropriate teaching infrastructure and didactic forms of education to support the form of entrepreneurship education with an impact on sustainability [9].
Based on observations at STU and WU:
- Use participant-centred teaching methods and case studies;
- Make use of the availability of large amounts of (international) case studies in entrepreneurship and develop the own ones in potential cooperation with other universities – e.g. fuelled by – suitable funding and institutions;
- Focus on practice-related/assigned team projects and “learning by doing” by student teams;
- Create possibilities for traineeship programmes at (technology-driven) companies similar to the British Knowledge Transfer Partnerships;
- Make and stimulate possibilities for exchange of and international cooperation among students and professors.
7.7 Alignment with institutional strategy that is manifested in two ways, firstly, congruence with basic values and secondly with teaching and learning strategy [9].

Based on observations at STU and WU:
- Create a specific vision as well as consistency with regard to entrepreneurship education on individual programme level;
- Gain strong support at the board of directors of the university and have it formulated in the university mission statement/goals;
- Make entrepreneurship a challenge for the board of directors of the university and keep the executives informed and involved;
- Create support at boards of individual faculties (that need to be involved) and keep the executives informed and involved;
- Disperse entrepreneurial activities in all educational phases.

7.8 Community engagement understood as relationships with entrepreneurs and other [local] community groups are important in the vibrancy of the entrepreneurship education [9].

Based on observations at STU and WU:
- Create technology/knowledge transfers and promote “networking” among the university and its business environment (“win-win”);
- Create partnerships with other universities;
- Create a successful incubator institution next to a CfE;
- Make the CfE and the incubator work closely together;
- Enhance current contacts with the business community, (collegial) universities of technology and other third parties (to partner up in the development process);
- Make the business environment enthusiastic and allow them to partner and cooperate;
- Establish contacts with superior schools of business, as well as universities of technology enabling extensive “benchmarks” and knowledge transfers in the process of preparing and implementing entrepreneurship education.

7.9 Alignments with policy context and funding understood as the funding regime, the audit mechanisms and the quality assurance methods applied all having an influence on the development and management of universities. [9].

Based on observations at STU and WU:
- Create awareness and commitment on a political/municipal, regional and governmental level in order to create (some kind of) state financing/subsidies.

An entrepreneurial university might be understood as a university where its management, students and staff of all disciplines are structurally encouraged to think and act in an entrepreneurial way. Some further guidance on implementation of entrepreneurial university may be used from [3, p. 8], where three alternative organisation models for the entrepreneurial university are proposed:
- the fully integrated and embedded model
- the intermediate: university-led model
- the external support model: stakeholder driven model

The STU might specifically adopt the elements of the intermediate models using also some implemented elements of the fully integrated model. Even the WU is on the way to establish and improve the university-led model with the incorporation of elements from the fully integrated and embedded model and the external support model.

The proposed framework could be adopted as a tool in this process. We feel that an entrepreneurial university should offer a great variety of interdisciplinary research and education (both in science, engineering and business) for students of all faculties, with a special focus upon training and working in interdisciplinary teams on case studies and (possibly real-life) business-related projects. In order to achieve these goals suitable organizational foundations appear to be most helpful, above of all:
- creation of a university body acting in the role of Entrepreneurship Centre, for curricular and extracurricular activities geared at entrepreneurship promotion and support, such as business plan contests
in close cooperation with businesses, summer schools, awareness lecture schemes, entrepreneurship “road shows” (e.g. by venture capital companies), as well as suitable ways of contracted cooperation of students and professors with businesses (e.g. topics of BSc., MSc. theses or projects should be embedded in curricular activities at all times.

- university incubator of technology, technology transfer office and valorization centre, and
- possibly a regional /university related (but not exclusively) business angel network or entrepreneurs association along with an efficient mode of cooperation among these institutions,
- as well as efficient networks of the above mentioned university units to businesses, regional authorities, regional development agencies or entrepreneurship and innovation support agencies.

CONCLUSIONS

Nation’s prosperity and well-being depends greatly on turning science and technology research and development into education, into innovation, into jobs and start-up companies and last not least into Regional development.

We need to develop an S&T education system that teaches collaborative competencies and technical knowledge and skills. This may include providing more course work on systems integration, entrepreneurship, managing global technology teams, and understanding how cross-cultural differences influence technology development.

We need thinking across boundaries. The Campus is where all fields can intersect. And in addition, private firms and investors, governmental agencies and non-profit organisations, all come to campus for cooperation in education, research and development and innovation, for joint projects, for sponsoring, to breed and recruit talents, to search for new ideas and we – universities - go out to them.

Around universities: that is where the high-impact entrepreneurs of tomorrow can build and grow. Consequently, Universities have to become more entrepreneurial – not only in what they teach and how they teach it, but also in how they operate, to transform the university into a more responsive, more risk-taking and entrepreneurial institution and in teaching entrepreneurial skills to young people. So universities are increasing the pool of those who may go on to start and successfully grow entrepreneurial ventures. However, obtaining the advantages for societies and for higher education institutions themselves requires a move from the past practices to welcome a more entrepreneurial vision of the university, to stress the importance of integrating entrepreneurship in the wider curriculum, using interactive teaching methods and profiling role models. It is necessary to create “entrepreneurship across the campus” that is better fitted to todays’ and tomorrows’ economies and societies.

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INCUBATION
EXPLORING THE EFFECTIVENESS OF A WORK INTEGRATED LEARNING PROGRAMME IN CONTRIBUTING TOWARDS THE EMPLOYABILITY OF GRADUATES: THE GRADUATE INTERNS’S PERSPECTIVE

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ABSTRACT

The objective of this research was to determine the effectiveness of a work integrated learning programme in contributing to the employability of graduate interns. A questionnaire measuring soft skills training, technical skills training and mentorship was developed and administered among a convenience sample of Graduate (N=79) in a ICT company. The findings confirmed the importance and effectiveness of soft skills and technical skills training and mentorship in enhancing the employability of graduate interns. The findings also showed the importance of a well structured work integrated learning programme in the enhancement of mentorship effectiveness. Recommendations for future research and practice are made.

Keywords: Work Integrated Learning Program, Graduate interns, soft skills training, technical skills training, mentorship,

1. INTRODUCTION

Higher education institutions have a significant role to play in a nation's wealth with its hard-edged capacity to foster intellectual capital, economic growth, stimulate development and innovation in a 'knowledge economy' (Barling, cited in Barkhuizen, 2005). In this context higher education institutions have both a responsibility and accountability for building theoretical knowledge and skills required for professional practice within a chosen field and contribute to the employability of graduates (Bates, 2008; Costley, 2007; Heerde & Murphy, 2009; Kruss, 2004; McIlveen & Pensiero, 2008).

Research evidence however suggests that a tertiary qualification does not necessarily prepare students for the work environment (Kruss, 2004; Griesel & Parker, 2008; Reinhard, 2006). In practice it is still found that not enough is done to prepare the graduates to adopt the workplace, both from a psychological (soft skill) point-of-view and technical capability. Consequently, employers are not able to use new graduates to fill their skill requirements because of a lack of practical skills and experience, the wrong types of graduates being produced, graduates who are not of a high quality and graduates not suited for specialist positions (Scottish Higher Education Funding Council, 2003; Development Policy Research Unit, cited in Pop & Barkhuizen, 2010a)

Consequently, organisations invest in work integrated learning programmes to attract, develop and retain high calibre graduate interns (Ingram, Bruning & Mikawoz, 2009; Kanye & Crous, 2007). Work integrated learning programmes are focused training where graduate interns are provided with an opportunity to learn from the various areas of expertise of an employer (Buhlunlu & Metcalfe, 2001, p. 67). The Scottish Higher Education Funding Council (2003) maintains that programmes to assist graduates to thrive in the real-world context of the workplace by, providing opportunities to maximize the assets (knowledge) they acquire through the university experience, will optimise their successful transition into organisations. Work-integrated learning thus has a significant role in the development of graduate skills and competencies and to produce graduates that are more “work ready” (Coll & Zegwaard, 2006; Costa, 2009). Researchers argue that the structure of WIL programmes provides graduates with organisational and cultural experiences that facilitate mastery in a variety of work related areas (Ingram et al., 2009).

This research sets out to explore the effectiveness of a work integrated learning programme in contributing toward graduate employability from the perspective of the graduate interns who participated in the program.
In the next section of the paper we will briefly discuss the relevant literature as it relates to the components (i.e. skills training and mentorship) of the work integrated learning programme.

2. LITERATURE REVIEW

Graduate Skills Requirements
The war for graduate talent necessitates the development of very specific skills required by the workplace in the 21st century. Companies are continuously assessing their current staff and future recruits on their soft and business/hard/technical skills (Clymer, Roberts & Strawn, 2001; Collective Resources, 2008). Many researchers have found that soft skills are an important contributor to the employability of graduate interns (i.e. Clymer, Roberts & Strawn, 2001; Coll & Zegwaard, 2006; Collective Resources, 2008; DPRU, 2007; Griesel & Parker, 2008; Menocelli, 2006; Pearce, 2007; Raftopoulous, Coetzee & Visser, 2009; Scottish Higher Education Funding Council, 2003). Some of the most important soft skills highlighted include amongst others: interpersonal skills, motivation, good inter-personal communication skills, business skills and etiquette, team spirit and cohesiveness and showing interest.

In addition researchers also identified academic and technical skills as an important category of skills required of graduates in the workplace (Clymer et al, 2001; Datta, Pellissery & Paul, 2007; Stanz & Mosoenyane, 2008; Raftopoulous et al., 2009). The lack of soft skills, workplace readiness and experience are many times the key considerations why organizations require work integrated learning programmes as a part of the student’s tertiary education (Eigsti, 2009; Kanye & Crous, 2007).

Mentorship
Mentorship also forms an integral part of work integrated learning programmes (Ingram et al., 2009). Mentors play a critical role in smoothing the transition of new graduates in the workplace and to make the transition from novice to expert (Beecroft, Santher, Lacy, Kunzman & Dorey, 2006; Berezuik, 2010). In most cases mentors are assigned to graduate interns to facilitate the learning process and guide the professional development and growth of the intern (Janse van Rensburg & Roodt, 2005).

Research has shown that protégés have greater career satisfaction, receive higher compensation and are more committed to their careers and organisations than employees without a mentor (see Henson, 2006; Ingram et al., 2009). Berezuik (2010) further maintains that new graduates can become competent and efficient more easily if they are guided by mentors. Previous research has shown that the mentorship process is an important contributor to the employability and retention of graduate interns, learners and artisans in organisations (see Mummenthey & Du Preez, 2010; Pop & Barkhuizen, 2010b; Van Rooyen, Du Toit, Botha & Rothmann, 2010). Having a proper mentoring system and programme is therefore vital for the employability and retention of graduate interns (Beck-Howard, 2009; Eigsti, 2009; Henson, 2006; Lo & Ramayah, 2011).

Against this background the main objective of this research is to explore the effectiveness of a work integrated learning programme from the perspective of the graduates who participated in the programme. More specifically we explore the graduate intern’s perspective of the effectiveness of the components of the programme i.e. soft skills training and technical skills training and mentorship toward contributing to their employability. This programme was established to appoint ICT graduates from designated groups on a work integrated learning programme and develop them during an eight month period to prepare them for employability and retention in the company. The programme focused on soft and technical skills training for the graduate interns in addition to mentorship. In this paper we focus on the descriptive and qualitative findings of the research as supported by the quantitative findings in previous publications (see Pop & Barkhuizen, 2010a, b).

In the next section of the paper we will present the research method adopted for this study followed by the research findings and discussion of the findings. We conclude this paper with recommendations for future research and practice.
3. RESEARCH DESIGN AND METHODS
An exploratory research design was followed using a combination of quantitative and qualitative data collection methods.

Target Population and Sample
This research focused on an ICT company that has implemented a graduate internship programme for IT graduates. A purposive sample was taken from Graduate Interns (N=79), who participated in the internship programme. This represented a response rate of 61%. In this sample Graduate intern respondents were primarily male (52%), aged between 20-24 years (50%) and hold bachelor degrees (64%).

Measurements
A questionnaire was developed to measure the effectiveness of the components (i.e. soft skills training, technical skills training and mentorship) of the graduate internship programme

• **Soft skills** - A soft skills questionnaire was developed based on the content of the soft skills training in the graduate internship programme. The questionnaire consisted of 16 items. Each respondent was asked to indicate the extent to which the programme contributed to his/her competence in the skills listed on a scale from 1 to 5: 1 = to no extent and 5 = to a large extent. The respondent was then asked to rank the importance of 16 listed skills on a scale from 1 to 4: 1 = Insignificant and 4 = Very important. After completion of this questionnaire the respondent was asked to identify any other important skills that were not addressed in the internship training. Finally the respondent was asked to rank the five most important graduate soft skills.

• **Technical skills** – The respondents were asked whether the technical skills training contributed to their employability. Respondents were required to answer either Yes or No.

• **Mentorship** - An adapted version of the Mentorship Role Questionnaire (Janse Van Rensburg and Roodt, 2005) was used to measure the frequency of interaction, quality of mentorship and the roles of the mentor from the perspective of the graduate intern. The questionnaire measured the frequency of interaction, quality of mentorship and the roles of a mentor. The MRQ measure has a 5-point intensity scale: to no extent (1) and to a large extent (5), and never (1) to always (5). Mentors were asked to indicate the extent to which the graduate internship programme enabled him/her to act as a mentor on a five point scale ranging from 1 = to no extent to 5 = to a large extent.

Open ended questions were included in each section to substantiate the quantitative findings. No research hypotheses were tested as the purpose of this paper is to report on the descriptive and qualitative responses of the respondents. Please refer to other publications on this research for hypotheses testing (see Pop & Barkhuizen, 2010a, b).

Data analysis
The quantitative data was analysed by using frequency analysis in SPSS. There reliability and validity of the quantitative measurements are reported elsewhere (see Pop & Barkhuizen, 2010a; 2010b). The qualitative data was analysed using content and theme analysis. In this paper, the qualitative results were used to substantiate the quantitative results.

4. FINDINGS AND DISCUSSION
In the next section of the paper, the research findings are presented as well as the discussion of the findings.

Findings of Soft skills training
The respondents were first asked to rate the contribution of the graduate internship programme to their soft skills development. The findings are reported in Graph 1 below.
The mean scores in Graph 1 show that there is a definite need for soft skills training for graduate interns as part of a work integrated learning programme. The overall results of the soft skills training indicate that the internship programme contributed to a large extent to the soft skills of the graduate interns. On average, the graduate interns indicated that the programme training contributed most to Business etiquette, Conflict Management, Problem-solving, Self-Management and Goal-directedness soft skills.

Qualitative Findings
Some of the qualitative by the graduate interns included:

“I was looking for industry experience and I get more than I expected, the soft skill training motivates me even more. I can say the company is the best, they real know what they are doing”

and

“Internship enables one to get an on-the-job training at the same time adjusting to a corporate world in terms of how a business is run, professional conduct, dress-code etc. If conducted effectively it can produce excellent results - both to the company and an individual. It can be a very exciting opportunity and experience, the beginning of real world that enables graduates to successfully apply their academic knowledge in the corporate world. I strongly believe that organisations should invest in Internship Programmes.”

The respondents were next asked to rate the importance of the graduate internship programme to their soft skills development. The findings are reported in Graph 2 below.
The overall results indicate that the interns perceive all the soft skills in which they received training, very important. On average soft skills such as self-motivation, attentiveness, personal awareness and teamwork and goal-directedness were perceived as the most important skills. When asked to rank the most important soft skills graduate interns highlighted verbal team work, communication, self-motivation, goal-directedness and attentiveness as the most important.

**Qualitative Findings**

Some of the qualitative responses by the graduate interns included:

"Internship programme helps students to acquire skills so that they can get jobs easily, so I think it is very important" and "I think it's important that the company takes graduates and give them exposure to the workplace and get them ready for employment. I believe that the skills acquired during the internship programme will benefit a company in the long run".

In addition, graduate interns indicated people management, networking skills, diversity management, time management and listening skills as soft skills they would prefer to receive training in. One of the graduate interns for example mentioned:

"Ubuntu, although it might not be considered to be important by some people. The "Give a hand" project that the interns coordinated, taught us values that some of us continue to live by up until today".

**Discussion of findings relating to Soft Skills Training**

Our findings are in line with several research studies that found that the benefits of undertaking work experience while studying include developing a work ethic, developing personal skills, time management, relating to other people and workplace etiquette, communication (which in some disciplines were not considered to be taught as part of the degree) and applying learning and the ability to continue learning (see Clymer, Roberts & Straw, 2001; Coll & Zegwaard, 2006; Collective Resources, 2008; DPRU, 2007; Griesel & Parker, 2008; Menocelli, 2006; Pearce, 2007; Raftopoulous, Coetzee & Visser, 2009; Scottish Higher Education Funding Council, 2003). Hughey and Mussnug (cited in Raftopulous et al., 2009) also indicated that better decision-making and problem-solving skills help employees remain employable.
Findings of Technical Skills Training

Our findings showed that 82.3% of interns felt that their technical training contributed to their technical skills, while 17.7% indicated that it was not sufficient. Some of the qualitative responses showed that the interns identified the need for more job specific technical training for the positions they were appointed in during the internship programme.

As mentioned by one of the interns:

“Yes my expectations were met but not fully. I feel that interns need to be placed in the field they had studied for at skill then let them explore other fields”.

Another graduate intern added

“I was hoping to get lots of opportunities and develop myself more in the dynamic field of Technology but to some extent, there were limitations”.

Other interns highlighted the need for the technical training to occur earlier in the programme.

Discussion of findings relating to Technical Skills Training

The above findings are important as science and technology stakeholders place considerable emphasis on cognitive (i.e. technical skills) in the employability of IT graduates (Coll & Zegwaard (2006). Our findings are also in line with previous research indicating that learning must include practical training (Bischoff and Govender, cited by Stanz & Mosoenyane, 2008). Recent research has identified the academic and technical skills as the most important category of skills required of graduates in the world of work (Datta, Pellissery & Paul, 2007; Raftopoulos et al., 2009). Clearly graduates need very specific skills in a technology-dependent workplace in the 21st century (Raftopoulos et al., 2009).

Findings on Mentorship

The findings on the mentorship roles are reported in Graph 3 below.
From Graph 3 it is evident that the graduate interns perceived the mentorship experience in the organisation positively. The findings clearly indicate a need for mentorship as an integral part of the graduate internship programme. On average, other findings also indicated that the intern benefited to a large extent from interactions with the mentor, received professional guidance from the mentor, received challenging assignments to improve his/her competence mentors displayed content expertise and mentors provided constructive and useful feedback on interns’ performance.

Qualitative findings:
The majority of the interns experienced the mentoring programme as positive as the programme offered them exposure and contributed to gaining more self-confidence and this in itself contributed to their own motivation. As mentioned by a graduate intern:

“My mentor/s had confidence in me and instilled a lot of knowledge and etiquette of professional conduct. My mentor/s gave me practical hands-on experience and how I should handle problems.”

Another graduate intern stated:

“I personally feel privileged to have had a mentor who was concerned and interested in our development. I received more than I bargained for”

and

“It's very important that you have a mentor who is always willing to help and guide you when you need it. I believe mentorship in internship programmes motivates interns and makes them more productive.”

A few interns experienced their mentors as unwilling to share knowledge as they were threatened by the interns and in these instances even though mentors had a willingness to support the programme they did not demonstrate the required interpersonal skills to guide the intern, which resulted in a negative experience for the intern. As mentioned by a graduate:

I think there should be a greater priority placed on finding suitable mentors as it plays a huge role in moulding an intern. It can clearly be seen that lackadaisical mentors (due to their personal growth within the company or just by nature) lead to lackadaisical interns which is not a good quality for growth.”

Another graduate intern added:

“The mentor I was placed under was not the right person to mentor young professionals coming into the business. I gained more from other senior members than I did from my mentor. I feel no background check was done when selecting mentor i.e. no consideration was given who would add the most value in development of the intern.”

Discussion of findings relating to Mentorship
From the above findings, it is evident that there is a need for mentorship as an integral part of the graduate internship programme. A mentor, who guides supports and counsels youth as they navigate their way through the world of work, will thus yield positive results (Stanz & Moseoanyane, 2008). In this context, our findings support the mentee benefits as indicated Ingram et al. (2009). Furthermore, our findings also confirm that the role of the mentor is indeed to guide the professional development of the mentee and knowledge, experience and organizational perspectives are shared candidly within a context of mutual respect and trust” (see Janse van Rensburg & Roodt, 2005). In this research it was also evident that the role of the mentor is indeed to guide the professional development of the mentee and knowledge, experience and organizational perspectives are shared candidly within a context of mutual respect and trust” (see Janse van Rensburg & Roodt, 2005; Kram, 1985).In addition, our findings also highlighted the need for matching the right mentor and graduate intern to ensure the success of the mentoring process (Berezuik, 2010).

5. CONCLUSION
In conclusion, our research highlighted the importance of soft and technical skills training and mentorship as an integral part of an effective work integrated learning programme. The overall findings of the soft skills training indicated that the internship programme contributed to a large extent to the soft skills of the graduate interns and were also viewed as important for graduate employability. Based on the findings one can thus conclude that the graduate internship programme contributed to the most important soft skills identified for
employability. The majority of the interns experienced the mentoring programme as positive since the programme offered them exposure and contributed to gaining more self-confidence and this in itself contributed to their own motivation. The results clearly indicate a need for mentorship as an integral part of the graduate internship programme.

Limitations
As with any research, this study also had some limitations. First, a purposive sample was used at one specific ICT company. This means that the findings of this research cannot be generalised to the wider population. Secondly, the sample size limited the research in terms of the types of data analyses that could be used. For example, the demographic distribution of the sample limited the researchers in terms of Anova analyses to test for significant differences between the components of the work integrated learning programme. However, the type of data analyses in this paper is sufficient for the objective that we wanted to achieve for this research

Recommendations
The following recommendations for future research are posited:

The present research took the format of a post-test only. This limited the researcher in terms of determining the contribution of the soft skills training, technical training and mentorship from an intern and mentor’s point of view. Action research should be undertaken with intervention training where measurements can be made on a consistent basis to determine whether the internship programme contributes to the soft skills of the graduate intern progressively. The methodology to measure soft skills should also be expanded to include observations.

The data gathered, analysed and interpreted by this research allows for the following recommendations when implementing a work integrated learning programme:

Training
• Conduct technical and soft skill training earlier in the programme
• Align graduate qualifications with relevant business unit or department

Internship Programme Process
• Reduce numbers of interns in order to make the programme more manageable
• Increase remuneration as intern shows progress and performance
• Rotate interns in order for them to discover their interest
• Consider extending the programme to a full year

Mentorship Process
• Formalise daily activities in a more structured manner
• More regular feedback from management on intern progress
• Shadowing senior employees
• Line managers and mentors need to inform their respective departments about interns being placed in their environment
• Line managers and mentors that indicated a need for interns need to ensure enough work is available to keep interns busy
• Implement a structured training and development plan per intern in business area appointed

Mentor Selection and Involvement
• Ensure that mentors are suitable and have the inclination for mentoring
• Managers play an essential role in the success of the programme, therefore buy-in from the business to support the programme from the beginning to end is essential
6. REFERENCES


CONCEPTUALISING THE SELECTION PROCESS OF BUSINESS INCUBATORS: A PROPOSED FRAMEWORK

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ABSTRACT

The business incubation process consists of sub processes namely selection, business support, mediation and graduation. The literature proposes that selection of incubatees has potential to influence the success rate of the incubation process.

This paper proposes a conceptual framework to improve the selection process of the incubation process. Incubator type, incubator objectives, stage in life-cycle of incubator as well as critical success factors have been identified as key factors and are proposed for consideration in the selection process. It is argued that the selection process informs the incubation process, distribution of roles between incubatee and incubator and acquisition and development of identified resource gaps.

1. INTRODUCTION

The small medium and micro enterprise (SMME) sector holds promise for advancement of innovation, competing in niche markets even absorbing ‘surplus’ labour. The failure rate of small business is significant in many countries and government, non-governmental and private sector agencies established programs to support development in the SMME sector. One such program, relatively young in South Africa, is business incubation (BI). BI has taken root in developing and transition economies and evolved from providing affordable premises and shared facilities to supporting knowledge-based businesses at an international level, [1] and incubating technology and growth orientated firms, [2].

BI, started in the 1950s as a mechanism to re-energise surplus human resources from declining manufacturing regions in the USA [3] also in the United Kingdom in the mid 1970’s [4]. BI evolved to a platform of convergence for support systems of business development in a synergistic way [5] and can be utilised to address more than just socio-economic activity [6].

Business incubators (Birs) proved an effective multi-faceted economic development mechanism. Successes documented include being effective high value-added job creators, [6], creation of jobs at a lower cost a person on welfare, [7]; [6], return on investment of 5:1 per dollar of public funding from a taxation perspective, [6]; [8] even a counter measure to unemployment, [7]; [6]. Colombo & Demastro, [9], found incubated firms outperformed non-incubated firms and accessed public funding more easily, they show promise to be more growth orientated than similar non-incubated firms. Birs generate synergy and a nurturing ecosystem that provides and unlocks resources needed to overcome potential market failure of the incubatees, [10].

A significant body of research were developed since the mid 1980’s on Birs. Limited research was done on the incubation process and it is required to better understand the associated variables, theories predicting outcomes developed, [11] and test new theories, [12]. This paper is a contribution which attempts to unpack the selection process. It takes a dynamic perspective of the BI process and incorporates a more strategic and comprehensive approach for selection.

The paper is structured as follows: section 2 provides a working definition for BI, section 3 presents the BI process, section 4 identifies the dimensions of the selection process from the literature, section 5 deals with details of the selection process, two South African case studies are presented in section 6 and 7, section 8 synthesise the study proposing a selection frame-work, section 9 concludes the study with suggestions for further research.
2. DEFINING BUSINESS INCUBATION AND THE GOAL OF Birs

Numerous definitions of Birs are found in the BI literature, see Hackett and Dilts, (2004b) for a detailed overview of definitions. This paper assumes the definition by the largest BI organisation, the National Business Incubator Association (NBIA), “Business incubation is a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services.” [13]. “A business incubator’s main goal is to produce successful firms that will leave the program financially viable and freestanding.” [13]. Two issues are addressed, what BI is about and the primary goal of Birs. Birs do not guarantee success; it increases the success of incubated businesses by bringing together businesses, [14] for shared support and learning.

3. BUSINESS INCUBATION PROCESS

The BI process consists of four primary activities: selection, business support, mediation and graduation. Selection is discussed in detail below. Business support is activities addressing resource deficiencies, which should preferably be co-produced episodic or continual, either incubatee or incubator initiated, [15]. Mediation is facilitating networks between incubatees and external parties, [3]. Developing networks are critical functions for incubators to bridge the newness liability of the incubatee and resources gap the incubator itself is unable to fill, [15]. Graduation is facilitating the exit of the incubatee from the incubation program.

4. SELECTION PRACTICES OF INCUBATORS: A SELECTED LITERATURE OVERVIEW

Selection refers to the process concerning which ventures to accept for incubation, [3] using incubator specific criteria, [14], [3]. Selection is an important component of the BI process, [14], [16], [17], because it has potential to influence the BI process, [12]. The criteria for selection seem to be primarily focused on the incubatee by most commentators. Lumpkin & Ireland, [14] however, argues that critical success factors be used for selection, they found the market, team and financials important dimensions for the selection process and incorporates incubator characteristics to influence selection. Birs evolve through different stages of its life-cycle and has to adapt selection strategies accordingly, [18]. Hackett & Dilts, [12], propose that BI performance is directly related to selection, business support and resource munificence: \[ BIP = f(SP + M&BAI + RM) \]; where \( BIP \) = business incubation performance, \( SP \) = selection performance, \( M&BAI \) = monitoring and business assistance intensity, and \( RM \) = resource munificence.

The dimensions found most influential on the selection component of BI in this study are incubator type, [19], [18], [10], stage in the life-cycle of the incubator [18] incubator objectives, [20], and critical success factors of the incubator and the incubatee, [14]. These dimensions are discussed below.

5. SELECTION PROCESS

Well balanced selection strategies can reduce failure of incubatees [21] and improve efficiencies. Figure 1 shows the primary influencing factors of selection to be type of incubator, objectives of the incubator, stage in the life-cycle of the incubator and critical success factors for the incubator and the potential incubatee. Three categories of applicants are possible: those that firstly, cannot be helped, secondly hold promise but need incubation and thirdly do not need incubation [11]. In a pilot study conducted on six incubator centres in South Africa [22], the most significant hampering factors found were inappropriate incubatees. Comments of centre managers noted were ‘they were not entrepreneurial enough’, indicative of weakness in the selection process.
5.1. THE TYPE OF BUSINESS INCUBATOR

Birs have been classified and categorised, Smilor, [19] classified Birs into two main categories either for profit or not-for profit. In the case of Bandwidth Barn, the case study below, further classification is required to accommodate, a mixed model, called ‘Hybrid’. Table 1 shows further classification of not-for profit incubators are public, university and corporate incubators. University incubators are intricately linked to universities primarily for commercialising research generated and corporate incubators serve strategic corporate purposes. Table 1 shows Birs that operate for purposes of real estate and business support, which according to Allen & McCluskey, [18] depends on the stage in life-cycle.

<table>
<thead>
<tr>
<th>Classification of Birs</th>
<th>First level classification</th>
<th>Second level classification</th>
<th>Primary objective</th>
<th>Secondary objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>For profit</td>
<td>Private Birs,</td>
<td>real estate model</td>
<td>Generation of profit</td>
<td></td>
</tr>
<tr>
<td>Hybrid</td>
<td>Mixed model,</td>
<td>real estate and business support</td>
<td>Employment creation, Promotion of certain types of activity, Generation of profit</td>
<td></td>
</tr>
<tr>
<td>Not for profit</td>
<td>Public Birs,</td>
<td>business support model</td>
<td>Employment, Stimulation of economy, Rejuvenation of industrial zones,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University-related</td>
<td>Technology transfer model</td>
<td>Commercialisation of technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corporate Birs,</td>
<td>Strategic purpose</td>
<td>Profit, Growth, Market development, Integration [23]</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Smilor [19] and Allen & McCluskey [18].

Objectives and classification of incubators determines the style, role and function of the management, levels and degree of sophistication with regard to networking activities and resources allocation. The type of business incubator influence the selection process, for profit Birs primary concern is the ability to cover the rent and would not accept companies that are not actively trading while public incubators selection criteria...
are influenced by funders’ objectives [14]. Employment and SMME creation are key performance indicators, determined by sponsors who have leverage to influence goals of the incubator, [24] which is evident in the case studies below.

5.2. OBJECTIVES

Business incubator objectives can be divided into three categories: Strategic objectives, incubator objectives and stakeholder/sponsor objectives.

5.2.1. Strategic objectives

Hannon, [20] proposes three strategic objectives incubators can use to position themselves, first to bring new ventures into existence, with no growth ambition, second to bring new ventures with high-growth potential into existence, and third to supporting new and existing ventures to grow. Each objective has different management, risk and also resource and environment implications [20]. Quality of management, resources and environment must be aligned with the strategic objectives for example incubator management and network competence will be different for developing a start-up business than for supporting a growing venture, [20].

5.2.2. Business incubator objectives

BIs has potential for contributing towards a number of objectives, employment creation, stimulating economic activity by creating companies, generating profit, commercialise and transfer technology, rejuvenating industrial zones, diversifying industrial profile, promote specific activities, and promote target population groups, [7]. These objectives are only achieved once successful businesses are developed hence they are secondary objectives, [14]. There may exist a degree of mutual exclusivity and/or inclusivity between these objectives.

5.2.3. Stakeholder objectives

Stakeholders influence objectives and key performance indicators (kpis) of BIs, [14]. Governments’ concerns for job creation require direct and indirect jobs created as kpis of incubators they fund. Private incubators have profit motives seeking rent paying ability as a kpi. These influences are counterproductive, because misalignment between primary and secondary objectives, create tension for incubator management. For the effective and efficient management of resources the BI process must be aligned to the strategic objectives of the incubator, [14].

5.3. CRITICAL SUCCESS FACTORS (CSFs)

5.3.1. CSFs for BIs

BIs are also businesses and there will be some commonality between success factors for a small business and success factors for an incubator. Lee & Osteryoung, [24] developed a broad framework of success factors for BIs which include the goals, resources (physical and human), services and the network program; Buys & Mbewana, [25] found access to expertise and facilities of science and technology, funding, quality of entrepreneurs and management, stakeholders, government policies, sustainability and networking to be important factors for success of incubators in the South African context. A distinction is made between the factors deemed necessary and sufficient for the success of BIs and those for an incubatee.

5.3.2. CSFs for incubatees

A critical success factor approach is a comprehensive approach to identify factors critical to the success of the firm, defined as internal or external factors sufficiently significant that they require special attention [26]. In their study Lumpkin & Ireland, [14] found 85% of the cases CSFs were considered for screening incubatees, and suggests that CSFs be used by BIs in selecting viable projects. The CSFs found useful by Lumpkin and Ireland, [14] and suggested by Dickinson, Ferguson & Sicar, [26] for a small business
correlates with practice, see case study of Furntech below. The critical success factors proposed for selection of incubatees are management team or a person capable to deliver; a defined or attractive market; profitable financial model; [14], as well as unique and marketable offering [26], such as a service and/or product. Better understanding the CSFs for an incubatee will enhance the capabilities of the business incubator to better manage resources in supporting and/or developing incubatees.

5.4. TEAM

A successful team requires competencies in entrepreneurial management, business management, technical ability and sustainable competitiveness. The quality of entrepreneur or team is critical for successful incubation, [25]. Requirements for an effective entrepreneurial management team are specific skills which include problem solving skill, communication skills, planning decision making, project managing, negotiation, managing external relations and administrative skills, [27]. Entrepreneurial orientation drives entrepreneurial activity, [28]. Entrepreneurial orientation has been defined in terms of dimensions, autonomy, innovativeness, risk-taking, competitive aggressiveness, proactiveness [29], stability and learning orientation, achievement orientation and personal integrity [28]. Business management implies functional skills to manage a business such as marketing, finance, operations, human resource and so forth. Technical ability refers to the competencies to produce the product and/or service. Sustainable competitiveness competence refers to ability to assess resources and capabilities in relation to competition and leverage advantage by configuring resources and capabilities to exploit opportunities, [30]. In the context of this debate, configuring resources must be done from a small and medium enterprise perspective with limited degree of complexity and limited strategic analytical skills, [31].

5.5. MARKET

Markets targeted should not be declining markets, but rather unexploited, growing or even existing markets, where needs for new products/services are identified; high potential defined markets are characterised by homogenous group of customers where premium and sustainable revenues are realizable and verifiable, [27].

5.6. PROFITABLE ECONOMIC MODEL

An efficient firm operates on a sustainably profitable economic model able to leverage its margin, the difference between price (p) and cost ©, in the face of fierce competition. That means, (p – c) is maximised allowing the firm to reduce its price and still compete in the market, a consequence of innovation, [32].

5.7. UNIQUE OFFERING

A unique offering is an idea proposed being a viable opportunity differentiated from existing offerings; Timmons & Spinelli, [27], suggests that an idea is an opportunity when it solves a problem and create value which market is prepared to pay a premium for there exist a good fit between the team, market and the economic model used to ensure fair return for the risk. The firms’ required resources have to be valuable, rare, and not easily imitated nor easily substituted; [33]; in addition, [31] suggests durability (reap long term benefits) and appropriability (ability to exploit market advantages) of the resources for sustainable competitive advantage. It is argued here that small business do not usually have the market power nor the capability to exercise strategies such as monopolising, integration and similar strategies, to gain industry attractiveness, as suggested by Grant [30] which lie well within the capability of large enterprises (Les). Strategies for small businesses must be simple and resource efficient, [31]. Rangone, [31] further suggests that SMMEs sustainable competitive advantage be modelled on three basic capabilities: innovation capability, production capability and market management capability.

5.8. STAGE IN THE LIFE-CYCLE OF THE INCUBATOR

The business incubator life-cycle spans three distinct stages each with its own identifiable characteristics. Allen & McCluskey, [18] refers to these stages as start-up, business development and maturity. The first stage being ‘start-up’, which is characterised by managing the real estate issues and attracting tenants; the second stage known as the business development stage, when the incubator is on breaking even and the focus
shifts to business development and the management's primary activity will be to nurture the businesses, and the third stage is maturity, characterised by demand for space in the incubator outstripping supply and the issues around increasing throughput and entrance and exit policies receive high priority. Peters, Rice & Sundararajan [34] found incubators learn the needs of tenants as they grow. When the incubator is in its first stage preference will be given to ventures able to afford the rental, trading businesses. As the incubator grows to the second stage, it will have attained reasonable levels of resource munificence, preference will be given to tenants with deficiencies in their resource composition and configuration, and when the incubator reaches the stage of maturity, its learning and experience will have increased substantially and policies and processes will be reviewed.

6. **CASE 1 – FURNTECH**

Furntech is a business incubator in the furniture manufacturing industry sector with seven incubator centres, in various locations across South Africa and has its head office in Cape Town. It is registered as a ‘Public Trust’ and registered as Furniture technology centre trust: Trading as Furntech. Furntech was established as a result of interaction between the Swedish government agency SIDA and the South African government's Department of Trade and Industry (DTI) with the aim to facilitate technical skills development in the furniture manufacturing industry sector. The board consists of seven members representing national government, academia, industry, local government, organised labour, industry board, and specialised technology department of DTI.

Furntech has a staff compliment of more than forty, five senior managers (including the CEO), one business development officer, one events planner, office staff, and reception. The facility manages a floor area of 42,927 square meters of which 19,731 is for rental, approximately 80% of the balance is used for showrooms and communal workshops and the rest of the space is used for staff offices, ablution, and training rooms. The top three key performance indicators (KPIs) prescribed to Furntech by its funders, primarily government, on which it is evaluated for continuous funding are number of jobs created, SMMEs established and turnover generated by SMMEs. In response to their KPIs, a recruitment strategy is to train unemployed youth for the job market of which 25% end up as start-up businesses for the incubator. A ratio of 70% start-up ventures to 30% existing ventures for incubation satisfied their KPIs thus far, which at times compromised the quality of clients that could have been taken into incubation. Furntech reported an income of just over R15 million of which just under R1 million was generated from rental.

Since inception, 203 SMMEs have been established, 401 clients received business support (includes the 203 SMMEs established), and producing 357 direct jobs and 795 indirect jobs (2.1 indirect jobs for every direct job). The average educational level of its clients is grade 11, (one grade below University entrance grade for South Africa) primarily technical qualifications. Opportunities developed for its clients include exposure to international business and industrial practices and export opportunities. Selection criteria priority order has changed recently. The criteria used earlier in order of priority are firstly viability of idea, followed by potential market, followed by quality/capability of entrepreneur or team and lastly financial viability of the business model. Recently, entrepreneur or team is the priority criteria followed by market then idea and lastly financial viability. Furntech has a success rate of around 70%.

7. **CASE 2 – THE BANDWIDTH BARN (BWB)**

BWB is a business incubator in the Information Technologies sector located in Cape Town, South Africa. BWB was established in 2000 as a subsidiary company of the Cape IT Initiative (CITI) with a not for profit strategy. CITI’s stakeholders include Industry, Government, and Academia. The mission of the Bandwidth Barn is to fast track ICT business growth by assisting businesses to establish themselves and accelerate their growth, providing support to overcome entry barriers. In this way they contribute to job and wealth creation in the region. The board consists of eight members representing primarily private sector in the ICT industry, CITI and funding stakeholders. BWB is indirectly funded by local and regional government via CITI. BWB has a staff compliment of twelve, which includes the General Manager, operations manager project coordinator, administration, reception, and housekeeping.
The facility manages a floor area of 2250 square meters of which approximately 700 square meters is shared space and the rest approximately 1500 square meters is rentable. The BWB can be termed a hybrid incubator, since it can be located between a real estate, a business development and recently an accelerator model. BWB, besides doing one on one mentorship, mediation and other business support activities, developed a series of business establishment and development programs that serve businesses from before inception, their ‘New Venture Creation Programme’ to a ‘peer to peer’ program that assist businesses in the more advanced stage called ‘My Business Group’.

BWB has on average 65 resident SMMEs at any point in time, approximately 300 clients received business support, and producing 556 direct and 140 indirect jobs (2006-2009). On the average, their clients’ have a higher education qualification. Opportunities developed for its clients include exposure to best business and industrial practices including international opportunities. Selection criteria are primarily determined by funders’ objectives. BWB has always accepted trading businesses and has of recent also included start-up businesses, and identified businesses for high growth. It takes a while to develop the knowledge and experience as an incubator which is required to venture into assisting start-up businesses and business acceleration programs. BWB has a 83% success rate for start-up businesses and 97% for growth businesses.

8. SELECTION FRAMEWORK

The process of selection will be incubator and context specific. Figure 2 shows the potential incubatee submits a formal application for admission to the incubation program (A). The selection program starts with a recruitment program when advertising for a specific profile of potential incubatees. The profile may be determined by any or a combination of the type of incubator, objectives of the incubator, and the stage in the life-cycle of the incubator. Should the incubator be in the mature stage of its life-cycle, preferred clients can be selected, and others may be referred to another incubator or alternative SMME development program.

When a good fit between resource gap of potential incubatee and incubator potential is found, incubatees are accepted into the incubation program, figure 2, (B). This means the CSFs for the business is sufficiently satisfied. When the fit is not good the gap between resource requirements of incubatee and resource potential of incubator (includes ability to unlock potential of the team) must be defined, which can of course change with time, figure 2, (C). Once the gap is defined, a plan for incubation of the business must be developed whereby the incubatee and incubator management agree on the role distribution for co-production of the envisaged firm for that specific incubatee, [15]. Of course, when the potential incubatee is not incubatable, (figure 2), path (D) is followed. It thus makes sense in the case of Bandwidth Barn, they only actively recruited new ventures and high-growth ventures at a later stage in their life-cycle; once they acquired and developed the understanding and competence. It is argued here that the output of the selection process is the input for planning management of resources the incubator and the distribution of roles in the co-production of the firm.

In the case of university incubators it is argued here that university access processes are selection processes. Selection criteria increase the probability for successful completion of studies and usually the candidates with high probability for success are selected. Quality assurances are built into university assessment programs and they invariably have access to resources not easily found in other institutions such as a student
labour, technology transfer offices, research capability and capacity [35]. This is especially the case for universities with strong focus on research and development projects. By the time the products of research and development or new technology are put forward for commercialisation, a high probability of success has already been ‘crafted’ into the offering. It is not unusual for commercially viable offerings to stem from postgraduate research, suggesting a level of age maturity in candidates [36]. The principles of the comprehensive selection process are applicable to business incubators in general, including university business incubators.

9. CONCLUSION

The purpose of this paper was to develop a selection process framework that serves as a reference for incubatee selection best practice. This paper provides a comprehensive framework accommodating the incubator objectives, incubator type, stage in the life-cycle of incubation, and critical success factors for incubator and incubatee. It provides a tool that should be very useful for incubator management in strategic configuration of allocating resources and networks so as to increase the impact of their effort, assist policy makers in strategic support decision making as well as a reference to assess and improve performance [12] and efficiencies from, since assessment of an incubator can only be based on the specific objectives of the incubator.

A comprehensive selection process is proposed as part of the incubation process, which informs the incubation process, taking into consideration the type of incubator, its stage in the life-cycle, its objectives and the CSFs of the potential incubatee and the incubator. Further research can empirically verify firstly the selection framework to ascertain best practice configurations of the model, secondly understand interactions between variables and constructs and also to determine whether selection strategies influence incubator performance and resource efficiencies in incubation processes.

10. REFERENCES


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ENTREPRENEURSHIP: RETHINKING THE FUTURE

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ABSTRACT

Entrepreneurship is a challenge that transcends the South African labour landscape; it permeates the boundaries of African states. The socio-economics in Africa, demands a diverse work force and UoTs are best positioned to deliver key competencies to the work force. Engineering is key to problem solving, but entrepreneurship expands the engineering offering by changing the environments engineering practices in. This article expropriates the engineering view regarding the importance of entrepreneurship education. The changing technological environment dictates a broad approach, one that considers the impact of the engineering but also the impact on the environment. This requires a fresh perspective, a new way of thinking. Graduating from a UoTs must mean that the graduate’s are equipped provide a solution rather than just solve the problem. This changed thinking could lead to wealth and job creation, as well as to address unemployment and poverty in the African context.

Key words: Engineering entrepreneurship, technology transference, unemployment, poverty alleviation

1. INTRODUCTION

When 12 million people in an emerging economy like South Africa is unemployment, radical interventions are required to challenge the status quo. A policy redress is required to align process thinking and the national objective. The policy change informs education, where instruction leads to reformed thinking, strategy and practice.

The South African Technology Network (SATN) 2008 reports of intent to foster technology transference and entrepreneurship as key priorities to drive changed thinking [1].

The contribution that entrepreneurs are making to economies around the world is noted, and we reflect by asking, ‘Could entrepreneurship education in engineering field, contribute to the address of unemployment and poverty in an economy such as South Africa [3, 4]?

The objective of this study then, is to note the student perception regarding engineering entrepreneurship education [5].

In a broad sense, unemployment means that people are jobless. Poverty, however, is a complex socio-economic phenomenon, underpinned by unemployment [2, 6]. A world view of poverty proposes a thinking that supersedes a pure money-metric thinking, an approach that represents the inability of actors to participate in the society due to a lack of resources. Poverty is more than simply the lack of money [7]. Conceptually, poverty speaks to a paradigm entrapment [8], the ‘one right answer’ syndrome [9], a lack of innovation [10] and a lack of creativity.

An emerging graduate view shows that the employment landscape in South Africa favored some of the population more than others. Thus graduates felt they were rendered poor and incapable to contribute effectively to the South African economy [11].

Esbach (14) and Van Rijswijk (13) says ‘adequately educated’ could mean the infusion of soft skills that are lacking in the engineering skill set.

Economic growth is dependant on technical skills and engineering competence. Diverse thinking is a graduate imperative to address national needs, not only industry needs. This disruptive thinking Schumpeter identified as being, entrepreneurship [15, 16, and 17].
2.2 DIVERSE THINKING

The 2001 National Plan for Higher Education (HE) challenges higher education to increase the participation rate from 15% to 20% by 2011. This objective has placed added pressure on HE resources. Apart from increased pressure for adult education, industry competency is dynamic; the skills requirement is constantly changing as employers set added criteria such as relevant knowledge and applicable skills to perform in industry [1].

In the dynamism of change one constant prevails and that being diversity. A changing global market, challenges the national policy, under change, emerging economies call for a change within the institution of learning. Institutions that would lead South Africa into the future must be different to the ones that served emerging economies in years gone by. Entrepreneurship is critical to continued dynamism of modern economies and job creation [1, 17].

This difference in approach that the SATN report refers to a new thinking which leads to the development of new approaches for effective combat of the challenges we face. Although the output is to be unified, the knowledge offering will be divergent perhaps placing more emphasis on meaningful innovation, technology transference and increased competitiveness [1].

Change and diversity is fundamental to the ethos of UoTs. The increased technological proliferation and rapid change is set to challenge human knowledge and its ability to manage uncertainty. Engelbart [18] offers bootstrapping as a process for engineering to deal with discontinuous progression. Having said this, SATN reports that the chaotic situation education finds itself in, requires a radical alternate strategy to lead progressive thinking. There is a real need to address the issues relating to the 47% graduates unemployment, requires diversity and a radical approach. This might be extremely challenging within an existing culture, where entrapment is evident. In such circumstances, it might prove useful to ensure that the environment be put in place to facilitate change. Such an environment will ensure that adequate resources, such as funding, policy and skills be made available [1].

The shift from product productivity to student productivity speaks to a changed mindset, a shift in perspective. This new developing culture the SATN report alludes to, challenges the status quo and the existing engineering culture at UoTs.

Introducing new thinking into an existing environment is generally met with oppose. Issues such as curriculation redress, academic ambitions, expected graduate outcome and institutional policy contributes to the negative sentiment to real change. Change is accepted to be difficult, therefore one expects that students would recognise change before the academics and the controversy between the new and the old perspectives becomes blatantly obvious. The problem is that the power to change is ceded with academia and not the students, albeit the student is the client that pays for relevant and applicable skills [1, 19].

Change the curriculum and develop an environment for student participation. Engage students in exercises that involve idea generation and self expression. Van Rijswijk (13) says that communication is key to graduate participation. It is virtually impossible for effective ‘diverse thinking’ if the academics themselves are not experienced or engaged in alternate thinking.

UoTs were established to exploit niche areas and technology transference, relevant to the environment demands. Rapidly changing technologies require rapid changing institution focus. SATN says that in producing product, services and process, the skills, expertise, knowledge and know-how must remain relevant. The effective and efficient application of which, may be construed as technology. SATN [1] reports that ‘science, engineering and management should be top priority’, Rogozin [20] thought the issue concerning the integration of engineering and humanities needed to be unpacked and offered his views towards the convergence of technical sciences and humanities.

SATN says that productivity is about making money, either our engineering faculties are not productive or they don’t understand economics because technology must make economic sense. Generally, science and engineering students come out of universities with little understanding of the real world or indeed,
the world of work. They are skilled in the science but are then faced with doing budgets, drafting strategic plans, writing reports, managing people, developing technology and applying skills, Lacquet draws our attention to the need for technical and non-technical skills, yet engineering education remains skewed towards the development of technical ability[1,21].

UoTs are in touch with reality connecting activity with financial return for society. The emphasis is to deliver employees ready for the world of work. The problem is that the existing curricula and research programmes should be less theory driven yet rigorous, and much more application driven with a huge endowment of industry partnership.

2.3 ALTERNATE THINKING

While the Secondary Education Institution (SEIs) must claim its rightful place along the education continuum, it is really the HEIs that yield opportunist entrepreneurs [22] who contribute to sustainable economic growth in South Africa. Engelbart [18] understood the importance of continuum progression, when he says that great men improve the way that they improve things, and that technological excellence is a consequence of human creativity and alternate thinking.

This creativity in the engineering fraternity presents opportunity to engineers that have the propensity, the alternate mindset, to take advantage of a niche. SATN [1] states that UoTs are characterized by searching and paying attention to niche areas. Esbach (14) found evidence of ‘entrapment’ in the faculty, as discussed by Petroski [23, 24], which negates the opportunities that any niche offers.

Entrepreneurship, in its fundamental form, speaks to change and creativity. Disseminating a sense of change, an ‘alternative thinking,’ must be the focus of the institution [1]. HEI, especially UoTs who collaborate, are able to pool their strengths, thereby awarding South Africa the opportunity to maximize the potential value that entrepreneurship holds [18].

Job creation comes about through the effort of an exclusive group of entrepreneurs with a different mindset. Audio [25] advances the notion that the bulk of jobs globally results from the efforts of 5% of all entrepreneurial activity. It is this 5% entrepreneurial effort that leads to the eradication of unemployment there must, however, be an environment conducive to entrepreneurial activity in the institution. If technology transference is pivotal to the design of the UoTs, then an enabling environment must be put in place.

Hegel’s dialectism theory on cause and effect is as pivotal to entrepreneurship theory as it is to Newtonian mechanistic physics. The fundamental strengths and tenacity, mental vigilance and creativity are element instilled within the young mind while negotiating the essential truths of physics and mathematics. The effects of academic and scientific endeavour is truly realised when expert research is commercialised, this is caused through a more proactive role played by universities.

Clark [26] says that universities that are to compete in the future must recognise that the way of doing business has changed forever. The way forward is innovative driven by a changed mindset recognising that intellectual property is the new gold. Just “being there” is no longer adequate. Part of the role of UoTs must be to provide academics with experience of the business world to allow them to translate their technical expertise into commercial terms [27].

2.4 CHANGED THINKING

Engineering has over time underpinned and continues to underpin economies around the world, but is no longer the gatekeeper of societal progressiveness [21]. The technological age has introduced rapid change that meets a dynamic customer demand. This change continues to be integrative and iterative, often presenting engineering as a static component in the economic structure.

The skills shortage in South Africa is one problem, but increasing numbers of highly educated people without guaranteed employment is another. Coetzer states: ‘This represents one of the most important
challenges facing UoTs and government: ensuring that the education system produces the mix of skills required by the labour market.’ [3, 4] that is relevant and applicable to the South African economy [1].

Mr. Vavi, Cosatu general secretary in his address to the National Skills Development Conference said: ‘One of the saddest ironies in South Africa is the coexistence of vacancies in skilled occupation alongside a mass of unemployed who lack the skills to fill the position’ [3, 4].

Professional skills are required to leapfrog South Africa out of this unemployment crisis. ‘Nothing short of a skills revolution by a nation united will eradicate South Africa from the crisis that the country faces’, said Deputy President Phumzile Mlambo-Ngcuka at the launch of the Joint Initiative for Priority Skills Acquisition [JIPSA] [3, 4].

A healthy mix of skills is required to address the needs of a growing South African economy. Such a mix includes both technical and non-technical skills [3; 4; 21]. Engineering academics must begin to recognise the value entrepreneurship offers. Evidence provided by Hindle and Rushworth [29] suggests that UoTs are still preparing graduates as good employees. Education and training has a pivotal role in the entrepreneurship capacity building process. Having said this, there is a case to be made for innovation and entrepreneurship where the scope must be employment and beyond. Alternative thinking must assess the value of all the options at hand, not all graduates will be employed, thus the need for alternate thinking.

Capacity is needed to help create the environment for the immersion of the graduates into an environment that addresses the issues associated with ‘alternate’ thinking, in a bid to develop a new mindset.

There is evidence that academics are aware of change around them, but they deem it to be macro changes. During the transformation process, the voice of change was somewhat ignorant of the fact that recurriculation needs to take place before the syllabus is changed. Academics defended their stance on ‘non-change’, by stating that the outcomes must be redefined before academic commitment to change. This was relevant to the argument and useful to understanding the perceived entrapment and the reluctance to change.

2.5 INTEGRATING ENGINEERING AND ENTREPRENEURSHIP

Engineering entrepreneurship Education (EEE) speaks to integration of technical aspects and the humanities, thereby yielding a new perspective, a new thinking.

Despite the huge interest in the subject, a definition for entrepreneurship is hard to pin down due to the varied context. It has been described as creating, founding, adapting and managing a business or enterprise [8]. This is where engineers distance themselves from entrepreneurship research. In the search for understanding how entrepreneurship impacts on engineering the researcher has been influenced, in a way that helps to explain why engineers distance themselves from the Schumpeter definition regarding the entrepreneurship phenomenon.

Lay Leng Tan captured the essence of the Thomas Magnanti view, in saying that entrepreneurship is believed to involve ‘rethinking conventional paradigms, and discarding traditional ways of doing things.’ Furthermore, writes Tan [30] Magnanti postulates that ‘contrary to popular opinion, we in engineering do not study entrepreneurship; we do entrepreneurship through the creation of products and processes that people use.’

The very nature of technical and non-technical speaks to integration. The nature of linearity and non-linearity speaks to integration. Engineers require an integrated skillset to face a rapid changing world. The integration of humanities into engineering education stimulates students to active thinking [20]. Esbach (14) found that students were persistent and determined to make a contribution to society, there is little evidence to suggest that the HEIs contributed to this enthusiasm.
The aim of engineering is to improve the lives of ordinary people by using science [16]. The aim of technology is to improve the lives of human beings [1], thus engineering entrepreneurship uses science and technology, to resolve challenges in society. Entrepreneurship affords the engineer a broadened set of skills as well as an altered perspective to address the social challenges in a rapid changing environment. Engineers might be required to engage human being when designing products for commercialization. Entrepreneurship ensures that engineers begin to adopt soft skills in order to make sense of the technological challenges [21].

The question: ‘am I, as an engineer, maximizing my return on investment by defining industry as my client?’ shows a loyalty to industry. The alternate question: what value would entrepreneurship thinking bring, when analysing my client, the industry?’ speaks to industry as a client and not the only client. This simple shift in perspective demonstrates the changed mindset. UoTs must foster progressive thinking.

Do I service the industry by supplying services or products, or is there an alternative to industry? This line of probing inadvertently results in SMME activity, engineers does not design new projects with commercialization in mind. Commercialization must be a consequence of good engineering practice and alternate thinking.

Engineers must know that to engage with your own environment and the environment of the world of work doesn't mean that engineers lose their unique characteristics and take on the characteristics of research or entrepreneurship for that matter. Engagement, rather, means to take the unique characteristics of an institution or discipline interacts with the new perspectives providing a unified output. In the process the fundamental principles of engineering are not changed but the practice, is changed [1].

2.6 ENTREPRENEURSHIP THINKING

South Africa’s tertiary education system imparts to engineering graduates the knowledge and skills required in industry. Young South African adults with tertiary education are most likely to be employed in industry. This may very well not be a reality for all graduates (unemployment 47%) [2].

Furthermore, the playing field is far from being level as South Africa tries to balance the injustices of the past, this leaves some graduates destitute. Entrepreneurship offers them one such option, but many UoTs have brushed the idea of engineering entrepreneurship aside. EEE requires a change in mindset, something that is extremely difficult to do in a culturally strong engineering environment [23, 24, and 14].

Dr Kjelt van Rijswijk, at the second annual SATN conference discussion posits the view that graduates needs exposure with respect to group work, discussing important issues with superiors, generate new ideas. This sort of activity lends to soft skills development. Esbach says that students are not attuned to this behaviour since the employee mentality is really a ‘do’ mentality thus the environment at the institution must provide the environment for engagement (14).

Entrepreneurship education in engineering, more commonly known as engineering entrepreneurship, offers the engineering fraternity this option towards alternate thinking [18].

Coetzer says that a plan is in place to reduce poverty by 50%, by year 2014 and skills are critical to meeting this objective [3, 4]. HEIs have a huge contribution to make [11]. UoTs speaks to a well trained graduate who is grounded in science and practice. A focus on engineering and management leans towards focus on entrepreneurship.

3. METHODOLOGY

This descriptive study aimed at investigating the experiences of graduates and undergraduates registered in the electrical engineering program at CPUT. The sample consisted of undergraduates from the Cape Town campus (66) registered to the electrical engineering program. The graduate sample is registered to the electrical engineering program at both the Bellville (55) and Cape Town (55) campus.
Two measuring instruments were designed, a questionnaire for the undergraduates and a questionnaire for the graduates. Both questionnaires included structured questions relating sense experience, personal status, and entrepreneurship awareness. The sense experience is a measure of the experience that tells us about ourselves and not the world around us.

Conceptually two people might differ on the subject at hand. This is so not because of the dualism but rather because of the perception difference. It is the interpretation of the sense experience that helps us to understand the world around us. The 5 point Likert-type questions ranged from weak (1) questions to strong (5) questions.

Questions one (undergraduate is correlated to Q2 for graduates) used 5 point Likert-type questions to test the perception regarding personal creativity, initiative, persistence, determination, leadership, engineer skill and entrepreneurship skill.

Question 3, is a multiple question testing for the professional status, that being engineer, entrepreneur or both.

Question 4 is a dichotomous questions testing to see whether there were courses offered in the faculty.

Question 5 is a dichotomous question testing whether the samples felt that engineering entrepreneurship should be offered within the faculty.

Question 7 (undergraduate sample) is correlated to question 9 (graduate sample). The 5 point Likert-type question is used. More particularly Q7a is correlated to Q9a. Q7b is correlated to Q9b. Q7e tests for the SEI influence on entrepreneurial ability correlating to Q9d tests for the HEI influence. Q7f correlates to Q9e.

The questionnaires were administered by an independent educator to the respondents. 56 questionnaires were given to the graduates at Bellville campus, a further 55 were completed by the graduates at the Cape Town campus, and 66 were completed by the undergraduate sample.

All ethical issues were cleared and students consented to being part of the annual research.

The view on the academic culture is subjective since the insights into this paper are influence by observation over a 5 year period. Personal experience includes informal discussion, formal interviews and questionnaire to academics and management over the 5 year period.

4. RESULTS

4.1 ENGINEERING STATUS OF SAMPLE

Table 1 depicts the sample status. From the column we see that the entire sample considers them to be engineers. The variance on the horizontal columns shows that thinking to be partially true.
From table 2 below we find the breakdown of the sample response.

### Table 2: Status - Both vs. Engineer

<table>
<thead>
<tr>
<th>Year 2010</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>no</td>
</tr>
<tr>
<td>1st</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Engineer</td>
<td>no</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>30</td>
</tr>
<tr>
<td>BTech</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Engineer</td>
<td>no</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>31</td>
</tr>
</tbody>
</table>

Both the 1st year sample shows a strong engineer – entrepreneur nexus (50%), as well as the BTech sample shows a (40%).

However, 49% of the 1st year sample is not engineers, but also not entrepreneurs. More significantly, 92% of the non-engineers, who registered a ‘both’ status are a mix of engineer and entrepreneur. Of the BTech sample, 39% are not engineers and of the 39%, 80% represents the mix between engineer and entrepreneur.

### 4.2 Entrepreneurship skills vs. Education

The 1st year sample was split concerning the availability of entrepreneurship courses in the electrical engineering program. The BTech sample was more aware (65%) of the fact that entrepreneurship courses were not offered in this program.

Both samples (50% 1st year and 60% BTech) were resolute that the institution did nothing to develop their competency as entrepreneurs.

### Table 3: Entrepreneurship skill vs. Education

<table>
<thead>
<tr>
<th>Year 2010</th>
<th>HEI Entre Edu</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1st</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Enviro</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>BTech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enviro</td>
<td>no</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>34</td>
</tr>
</tbody>
</table>

### 4.3 SAMPLE DEMAND FOR ENGINEERING ENTREPRENEURSHIP EDUCATION

### Table 4: Engineering Entrepreneurship Education

<table>
<thead>
<tr>
<th>Year 2010</th>
<th>Eng Entre Edu demand</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1st</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEE</td>
<td>no</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>BTech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEE</td>
<td>no</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>3</td>
</tr>
</tbody>
</table>
The 1st sample, when asked whether they wanted a range of courses that would allow them to choose between a career as an engineer or an entrepreneur, the response shows conviction (75%) that is not offered them.

The BTech sample shows an equally strong (88%) conviction.

The question that probed whether the sample wanted a strong entrepreneurship program to prepare them for their own business, the 1st sample response showed a (70%) demand while the BTech sample showed a (61%) demand.

### 5. DISCUSSION of RESULTS

#### 5.1 ENGINEERING ENTREPRENEURSHIP EDUCATION

The entire sample considered them to be engineers and although the ‘both’ status showed a strong tendency towards entrepreneurship, an assumption made because the response was overwhelmingly non-engineer, the outcomes is highly significant.

Table 1 and table 2 are meant make the following statement,’..the engineers says..’. There are no courses that might suggest that entrepreneurship is a valued discussion topic in the electrical engineering program. There is no ambiguity concerning the institutions contribution to the development of the entrepreneurship skills of the sample.

This enforces the theory that the institution educates the graduates to be employees irrespective of whether the graduates do not have the same opportunities in the South African labour market, irrespective of whether 47% of graduates are unemployed and 10% of those are engineering graduates. The sample recognized entrepreneurship as an enabler, an alternative to industry and the job markets.

The sample showed a strong interest towards engineering entrepreneurship education (EEE). The 88% represents a substantial persuasion towards EEE as reflected in table 4.

The impact that entrepreneurship makes on world economies are real and measurable, the researcher is not sure whether the students are aware of this fact.

#### 5.2 Graduate demand for Engineering Entrepreneurship

It is not that engineering education be replaced with entrepreneurship education, but the sample shows that engineering education be re-curriculatd to offer programmes that will enable all engineers to find a place in the South African industry and to make a contribution as employees or other.

Students agree that engineering is critical to support a growing economy but EEE provides the alternative to the problems and challenges they face in the job market. Also that EEE must be offered at UoTs as part of the engineering programme, much in line with the SATN report.
The sample endorsed the GEM view on EEE, by recognising a BTech focus as being crucial to the graduate’s development.

6. CONCLUSION

The discussion leads around unemployment, a catalyst to poverty which is more than merely a money issue, it speaks to entrapment. Student choice is inversely proportional to entrapment, and the research has shown that the demand for alternative education is engendered in the pursuit of the sample when considering their roles in the South African economy.

The discussion has therefore showed that higher educational institutions must begin to consider the plight of all South African when putting in place programs to advance their careers.

The new thinking is not about challenging the engineering discipline but rather to expand the program to broaden the graduates’ skillset.

The changed mindset required for negotiating through the maze of uncertainty and technological advance is both a phenomenon that appeals to educators and policy makers as well as to the student.

The infusion of entrepreneurship education into the engineering programmes offers graduates the scope towards ‘alternate thinking,’ as depicted in figure 3 below [31].

Alternate thinking and entrepreneurship stimulates the pursuit of technology excellence. The shift in mindset moves from desire to design. Excellence is expected from design to commercialization. It can no longer be a consequence of good engineering; it must be the design objective.

Engineering defines the skill set of the engineer; entrepreneurship helps to define the environment in which the engineer operates. EEE is important and critical to the changed mindset process.

Further research could focus on evaluating the academic perspective on entrepreneurship education in engineering, but more specifically research should look at the alignment of the national, institutional and faculty vision on science, entrepreneurship and technology transference.

In conclusion, the above discussion provides compelling evidence that an alternative engineering education focus is required if the national objective, to address the unemployment issue in South Africa, is to be met.

7. REFERENCES


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THE INFLUENCE OF CULTURE ON PROJECT MANAGEMENT IN EMERGING BUSINESSES

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ABSTRACT

Culture influences the way we do business, our communication, the importance of time, the way how to deal with problems and go about conflicts as well as the criteria for choosing business partners. Being aware of cultural differences in doing business is one of the important key factors for successful international project management. In South Africa many engineering graduates entering industry in the real world are faced with problems in project management. Students lack soft skills necessary to manage projects properly and to successfully complete them on time. Many of the emerging small businesses are driven by the initiatives taken by the owners. According to statistics most normally fail due to lack of project management hard and soft skills. The aim of the authors is to promote proper business acumen between different cultures.

1. INTRODUCTION

To prioritise the socio-economic upliftment of South Africa, one of the key factors of the CSIR’s Integrated Energy or Economic Framework to ensure community ownership and sustainable enterprise management [1]. This paper pleads for an undertaking in line with the CSIR’s framework to empower contractors and project managers to overcome numerous shortcomings as addressed in this paper.

2. PROJECT MANAGEMENT

Project management is the discipline of achieving targets by optimizing the use of resources such as time, money, material, energy, space, etc. The project manager strives to maintain the progress and productive interaction of the various parties involved by executing all or some of five project stages – initiation, planning, execution or production, monitoring or control and completion. He should have three main objectives viz. performance, effectiveness and cost.

Constant problems of dealing with the different parties involved the project viz. the customer, the project team, the public, various forums and committees and management, requires a special individual. The project manager is required to identify and solve any problem as soon as possible. If these problems are not resolved timeously, deviations to the project plan will result, with the consequences of late deadlines, over budgeting, penalties, etc.

Jack Welch, CEO of General Electric for more than 20 years, invested heavily in his project managers, equipping them with the skills and the drive to follow suit with their own teams. In every potential leader he looked for his “E to the fourth power” viz. enormous personal energy, ability to motivate and energize others, having a competitive edge, and the skill to execute on those attributes [2]. Peter Drucker is referred to as the man who invented management. What J. Maynard Keynes is to economics or W. Edwards Deming to quality, Drucker is to management. He was the first to assert that workers should be treated as assets, not as liabilities [2]. Pinto and Slevin associated three strategies in the implementation phase of projects; project mission, management support and project action plan [3].

Control from the start in project management can be ensured, if the following nine steps are followed:

- Get the basics right; such management support, adequate sponsorship, funding and resources to complete the Project in the required time frame.
- Clarify the Scope with review and clearly defined deliverables.
- Get agreement from both the Customer and the Sponsor regarding the feasibility of the delivery date.
- Identify Project Priorities and rank them in order.
- Know the product and the business by getting to understand the customer's business and document it in the Project Plan.
- Is it 'Do-able'. Can the Project produce the deliverable within the timeframe and resources available, within budget?
- Identify the customer needs to help in decision-making.
- Employ qualified staff.
- Plan.

Of these steps project planning and budgeting are most important.

2.1. PROJECT PLANNING

An expert in Organisational Behaviour and Leadership, Lize Booysen’s response to what she considers to be her greatest strength as a businessperson was as follows: “I have exceptional planning skills” [4]. Planning is vital to meet project deadlines. Without a clear beginning, project planning and progress can easily go astray, thus a project launch meeting is well worth the effort. The outcome of regular meetings should always be that; the technical scope is established, areas of performance responsibility are accepted, schedules and budgets are spelt out and a risk management plan is reviewed [3].

In order to meet project deadlines, the calculation or proper estimation of the most likely activity times is crucial. Actual activity times of projects are rarely less than the estimated time. This is attributed to Parkinson’s Law that states that work expands to fill the allotted time [3]. According to Robinson, activities of daily living (ADL) are personal activities that are performed in the course of a normal day. They include eating, using ablutions, combing hair, brushing teeth, reading etc., but exclude hobbies and work related activities [5]. These ADLs must be taken into account when compiling an estimate of actual working time.

Expected completion times of activities in a project should be derived at by using three time estimates – optimistic, pessimistic and most likely times. These estimated times are expressions of risk associated with each activity time. Assume that all possible times are represented by an asymmetrical beta statistical distribution as shown in Figure 1 [3].

![Figure 1: Distribution of all possible activity times](image)

The most likely time (m) is the mode of distribution. The project manager should select the optimistic time (a) so that the actual time required to complete the project is greater than a about 99% of the time. Likewise the pessimistic time (b) should be estimated so that the actual time required to complete the project is less than b about 99% of the time. The expected time (TE) is given by

\[
TE = \frac{(a + 4m + b)}{6}
\]

where
- a = optimistic time estimate
- b = pessimistic time estimate
- m = most likely time estimate

The beta distribution is highly flexible compared to a normal distribution (where m-a = m-b), since extremes such as a=m, b=m can be catered for. The expected time is an estimate of the mean of the distribution. It is the weighted average of a, m and b with weights of 1-4-1. The actual activity time is rarely less than the
estimate of the mode accounting for the right skew of the distribution. This is due to Parkinson’s law. If unaccountable problems occur, the actual activity time may increase, but almost never decrease. The normal tendency to counter timing issues is to increase manpower. This can unfortunately backfire as some projects adhere to Brooks’ law viz.: “Adding manpower to a late software project makes it later [3].

Peter Drucker is quoted on the issue of planning; “Plans are only good intentions unless they immediately degenerate into hard work” [3]. The primary purpose of planning is to establish a set of directions in satisfactory detail in order for the project team to know exactly what needs to be done, when it must be done, and what resources to use in order to produce the deliverables of the project successfully. In the planning process activities should be identified to be done sequentially and others simultaneously. The only certainty is that things will not go precisely as planned.

2.2 BUDGETING

Money is the lifeblood of business and is spent either as capital expenditure or operating expenditure [6]. The sub-contractor in this case did not have funds for capital expenditure to acquire proper installation and safety equipment and expected an advance from the main contractor. This was an early indication that the sub-contractor project was heading for disaster. All projects are unique and their budgets are based on forecasts of resource usage and the associated costs. Therefore, estimating the cost for any project involves risk [3]. Risks are significant with many challenges in project management, but at the end of the day with proper budgeting and project success, the rewards are obvious.

A budget is a written financial plan for the future. It sets a framework in order to make forecasts and sets goals for a specific period. There are various types; the master budget, sales budget, production budget, materials budget, labour budget, admin and overhead costs budget, profit budget, cash budget, financial budget, capital expenditure and equipment budget etc. The most important control measure in budgeting is measuring the actual cost against the budgeted cost. This exercises control over the budget and the cash flow. The difference between the forecast profit and cash flow has the emphasis on when cash will be received and when cash payments are made. The cash flow budget is the main lifeline of the business. It helps to make early provision for cash shortages due to over-expenditure etc. On the other hand it allows cash planning to take place, where the investment of excess cash can be made etc. Besides inadequate business skills, the other common shortcoming is the inability to manage credit and debt due to the misunderstanding of the concept of cash flow.

3. SOFT SKILLS AND THE INFLUENCE OF CULTURE ON PROJECT MANAGEMENT

In the previous section it is clear that there is a huge lack in hard skills, let alone soft skills in project management regarding upcoming companies in South Africa. Looking at international opportunities for joint ventures especially in the field of technology, it is statistically proven that most joint venture activities fail due to cultural misunderstanding. To compete in a global business world and successfully manage projects one of the important soft skills in international project management is intercultural competence.

Intercultural competence is the ability to engage in successful communication with people of other cultures. A person who is inter-culturally competent has the ability to; capture and understand other cultures, interact with people from foreign cultures, have specific concepts in perception, thinking, feeling and acting. Culture is significant for our behaviour and our perception of the world. Culture;

- Is an orientation system which provides dependable standards that enable the members of a group to have a predictable and smooth interaction which each other,
- Expresses itself in different values and norms, and
- Is subject to constant change.

A strange culture presents itself like an iceberg as shown in Figure 2 [8]. The smaller part of the iceberg which is above water represents those aspects of your own culture that you are aware of. This represents the visible expression of a culture; for example greetings, eating and drinking habits, dress, language and
The larger part of the iceberg represents deep culture which is hidden below the surface of conscious.

The invisible part of culture consists of the values and norms (the cultural logic or cultural standards) that determines the persons thinking and actions for example dealing with time, space, problems, emotions, power, meaning of identity, justice, friendship, work, family and groups and so on. Culture influences without our awareness, our behaviour, body language, communication style and our perception of the situation and the judgement. Culture defines the accepted business behaviour. Culture does not only refer to the obvious visible differences like languages and greetings; the invisible elements of business culture are more crucial to the success of international project management. The following cultural differences that influence business success are addressed as follows:

![Image of iceberg model](image)

**Figure 2:** The iceberg model

### 3.1 UNDERSTANDING THE CONCEPT OF TIME

Time can be structured and used in many different ways. In some cultures people prefer to make rough plans and then act spontaneously depending on the situation. Time is of vital importance to Europeans, especially Germans. More than other culture, they seem to be completely engrossed in their schedule planners and diaries and are obsessive about appointments and time planning. This difference is depicted in Figure 3 [7]. The fact is that time is a valuable asset and they feel that it should not be wasted, but rather used as effectively as possible. For this reason they prefer to plan their time far in advance, making exact schedules and then following them precisely. In project management a common understanding on the planning process is to be taken seriously, where different cultures are involved. This means deadlines need to be properly agreed upon to avoid any misunderstanding.

![Image of time concept](image)

**Figure 3:** Differences in the concept of time

### 3.2 SELECTION OF BUSINESS PARTNERS
When it comes to the selection of business partners, cultural differences often lead to variations in the
dynamic of the relationship. In some cultures it is an unspoken rule that private and professional life needs to
be separated (never enter into a business partnership with family or a friend). It does not mean that good
business relationships are not important, but they are not regarded as a requirement for doing business or
working together. In cultures which are more relationship oriented, there is no clear separation between
private and professional life (business partners are often friends) which means that a good relationship is a
basis for doing business and therefore needs to be fostered before the actual business interaction can start.

3.3 CONTRACTS AND AGREEMENTS

Linked to the afore-mentioned, another area which often creates friction amongst cooperation partners is the
understanding of contracts. In some cultures a contract is a binding document which is the base of the
cooperation and needs to be very detailed while in other cultures a contract just shows the willingness to
cooperate and is understood as a general statement which expresses the interest to cooperate and can be
flexibly adapted and changed.

3.4 COMMUNICATION DIFFERENCES

In general we can distinguish between two main communication styles as shown in Figure 4 [7]. The more
direct communication style, which is more commonly used in Western Europe, compared to the more
indirect communication which is used in most Asian, African and Latin American countries.

![Figure 4: Direct vs indirect communication](image)

Being honest is a cultural value in Europe. Saying “no” is not considered impolite, but rather a statement that
prevents misunderstandings. To people from almost all other cultures, this direct communication style can
seem very impolite, extremely demanding and authoritarian. This direct communication style is often seen as
being anything from hurtful to arrogant, occasionally heartless and cold and not appealing at all.

There is a clear separation between the individual and the matter of business communication. In many countries
direct communication, especially when it comes to communicating problems, is avoided because the aim is to
keep harmony and create a good business atmosphere. Problems are not directly addressed or communicated,
which often creates friction between business partners. Germans tend to think that the term “No problem” means
that everything is in order and that there are no problems. With indirect communication this might not be the
case, since in most of the cases there are problems but it is not addressed at that moment. Direct criticism is taken
personally and for people from Western Europe the indirect way of communicating problems is often not
understood at all.

The aim of indirect communication is keeping harmony, avoiding confrontation and creating a good working
atmosphere. Therefore criticism and different opinions are often communicated indirectly. This can lead to
misunderstanding with the potential for conflict.
Business communication in Western Europe is generally conducted on the objective level. It can be so fact-oriented and objective that the humane part is all but lost. The communication is straight and to the point. They concentrate on the issues that seem relevant to them; side-tracking small talk or the time-consuming establishment of contact on a personal level. This objective task-orientation is often perceived as being unfriendly, arrogant and aggressive. The way in which different entities deal with problems and conflict is also culturally dependent. This is illustrated in Figure 5 [9]. In some Western cultures confronting others with conflicting scenario is not seen as a bad thing, but as a way of highlighting and addressing problems (conflict as an opportunity as compared to conflict as a threat) because in Western cultures one separates the person from the subject, different opinions are not meant to be taken personally.

Examples of different communication styles are shown in Table I [8].

<table>
<thead>
<tr>
<th>Linear communication (Western European)</th>
<th>“Round-about” communication (Asia, Africa, Latin America etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic: Getting straight to the point.</td>
<td>Characteristic: The objective of the talk is communicated indirectly. Slowly and a round-about way of getting to the topic of interest.</td>
</tr>
<tr>
<td>Regulating cultural value: Task orientation</td>
<td>Regulating cultural value: Person and relationship oriented</td>
</tr>
<tr>
<td>Advantage: The chance of misunderstanding is reduced; less time is needed</td>
<td>Advantage: Suitable to create a good atmosphere and establish confidence.</td>
</tr>
<tr>
<td>Self evaluation: Professional and clear</td>
<td>Self evaluation: Skilful and dignified</td>
</tr>
<tr>
<td>Perception and interpretation of the round-about communication style: Imprecise, unclear, long-winded.</td>
<td>Perception and interpretation of the linear communication style: Cold, impatient, not diplomatic, unfriendly</td>
</tr>
<tr>
<td>Usually in combination with direct communication</td>
<td>Usually in combination with indirect communication</td>
</tr>
</tbody>
</table>

For Western Europeans, when problems arise they are dealt with systematically and in an order that is deemed to be logical; firstly the causes are discussed, suggestions for solutions are then sought finally a step-by-step implementation of the chosen solution is delegated to the responsible persons. Europeans (particularly Germans) are often seen as being very confrontational and as they have a natural tendency to face conflict. The Italians, French and Spanish are comparatively more “diplomatic” as they tend to discuss problems more openly. The German way of criticizing and discussing problems, with the objective of rooting out the source of the error, is seen by others as very offending and impolite. Table II compares the different communication styles between Europeans and other countries [8].

<table>
<thead>
<tr>
<th>2.2. Meaning</th>
<th>Possible sentences from Europeans</th>
<th>Possible sentences from Asia, Africa, Latin America etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No. it is not possible. No, the product is too expensive. No. I really would have liked to cooperate, but the product is too expensive.</td>
<td>“I’ll see what I can do...” “We’ll try...” “We do our best” “We’ll see how to manage it.,” “We’ll manage it somehow” “We’ll surely do it, if it’s possible” “Let me think about it.” “It is very difficult.”</td>
</tr>
<tr>
<td>Maybe</td>
<td>Maybe...I will think about it Maybe ...if we change... Maybe it is possible</td>
<td>“Definitely...”</td>
</tr>
<tr>
<td>There are problems</td>
<td>I see problems with the transportation.</td>
<td>No problem.</td>
</tr>
<tr>
<td>I have a different opinion.</td>
<td>I don’t agree; I have a completely different opinion; From my point of view.</td>
<td>I will have to check with my boss.</td>
</tr>
</tbody>
</table>
3.5 TASK ORIENTATION
Whenever people meet, they meet on at least two different levels; on the task level which deals with content and its objective, and on the social–emotional level where the individual emotions and relationships are prioritized. See Figure 6 [7]. Professional meetings are normally conducted at the task level and in certain cultures this in strictly adhered to.

![Figure 6: Task orientation vs relationship orientation](image)

Cultural differences occur in meetings when one person’s culture places more emphasis on the task level whereas the other person’s culture sees the social-emotional level as being more important. Both the levels are important to both cultures but to different degrees. Collaborating with others does not necessarily mean establishing a social relationship beforehand. The persons involved interact on the basis and responsibilities of their mandate, even if they do not know each other well or at all. In summary, Figure 7 indicates some of the cultural differences relevant to business and project management.

There are a number of other less obvious situations where cultural differences within an international or local project can bring about conflict amongst the collaborating partners. These include dealing with business gifts, dress codes, the choice of venues (private home, restaurant or meeting room) and cultural religious taboos at business dinners.
4. CONCLUSION

The success of a project is dependent on the interaction of a myriad of activities and relationships. The activities such as finance, stock control, etc., can be easily managed in order to realise the stated objectives. It is in the softer areas such as communication and inter-cultural awareness where potential conflict and mismangement can derail a project. Whilst the case of an east / west collaboration was used to highlighted the potential pitfalls in this area, cultural insensitivity can occur in environments assumed to have a high level of cultural homogeneity. Cultural awareness, as part of project management training, should be a compulsory component in order for practitioners to best utilise the human resource component of the overall project.

5. REFERENCES


ENTREPRENEURIAL CONCEPTS & STRATEGIES
ENTREPRENEURIAL UNIVERSITY - REFLECTIONS FROM THE ECONOMY

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ABSTRACT

Wismar University pays special attention to teaching students entrepreneurial skills. But is it successful? What areas of competencies are particularly valuable for companies seeking to employing graduates?

Staff from Robert Schmidt Institute of Wismar University interviewed more than 100 entrepreneurs focused on three questions: “What kind of entrepreneurial skills do companies expect from graduates?” “How do they assess the actual skills of graduates?” and “How do of Wismar University graduates equate with those from other universities?”

In regard to required entrepreneurial skills Wismar University graduates are rated slightly higher than others. Such results are a confirmation Wismar University is successful in its campaign to create entrepreneurial graduates.

Keywords: Entrepreneurship, entrepreneurial university, company

1. INTRODUCTION AND OBJECTIVES

Entrepreneurial-wise Wismar University endeavoured to teach exceptional technical and entrepreneurial skills to students. This method aimed to improve students’ career prospects, better preparing them for future professional requirements. This paper outlines and describes success of this effort. At the same time approaches for developing teaching entrepreneurship were determined by the university. Between May 2009 and February 2010 the Robert-Schmidt-Institute (RSI) of the Wismar University interviewed more than 100 entrepreneurs and leaders/managers and asked three questions:

• What importance did entrepreneurs, leaders and potential employers put on various aspects of entrepreneurial skills in particular for graduates at the start into their professional lives?
• how are such skills developed in university graduates?
• how are these skills developed specifically in Wismar University graduates?

2. MODEL FOR ENTREPRENEURIAL SKILLS

The competency model used for the research had been developed for start-up-seminars in the foundation-network in Rostock as a part of the funding EQUAL of the European Union (2002 - 2005). The model was also used by education service providers to check on suitability of leaders and entrepreneurs. It is well known and accepted by regional entrepreneurs also part of the examination process.

Garnjost (2010) writes “in particular, many empirical examinations by Muller (questionnaire for diagnosis of entrepreneurial potentials ...) show that entrepreneurs significantly differ in the values of some dispositions of managers and the so-called normal population. Therefore, it is typical for entrepreneurs, besides high willingness to perform and a locus of control, a high problem-solving orientation, ambiguity tolerance and willingness to enforce as well as a medium risk tolerance (eg Müller 2002, 2000)."

The RSI sought a clear boundary between methodological competences (representation competence) and "self"- competences (time- management).

For this reason the RSI chosen five sub-competences of entrepreneurial skills for its research:

Achievement motivation
That means willingness to take over tasks to prove abilities and skills.
Internal Locus of control
Internal locus of control is to take the initiative and to possess a strong conviction of feasibility people such as these who prefer “to do things” instead of “letting things be done”. They strive for independence and dislike to be dictated to.

Problem-solving-orientation
Those with a problem-solving-oriented style view the demands of professional life as principally to solve problems. A distinct problem orientation enables them to deal with numerous “non-routine tasks” usual in entrepreneurs.

Risk-taking
Entrepreneurs must accept risk factors and possess strong nerves. A fearful avoidance of risk is just a great a disadvantage as extreme risk inclination. It is far more important to be able to realistically assess and calculate risks.

Assertiveness
Successful entrepreneurs are sometimes described as 'mildly sociopathic'. They need to be socially independent, dominant and insensitive interference, preferring to prevail with a business idea. On the other hand, they also need to be co-operative to be successful in customer relations.

3. QUESTIONNAIRE
In general, entrepreneurs and leaders/manager enjoyed less available time. Therefore, the RSI chose a limited number of comprehensible questions in five areas:

- Information about interviewed companies and partners;
- importance of entrepreneurial skills concerning graduates;
- existence of entrepreneurial skills concerning graduates;
- assessment of entrepreneurial skills concerning Wismar University graduates, and
- economic requirements concerning Wismar University graduates.

Multiple-choice questions were used in the research. For each of the five sub-competences three items were selected and mixed into the questionnaire. A four-point ranking scale was chosen, as school grade scales often had different and individual interpretations, which led to distortion.
Possible polarities were determined and for this reason participants had to specify exactly one of 15 items. An item which is dispensable for graduates (less important for a successful career start) and another which is indispensable.

4. SAMPLE
Potential participants for questioning had been personally contacted by RSI staff, to discover, if there was general willingness to take part. The response rate was about 35% in favour. A total of 109 persons from 98 companies and institutions participated in the research; 98 from Mecklenburg; Western Pomerania, 11 from different federal states.

Mecklenburg-Western Pomerania predominantly has a small-scale economic structure. The federal state is dominated by companies with fewer than 50 employees (78%) and by various service sectors (51%). Ten out of 14 industry groups in the establishment panel of IAB (Institute for Labour Market and Employment Research) were involved. Ninety-six participants answered voluntary personal questions, 54% of them were owner or co-owner; 33% manager or leaders. In the sample involved were mainly those involved in personnel and business decisions. The education level of participants also indicated an ability to assess competence levels from graduates, as 83% had university degrees.

The research indicated difficulties for participants to answer questions about competence from graduates. All 109 participants evaluated the importance of entrepreneurial skills concerning graduates, but only 44 were
able to assess graduates’ entrepreneurial skills. Twenty two participants knew Wismar University graduates or could judge their entrepreneurial skills.

5. EVALUATION

The 15 items were rated on four-point ranking scale. It was assumed distances between the four scale values were identical. The numbers therefore, had been assigned: 0 = worst judgment up to 3 = best judgment. This allowed calculation of arithmetic mean and variance \( \sigma^2 \) as a measure of the variability of ratings. Another component of the evaluation was made by statements about specific competences, then judged as either dispensable or indispensable.

6. RESULTS

The ranking of importance of individual sub-competences concerning graduates (average values) is reflected in Figure 1. Figure 2 shows the variance of the valuations. In addition, Figure 3 indicates participants responses on which competences are dispensable or indispensable for a successful career start. Probably the most highly valued sub-competences also might be of greatest importance for a successful career start. The examination showed participants attributed problem-solving-orientation of the highest and risk-taking of the lowest, significance.

![Figure 1: Mean-valuations of five sub-competences concerning significance for graduates in general](image)

Regarding variance results in a different sequence of the five sub-competences, a slight variance in valuation of a sub-competence meant a high degree of agreement among participants. From the perspective of participants this indicated a high stability of rating.
In this case and with a high mean value it was assumed a corresponding expression of competence improved the employability and career opportunities for graduates.

Figure 3 showed assessments on which sub-competences were dispensable or indispensable.

The three sub-competences with the highest mean valuation - problem-solving-orientation, achievement motivation, internal locus of control - were more frequently judged to be indispensable. The largest positive balance of assessments "indispensable" and "most dispensable," reached the achievement motivation.

Both sub-competences with the lowest mean valuation – assertiveness and risk-taking - were more frequently judged to be dispensable.

Remarkably, there was an apparent disagreement on competence assertiveness, which was also relatively frequently rated as indispensable. Perhaps the significance of this sub-competence depended on the degree of division of labour; answering at question required further investigation.

Figure 4 shows the differences between the assessed significance of the five sub-competences (target values) and their degree of development concerning graduates in general and Wismar University graduates. The perceived degree of development was always lower than the estimated significance. In all five sub-competences Wismar University graduates reached slightly better values than the graduates in general.
The examination shows the lowest perceived shortfall in target value as achievement motivation. In this sub-competence Wismar University graduates achieved slightly different results from the target value of all five competences. The largest percentage deviations from target values indicate the perceived feature of risk-taking. The highest assessed competence was problem-solving-orientation and perceived the second largest deviation from the target value.

The relative "advantage" of Wismar University graduates compared to others can be seen in Figure 5. Best results concerning competences of Wismar University graduates were achievement motivation and risk-taking, although, their perceived superiority in problem-solving-orientation was the lowest.

7. CONCLUSIONS

There was a visible difference in the assessment of interviewed entrepreneurs and managers in the five sub-competences of entrepreneurial competences in the investigation.

The two sub-competences, achievement motivation and problem-solving-orientation, were highest-rated in terms of their general significance and their results had the lowest variance. In addition, they were more often judged as indispensable rather than dispensable. One conclusion was to realise this competence mostly promoted career opportunities. The two sub-competences assertiveness and risk-taking achieved lowest significances and in contrast to others were frequently classified as dispensable. From participants’ perspectives these competences might be easier to develop in future careers. Therefore, the focus on didactic
and methodological approaches was meaningful for entrepreneurship education at Wismar University, to strengthen problem-solving-orientation, achievement motivation and internal locus of control. Wismar University already “produces” graduates with above-average achievement motivation. The results could be considered as a confirmation that Wismar University was on track to becoming a true entrepreneurial university. To strengthen its profile as an entrepreneurial university the didactic and methodological approaches required continued development of problem-solving-orientation competence.

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INTERCULTURAL INNOVATION INSIGHT WORKSHOPS

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ABSTRACT

A two-week international workshop was held in Finland during February 2010 and again in Glasgow in February 2011. Entitled “Intercultural Innovation Insight Workshop” (3EYES), they were sponsored by the European Lifelong Learning programme. Students from Portugal, Cyprus, Czech Republic, Finland and the United Kingdom were placed in multi-cultural teams of five. Each team had two product designers, one graphic designer, one financial and one marketing student. They were set the task to devise new product ideas for a local company and they had two weeks within which to do it. These intensive workshops comprised lectures and practical tutorials as well as ideation sessions for the new product ideas and represent one way in which international issues may be appreciated and accommodated.

The concept of these innovation camps has been introduced to improve and foster an understanding of international issues: specifically the notion that modern business must conduct its affairs globally for which an understanding of cultural similarities and differences is a necessary pre-requisite for a proper and sympathetic approach to business issues. For this reason, students of different cultural backgrounds and different specialities were considered a necessity. Equally, it was considered important to show the students how new product development really does need input from all specialities within a business and especially that different cultural viewpoints that can lead to different product requirements.

Following a first innovation camp in which the students examined product futures for a fairly large Finnish ceramics company, the latest 3EYES workshop liaised with a micro-company that had only two employees. It was a company that made products from glass fibre composite and was considerably far from the style of business hitherto contemplated by the students who attended the workshop. This paper will compare the two events and discuss issues of social responsiveness, shared goals and identity and draw conclusions on the suitability and sustainability of this form of activity.

1. INTRODUCTION

Methodologies in education are going through a great shift lately. This has been an inevitable development running parallel to the technological advancements, the globalization as well as the role of the teacher who has become more like a facilitator to knowledge rather than an instructor.

The European Union has had a great impact on the new educational methodologies, encouraging a greater student centred teaching and learning, and had promoted various programme of studies, which are aligned with the learning-by-doing approach. These are known as IP - Intensive Programme – and are designed by encouraging teaching and learning through a cross-disciplined, multi-cultural and real life professional mannerism.

The paper is organized into four main sections. The second section provides contemporary literature review in educational methodologies. The third section provides information about the organization and methodology of the two camps. The fourth section presents the evaluation of the two camps by the participants as well as some conclusions, whereas section 5 concludes with some remarks.
2. EDUCATIONAL METHODOLOGIES

According to the Design Council of the UK in 2009, we must “develop new capabilities to meet the need for sustainable products and services, as well as new requirements for working in multi-disciplinary teams. To meet the needs of a fast-changing business environment, there will need to be stronger links between design education and professional practice”. Today, their message is, if anything, more forceful [1].

A sentiment echoed by Stamm [2], the European Union [3] and many others. To accomplish this, the new product development process “will have to include not only the product, but the whole venture. Developers will have to become proficient at aligning the needs and capabilities of markets, technologies and businesses. Success depends on how to manage and address the needs of multiple stakeholders: investors, suppliers, content-providers, distributors and others” [4].

For education to buy-in to these ideas, students need to be guided through multidisciplinary and multicultural activities if they are to understand how their work must suit a spectrum of needs and aspirations within the global market. The problem is that students, who have learned within a single HEI, tend to have a rather parochial viewpoint with little awareness of the variety of cultures and perceptions that are the real world. Thus the intention of this project is to provide intensive multi-cultural cross-disciplinary experiences in a foreign country that will kick-start a change of attitude. It will help the students to look outwards, rather than inward and thus improve their professional skills through an intensive experience within an innovation camp.

An additional and recent notion in education is the increased need for creativity in all spectrums of education. Creativity is sometimes associated with free expression, which is partly why some people worry about creativity in education. Critics think of children running wild and knocking down the furniture rather than getting on with serious work. Being creative does usually involve playing with ideas and having fun; enjoyment and imagination. But creativity is also about working in a highly focused way on ideas and projects, crafting them into their best forms and making critical judgments along the way about which work best and why. “In every discipline creativity also draws on skill, knowledge and control. It is not only about letting go, it is about holding on!” [5].

The background to this idea is the successful innovation camps already delivered by one of the partner institutions but, whereas they have been run nationally, we proposed to do them internationally. North Karelia University of Applied Sciences D’ART innovation camps are intensive workshops that produce lots of ideas in a short period of time using ideation, future and user orientated methods. They have been especially successful in supporting local companies with the purpose of producing new concepts for both products and services. The D’ART innovation camp concept was selected in 2005 as the best practice in the last period EU projects in the Eastern Finland.

3. THE TWO CAMPS

“Everybody experiences far more than he understands. Yet it is experience, rather than understanding, that influences behaviour.” [6]

Experience as a definition is the accumulation of knowledge of a person within a set period of time. Shared experience is the shared accumulation of knowledge between two or more persons within a set period of time. It is never limited, and yet never complete; it is an enormous sensibility, a kind of a huge spider web of the finest silken threads suspended in the chamber of consciousness and catching every airborne particle in its tissue. After all Experience is not what happens to you but what you make of what happens to you.

The European Commission defines an Intensive Programme as “a short programme of study which brings together students and teaching staff from higher education institutions of at least three participating countries. It can last from ten continuous full days to six weeks of subject related work” [7].

For the 3EYES project the first workshop was held in Joensuu, Finland from 21\textsuperscript{st} February till 6\textsuperscript{th} March 2010 and the second in Glasgow, UK from 20\textsuperscript{th} February till 5\textsuperscript{th} March 2011. Both were sponsored by the
European Lifelong Learning programme. The five international partners who participated in the two camps were the Glasgow Caledonian University (GCU), UK, the North Karelia University of Applied Sciences (NKUAS), Finland, the Frederick University (FU), Cyprus, the Institute of Accounting and Administration of Porto, Portugal (ISCAP) and the Silesian University (SU), Czech Republic. Students were placed in multicultural teams of five. Each team had two Product Designers (GCU and NKUAS), one Graphic Designer (FU), one Finance (ISCAP) and one Marketing (SU) student. They were set the task to devise new product ideas for a local company and they had two weeks within which to do it. These short programmes of study comprised lectures and practice sessions as well as ideation sessions for the new product ideas.

For the European Commission “an Intensive Programme aims to:

- Encourage efficient and multinational teaching of specialist topics which might otherwise not be taught at all, or only in a very restricted number of higher education institutions;
- Enable students and teachers to work together in multinational groups and so benefit from special learning and teaching conditions not available in a single institution, and to gain new perspectives on the topic being studied;
- Allow members of the teaching staff to exchange views on teaching content and new curricula approaches and to test teaching methods in an international classroom environment.” [7]

The objectives, as stated in the grant application were as follows:

1. To deliver yearly intensive innovation camps that will:
   - Provide a real-life innovation process experience in which to put theory into practice through solving problems set by industry.
   - Help local SME develop innovative ideas for new products/services.
   - Achieve this by working in multi-disciplinary/multi-cultural teams
   - Provide an information/learning environment for the project.
   - Provide a web environment that will inform participants and others of the nature and purpose of each camp.

2. To provide learning material before and after each camp.

3. To provide a continuing experience for the participants by means of a discussion board.

4. To publish the results of each camp in the form of analysed case studies both from the educational perspective and the successful innovation process perspective. To further develop these case studies as content-based language learning (CBLL) material to facilitate the learning of English to business and technical students.

3.1 THE JOENSUU CAMP

Prior to the start of the Joensuu camp, students were given information on the nature of the company that they were to work on. This was a very generic and non-specific brief, which required them to get familiarized with the products and the style of the company so that they would understand their product philosophy. Furthermore all participants were posted on the official 3EYES website [8] so that everybody could get to know each other prior to their arrival at Joensuu.

The North Karelia University of applied sciences, where the programme took place, is the most easterly applied sciences university in Europe and has approximately 4000 students and 400 staff members. It is a very compact campus with only one main building. Although very compact it is a modern university with a large variety of facilities. For the designers there is a large workshop occupying a large proportion of the ground floor. This was split up into metalwork, woodworking, sanding and painting rooms. This was very well equipped with all the machinery needed to produce models, prototypes etc., including: hot wire cutter, welding units, sanders, saws to name but a few. It was here where the product designers produced models for the final presentation.

At the Joensuu camp, students were given a series of lectures and focused workshops to illustrate the processes that they were expected to follow during the course of the two-week programme. Following an introduction to the course, the SME gave a presentation on the company and the issues they faced: leading to a statement of their project brief.
Students made a site visit to the company premises, where they had the chance to receive a more detailed presentation as well as get a first-hand experience of the company and its products. On successive days the series of lectures continued adding more information in a sequence designed to parallel and to support the devolution of the project. Lectures concentrated on diverse issues encompassing all disciplines and specializations of the groups, ranging from requirements analysis, design process and desirability, marketing and finance, project management and presentation techniques.

At the end of each day, staff met and discussed progress as well as adjusted the programme as necessary. At the end of each week there was a formal student-staff meeting to evaluate progress and to form recommendations for the following week.

The final day was dedicated to presentations of the new ideas to the SME, followed by a de-briefing session. The working pattern was based round flat tables, where students were encouraged to draw or write ideas on large sheets of paper. At the end of each day, groups presented their ideas to the whole assembly for their constructive criticism. The Internet and a good variety of printed literature was made available to help the flow of ideas. Informality was encouraged and crazy ideas explored rather than dismissed.

In addition to the studio based environment and the business visits to the target SME, several events were arranged to help integration. These were socially based events and visits, which allowed the intake of the local culture.

3.2 THE GLASGOW CAMP

Similarly to the Joensuu camp, prior to the start of the Glasgow camp, students were given information on the nature of the company that they were to work on. This was a slightly more specific brief compared to Joensuu, because of the fact that the company in Glasgow was a much smaller operation with a much more limited range of products. Furthermore all participants were posted on the official 3EYES website (photo and short resume) so that everybody could get to know each other prior to their arrival at Glasgow.

Glasgow Caledonian University offers a stimulating, vibrant and accessible environment for learning, teaching and applied research. Nearly 17,000 students from the UK and abroad study here, and the university aims to provide each and every one of them with an unbeatable student experience, a high-quality education and valuable employability skills. The IP took place in the Department of Computing and Creative Technologies. This is one of the most exciting units of its kind in the UK and certainly one of the friendliest.

At the Glasgow camp, students were given a series of lectures and focused workshops to illustrate the processes that they were expected to follow during the course of the two-week programme. Following an introduction to the course, the SME gave a presentation on the company and the issues they faced: leading to a statement of their project brief.

Students made a site visit to the company premises as well as a general visit to the city of Glasgow, where they had the chance to receive a more detailed presentation as well as get a first-hand experience of the company and its products. On successive days the series of lectures continued adding more information in a sequence designed to parallel and to support the devolution of the project. Lectures concentrated on diverse issues encompassing all disciplines and specializations of the groups, ranging from requirements analysis, solar energy, design process and desirability, marketing and finance, project management and presentation techniques.

At the end of each day, staff met and discussed progress as well as adjusted the programme as necessary. At the end of each week there was a formal student-staff meeting to evaluate progress and to form recommendations for the following week. The final day was dedicated to presentations of the new ideas to the SME, followed by a de-briefing session.

The working pattern was based round flat tables, where students were encouraged to draw or write ideas on large sheets of paper. At the end of each day, groups presented their ideas to the whole assembly for their constructive criticism. The Internet and a good variety of printed literature were made available to help the
flow of ideas. Informality was encouraged and crazy ideas explored rather than dismissed.

In addition to the studio based environment and the business visits to the target SME, several events were arranged to help integration. These were socially based events and visits, which allowed the intake of the local culture.

4 THE EVALUATION OF THE TWO CAMPS

Evaluation for both camps was made available through questionnaires that were handed to all participants at the end of each camp. Furthermore each participant was also asked to provide a short written feedback about the programmes’ experiences. The evaluation for each programme also takes in consideration the staff’s feedback, comments and recommendations, either through written documents or during informal discussions.

4.1 THE STUDENTS

Nearly all students were very favourable to the IPs both in Joensuu and in Glasgow. It became evident after the end of both projects that students had left the IP exercise quite content and full of enthusiasm that they had acquired further knowledge. Most of the comments made by the students praised the fact that they learned more by interacting with other students from diverse expertise and culture. This justifies the purpose of the IP, which is none else than cross-discipline and cross-culture experience. It was also quite evident that students were able to perform even better in their studies at home institutions, after the IP experience. Students have stated that the whole experience had enhanced self-confidence and boosted more professional morale.

This project was an immense cultural experience, combining both group work and working for a company. We had seen firsthand just how certain challenges can show peoples’ true colours, what they are really made of. In all this project has brought the Scottish students closer as a group, as friends. We now have a better understanding of design within the real world, the highs and the lows. It has taught us to expect the unexpected. (GCU student, Joensuu 2010).

Working in a multi-disciplinary group was also very beneficial as many students will have never had the opportunity to work in a group where there are students from several different degree courses. This is the closest many have [come] to what we imagine a real project would be like from initial group research, then design through to marketing and advertising keeping a close eye on finances. (GCU student, Glasgow 2011).

Basically I like this workshop. I improved my English, I learned a lot about different cultures and how to deal and worked with them, I saw a lot of beautiful places, I worked hard on the project, I had a lot of stress – which overall helped me to concentrate on my work – and I had a great time. (SU student, Glasgow 2011).

The IP projects have also helped students acquired a better understanding of social behaviour throughout the European Union. The initial mix of partners spanning from North to South and East to West has made social interaction even more interesting.

Finnish people seem to be very careful but friendly. You have to do the first step. Students from Portugal and Cyprus are very similar, very temperament, loud and friendly as well. Students from Scotland have very specific accent and it was very difficult to understand them because their English seems to me like mix of English and French language. During mornings were for us prepared many of presentations from teachers and lectors from Czech, Finland, Cyprus, Portugal and Scotland. The presentations help us in many cases. Very important presentation was the last one – how to present our work, project and our product in itself. For Czech students were very important presentations about marketing staffs. The information were used for single presentation of single team. I’ve learnt how to work in a team with unknown people from different countries who have skills and knowledge which I don’t have. (SU student, Joensuu 2010).

After all the trip was a learnful experience. I was happy that everything went great, and I have a good taste about the trip. I had opportunity to get to know in a great people from different parts of Europe, and thanks to modern technology, they can be reached easily with Facebook and social medias. In two weeks, I also
had time to get to know a bit more in the city of Glasgow, and it’s glory. The history and architecture in Scotland are after all so much different than anywhere else. Glasgow had a lot of great things to offer, but two weeks weren’t just quite enough to get it all. I think that might mean that some day I’ll have to come back to conquer Scotland again. (NKUAS student, Glasgow 2011)

Ice-breaking exercises were delivered at both of the workshops, aiming at bringing the groups together and allowing better interaction. It became evident that the best ice-breaking exercises involved social activities rather than studio-based activities. However, some students needed more time to develop their interaction and in some cases interaction was very marginal. Therefore, ice breaking activities at the start of the workshop need to be re-thought so that the mingling and synergy of the group is achieved both more easily and more effectively.

It also became evident that students from the first camp in Joensuu seemed quicker to interact and liaise compared to students from the Glasgow camp.

The Glasgow experience was definitely something to remember by. We got to interact and cooperate with other students from other countries, which is something challenging and self learning at the same time. We enjoyed the many pubs, shops, restaurants etc that Glasgow had to offer, to the fullest. We got to interact with the other students during and after university hours, even though this began a week after our arrival. Disadvantages were first of all, that we didn’t socialize with each other before starting to work in our groups, which would help break the ice between us (FU Student, Glasgow 2011)

This student is representative of several others who link ice-breaking-like activities with a potential for improved interaction. The point was made that better interaction followed a weekend of social events and it is true that the first week might have been considered too formal and dry since it largely comprised lectures and exercises linked to the project rather than free flow project activities. Moreover, the long studio-based hours seemed to have caused some dissatisfaction to most of the students.

In reality, there was an accidental difference between Finland and the UK because the contact hours in Finland, while nominally equivalent, were about 9.5 hours fewer over the two weeks because of different lengths of lunch break. In fact, there was no requirement to stay in the university outside of lecture time, but there was less flexibility during the first week and it seems that students did feel constrained to work within the four walls, so to speak. This feeling may have been reinforced by the informal method of tutoring whereby staff kept moving through the groups to advise where appropriate. There is a clear requirement to re-assess the method of mentoring to allow for student flexibility.

On the same theme, the majority of students made a very clear remark that all lectures should be concentrated in the first couple of days so that the rest of the days can be left free for them to work on their projects accordingly. Clearly, they are keen to work on the project but think that the background tutoring should be revised:

First week’s lectures were helpful. I would appreciate if all lectures were organized in two or three days and weren’t interrupted by team activities. (SU Student, Glasgow 2011)

Additionally it was felt that some lectures seemed to be very specific and very technical for the nature of the project and for the students’ expertise and understanding.

Glasgow what an amazing city! I love it a lot. It’s just an amazing city. I love everything in this city and I have received very fresh and nice influences from this city. However I found the long hours of the lectures and workshop (8 hours everyday) did not allow enough time to explore the city very well. (FU Student, Glasgow 2011)

When we started some activities, we were interrupted by the need to attend another lecture, although we sometimes weren’t completely done with our tasks. Design and Marketing lectures were brilliant. I learned several new interesting information and they helped me to think about ideas regarding our product project. Finance lecture was surely important, but I would appreciate more time to practice counting. Another thing
that could also help to improve this project should have been the possibility to be in intensive touch with the owner of the company. During working on our project we found some information we weren’t sure about. Darren explained to us the process of making fibre glass product very well, but it is impossible to learn everything and all technical information that we needed in several hours. That is why we must bother him with e-mails and it took much time to get answers. (SU Student, Glasgow 2011)

4.2 THE STAFF

Like everything in life, professional and social bonds need time to develop. All members of staff who participated in the two camps were very positive as well as very supportive to students and the projects in general. This was made specifically evident after the first camp, during the second cycle in Glasgow, when all came more confident and with greater awareness about the whole experience. The bond had been laid out the previous year and it had become a kind of tradition around the last week of February for all parts to meet, converse and learn from each other’s experiences. It was good to be greeted by friendly faces upon arrival and hear…..’…so good to have you back’!

There were some concerns by some members of staff that the two-week period of the project might be too long to be away from home Universities but it became evident that there was a need for all to be part of the experience throughout the whole period. It seemed that students related to each member of staff individually and this has given the idea for the introduction of a staff group leader for the next IP. The role of the group leader will be of a ‘pastoral’ nature, tutoring the group on a daily basis and developing own working patterns.

5 CONCLUDING REMARKS

The two Erasmus Innovation camps have proved successful in so far as all students have gained from the experience in both cultural and technical arenas. Inevitably, there have been areas where the experience might have been improved and it is these that will be addressed during the forthcoming 3rd 3EYES workshop in 2012. Of the issues that have been identified, the two most critical are firstly the ice-breaking/team-building events and secondly the desire for a more relaxed learning style.

Nevertheless, while one can find areas of improvement, these should not detract from the principle message that this form of teaching is extremely effective. After all, someone once said that the world is a huge book and everyone who actually participated in the 2 IP camps really enjoyed reading every single page of it!

6 REFERENCES


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FOCUS GROUP STRATEGIES IN PROMOTING COMMUNITY AND ENTERPRISE DEVELOPMENT

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ABSTRACT

This paper is based on the work of the Tabeisa organisation in promoting social and commercial entrepreneurship towards community development and presents a critical perspective on managing Focus Group Sessions (FGS) that are focussed on pertinent development issues within socially disadvantaged communities. The power relations that inform ownership and efficacy of community development projects are interrogated using a framework based on critical theory. The role of a “higher functioning” project facilitator is investigated in facilitating an “ownership” discourse which extensively takes place outside the usual socio-cultural domain of the researcher.

The experiences around a series of Tabeisa FGS are reported which were conducted in the process of delivering various and divergent entrepreneurship development projects. The Is‘baya fruit farming development project in the Eastern Cape was used as a case study.

The paper evaluates the relative performance of project facilitators who do not derive from the community aka “outsider facilitators” versus “insider facilitators”. The perceived non-reporting of information to the “outsider facilitators” versus “insider facilitators” during FGS or community exchanges is investigated on the basis of observed imbalances in the respective dynamics that typically manifest. This paper consequently focuses on the socio-cultural and power relationships that may manifest within sessions and potentially compromise the effective gathering of data and information against the defined agenda of the project.

The best traditions of qualitative research towards community development recognise the notion of shared control of the experience [1, 2]; and the community should therefore be able to direct the foregrounding of their own agenda, if such exists in contrast to that of the development agency. This sets the scene for a potential power struggle within the FGS, and it is in this regard, that it is proposed that the “higher functioning” project facilitator could play an important role.

Jojola (2000) warns that development is not charity; and communities-in-development should be the enablers of their own destiny [3]; and external development participation in the communities should be based on principled and strategic approaches.

This paper argues that a critical approach is indicated to navigate the process through the challenges of the socio-cultural divide and supports the views of Grudens-Schuck et al (2004) that FGS can produce high quality data and information if correctly structured [2]. Furthermore, the development agency has to be conscientious of the character, capacity and the underlying power dynamics in the community that produces the experiences observed during the FGS.

The paper provides practical insight into the management of FGS by providing analysis and anecdotal accounts of the experiences of the “Is‘baya” project as mentioned above.

The paper will discuss the contexts for focus group session deployment, a brief analysis of Critical Theory, a landscape for FGS in community development, cross-cultural issues within FGS, intra-
group dynamics within FGS, the question of altered external identities of socially disadvantaged communities, and a proposal for a “higher functioning” project facilitator in FGS.

1. INTRODUCTION

The paper is based on a case study of the Is’baya organisation and communities and their Integrated Village Renewal Programme (IVRP) which is set within the rural villages of the Transkei in the Eastern Cape province of South Africa. The target communities would be considered to be socially disadvantaged by most measures.

The IVRP is a comprehensive implementation strategy for supporting the development of traditional small farming enterprises (TSFE) within a rural environment. The objectives of the IVRP are to ensure that households that are dependent for their livelihoods on TSFE are empowered to achieve food security on a sustainable basis; and to support and develop TSFE farmers to make the transition from subsistence farming to commercial production by providing them with agricultural, ICT and other technical support.

The IVRP has been developed by a consortium of development organisations, universities, and specialists. The IVRP features several strategic imperatives that are indicative of the integration aspect of the programme, namely – (1) community-centred programme management of the IVRP supported by central IVRP project management, (2) agriculture production, (3) community health, (4) heritage and indigenous knowledge, (5) trade and business development, and (6) ICT4D.

This study is situated within a broader ICT4D environmental assessment study which was directed at building understanding of the socio-environmental conditions that inform ICT deployment strategies and the choice of appropriate ICT technologies. In addition it explains the ICT adoption phenomenon in communities, where ICT technologies are not commonplace, and further sought to build an understanding of the socio-techno-economic dynamics within TSFE around ICT deployment that inform production enterprise performance.

The principal right of access to the communities was the promise of contribution by the broader study to the understanding of the appropriate strategies and technologies to support the expansion of programmes to realise commercialisation strategies of the production enterprise over-and-above the current subsistence-level engagements. The research furthermore promised to offer insights into the drivers of ICT4D success and provide elucidation of the associations and interactions around the induction of technology into a socio-political setting, or the induction of ICT into rural communities, and the adoption of said technology.

The Problem Situation

The problem of this study is to ascertain under what conditions FGSs could deliver reliable data in an environment where the researcher is operating in a cross-cultural context and the internal politics of the target community is unclear.

A FGS in qualitative research is a structured or semi-structured group interview in which a group of people are asked about their perceptions about specific issues. According to Grudens-Schuck et al (2004), FGS can produce quality data when employed for the right purposes and using the correct procedures [2].
A landscape model is presented that explores the general relationship between researcher, interpreter and participants in developing understanding of the socio-political-economic environment and aspirations of the community. In addition, the model explores the challenges of bridging the cultural divide and the embedded socio-cultural biases of the researcher, the intra-group dynamics of the participants representing the case of the community is explored, and the apparent (or observed) manifestation of the internal identity and an occasional altered external identity of a socially disadvantaged community is explored. Lastly, a proposal for a higher functioning interpreter is presented.

At a practical level, the paper presents a technique which the interpreter in this study light-heartedly referred to as ukukhetha umdlungu emboneni [an isiXhosa phrase, meaning separating the wheat from the chaff], which evolved during the course of the field sessions when the groups could not reach consensus on what was perceived to be difficult or uncomfortable issues to be clarified.

This paper is organised into seven content areas, namely – (1) the context of the study, (2) an outline of critical theory, (3) a landscape for FGSs in community development, (4) the researcher and the cross-cultural divide in FGSs, (5) intra-group dynamics of participants within FGSs, (6) the question of altered external identities of socially disadvantaged communities, (7) proposal for a higher functioning interpreter in FGSs, and (8) the Ukukhetha technique for dealing with FGS impasses.

2. CONTEXT

A critical perspective on managing FGSs that are focussed on pertinent development issues within socially disadvantaged communities is presented here. It particularly investigates the role of the interpreter in facilitating a discourse which extensively takes place outside the usual socio-cultural domain (or comfort zone) of the researcher.

The experiences around a series of FGSs that took place in the former Transkei region of the Eastern Cape of South Africa, as part of an ICT4D environmental assessment study are reported. The work also explores the perceived non-reporting of information in the interpreter-to-participants exchanges (IPE) versus researcher-to-interpreter exchanges (RIE) on the basis of observed imbalances in the IPE and RIE dynamics. This paper consequently focuses on the socio-cultural and power relationships that may manifest within sessions and potentially compromise the effective gathering of data and information against the defined agenda of the researcher; whereas the best traditions of qualitative research recognise the notion of shared control of the research experience [1, 2]; and the community should therefore be able to direct the fore-grounding of their own agenda if such exists in contrast to that of the researcher; which sets the scene for a power struggle within the FGS, and it is in this regard, that it is proposed that the interpreter could play an important role.

The use of FGSs for qualitative data gathering has become increasingly popular because of its perceived time-efficiency and cost-effectiveness; but there are also potential methodological difficulties related to applying FGSs within cross-cultural contexts [4]. This sentiment is echoed by Strickland (1999) who urges that the researcher needs to be aware of traditions, communication protocols, roles and relationships when conducting FGSs within cross-cultural settings [5]. The literature is abound with procedural templates for conducting FGSs, but there is only limited critical treatment of the FGS as a viable qualitative data gathering method within socially disadvantaged communities where the researcher operates within a cross-cultural context as was the case within the broader research environment of this study. This paper presents a strategy for bolstering researcher confidence in the veracity of data gathered in FGSs and reduces the potential risk of the credibility and confirm-ability of the data being compromised through misinterpretation of exchanges that take place within the FGS.
The recommended procedures for conducting focus group sessions are well represented in the literature and indeed much of the suggested mechanisms are also deployed within this study, such as drafting the agenda, identifying and recruiting participants, selecting the venue and setting, conducting the sessions with ground rules and protocol duly observed, and recording and analysis [6, 7, 8].

3. CRITICAL THEORY

This study demands a critical lens for the gathering and analysis of qualitative data. Critical theory deals with the phenomenon of power relations within social settings that is premised on the notion of hegemony, which recognises a struggle in which the powerful win the consent of those who are oppressed, with the oppressed unknowingly participating in their own oppression in order to maintain the status quo [9].

The critical theoretical perspective that underpins this study is derived mainly from Gall et al (1999) who propose a strategy for engendering a critical perspective that provides a coherent framework for the contextualization, critique and analysis of social experience [10]. They propose the application of seven basic assumptions that acknowledges the prevalence of specific social relational dynamics with and within the target community, namely – (1) the manifestation of privilege and oppression or non-privilege; (2) the potentially multifaceted nature of oppression; (3) the role of language in establishing awareness; (4) the biased inscription of experience into discourse; (5) the mediation of individual perspectives through social and historical power relations; (6) the ideological inscription of truth; and (7) the problem of instrumental rationality.

Each of the aforementioned assumptions of criticality will now be considered in relation to data gathering and analysis practice within FGSs to ensure that such practices are consistent with the broad traditions of critical theory. In the context of the FGS of this study, critical theory informs the engagement process towards uncovering the bona fide conditions and aspirations of individuals and the community.

The prevailing socio-political conditions or landscape needs to be understood with regards to the power relations that define privilege and oppression. Critical theory “seeks to disclose the true interests of groups and individuals”, and promote the emancipation of the oppressed or non-privileged [10]. It is therefore of paramount importance for FGS that a context be created where non-privileged groups have freedom to give expression to their aspirations and potential to engage opportunities.

The next consideration in engendering criticality in the FGS engagement strategy towards understanding the prevailing socio-political conditions, relates to the potentially multifaceted nature of oppression – which demands that the researcher be vigilant in exploring any potential manifestation of oppression and its relation to other (more dominant) forms of oppression. The ability to effectively combat oppression is contingent on having comprehensive understanding of these conditions.

Language is generally key to the formulation of awareness, but even more so in a cross-cultural environment. Different forms of discourse which are formally and informally established are involved in shaping the conscious and unconscious experiences and consequently the awareness of individuals and the community; and language usage or “voice” of the discourse often is an expression of dominance or oppression [10]. Submissions of individual and community perspectives during FGS could therefore contain more than just mere literal content, and it is imperative that the researcher (and/or translator / interpreter) should be sensitive to nuances in language usage to potentially uncover a broader formulation of what is being conveyed.
The inscription of experience into discourse is biased by context and perspective where the actors within the discourse will ascribe meaning based on their own distinctive worldviews. Critical theory proposes that the discourse has no definite meaning and could yield multiple, even contradictory interpretations. It is therefore incumbent on the researcher within the FGS (and generally) to deconstruct the discourse and extract value with due consideration of the influences of hegemony, popular culture, and other aspects, including those referred to above.

“All thought is fundamentally mediated by power relations that are socially and historically constituted” [10]. In the context of this study, this assumption implies that the beliefs and perspectives of participants as communicated in FGSs are affected by their experiences with power relations, both outside and within the FGS; and that it is fundamental to who they are. The researcher should be aware that there are inherent social and historical biases that probably will persist despite attempts at structuring a social environment for the FGS that appears to be conducive to open exchange.

The critical theoretical assumption relating to the ideological inscription of truth refers to the notions that the pursuit of truth within qualitative research is value-referenced and not value-free; and that extant systems invariably favour the endeavours of the privileged or dominant groups over the non-privileged groups. A critical approach when conducting social inquiry within FGS therefore attempts to level the playing field by promoting the emancipation of the non-privileged.

Critical theory highlights the problem of instrumental rationality and cautions against the over-emphasis of technological determinism (the means) over the outcomes of social intervention (the ends). It is important within the FGS that the researcher does not overly promote a particular agenda, but rather remain open to the aspirations of the community and the emancipation of the non-privileged.

4. LANDSCAPE FOR FGS IN COMMUNITY DEVELOPMENT

The landscape model presented here is based almost entirely on observations in the field. The FGS is able to forge a summary view of the perspective of a community, from the melting pot of differing individual perspectives, in a manner that is not easily attainable with other forms of survey; but this, we believe, is possible only under properly managed circumstances.

The community perspective on a particular issue need not always reflect a consensus view; but the general orientation of the community to that issue must be clearly articulated which may even reflect that the community has a disparate orientation to the particular issue or aspects of it.

It is important to note that the focus group setting is not the proper environment for recording individual submissions as one might be tempted to do from time-to-time as when prominent community leadership figures are present in the session [2]; because political motives and undercurrents around submissions are not easily detected (or are at best unclear) within the high pressure environment of the FGS. It is equally important that a strong uncontested submission not be construed as the collective perspective even if one or more other persons confirm that particular point of view; all perspectives must be subjected to rigorous in-session testing and thoughtful discussion to ensure that it best captures the community view, in terms of scope, complexity, (multi-sectoral) representivity, mood, intent, and more.

The FGS landscape presented here will investigate – (1) researcher- interpreter dynamics; (2) FGS dynamics; (3) focus group dynamics; and (4) community dynamics; as is illustrated in the figure below:
The researcher has to validate the data and preferably use some form of qualitative triangulation of the data presented in FGSs to attain the reasonable levels of comfort with it; and this typically would take the form of engaging community members in one-on-one interviews where the prevailing political environment is less imposing and to also incorporate the experiences and insights gained through personal exposure to the environment.

The role of the interpreter is of specific interest in this study because the interpreter (of this study) is also a community developer and has a vested interest in presenting the case of the community and is not simply a neutral functionary. The role of the interpreter is of general interest because suitably qualified interpreters as the liaison between the community and the world external to the community probably would have some connectedness to the socio-cultural conditions and aspirations of the community, so there typically would be no neutral interpreters.

The research-interpreter dynamics are governed by several considerations; it is first of all an interpersonal relationship which is subject to the basic values of interpersonal communication, such as respect and trust. However at a functional level, it is governed amongst other considerations, by namely the agenda of the researcher, the competency of the interpreter, and the general political disposition of the community.

The FGS dynamics are essentially defined by the three-way exchange that takes place among the researcher, interpreter, and participants. It is crucial that this dynamic be managed in a considered manner as directed by the extant literature, recognising – (1) adherence to contextually or culturally appropriate protocol; (2) the binding imperative to pursue the research focus; (3) the varying political and cognitive capacities of participants; and (4) the art of communication beyond the verbal submissions. There could be hidden information in the audience demeanour, the body language of the participant and even the unsaid.
The focus group dynamics are the internal organisational power relations that manifests within participant groups. The participant groups could take many different forms and the group dynamics need to be accommodated and managed within the FGS. The most common groupings have been identified as being egalitarian, hierarchical, clustered, conflicting, disparate or isolated. An egalitarian grouping is characterised by its open and democratic approach to making its case and resolving potential internal issues and is indicative of communities having incorporated a degree of modernity into their modus operandi. A hierarchical grouping is identified by an uncontested spokesperson and is indicative of traditional communities. Clustered groupings are identified by the clear manifestation of separate agendas. Conflicting groupings are identified by the manifestation of contrary agendas being supported by the separate groupings. A disparate grouping is indicated where there seems to be no common ground or agenda within the grouping. The isolated or discrete view needs also to be noted and accommodated.

The understanding of community dynamics is important for the researcher to establish a realistic scenario of the perceptions and aspirations of the community so that sensible interventions through development programmes could be instituted.

The notion of community however is a complex construct that seeks to interpret and/or place identity on a group of connected individuals, in terms of their – geographical location; social condition; cultural orientation which remains a vague concept to me; and other considerations; which together creates a collective persona or identity of the community [11].

When addressing a FGS (or any gathering), we relate in our own minds to this collective persona or identity as opposed to simply directing our address to discrete individuals or receiving submissions from them in order for us to have sensible exchange. It is not the purpose of this study to elucidate in any academic form the phenomenon or collective persona that is referred to here but will explore this further in this paper.

5. RESEARCHER AND THE CROSS-CULTURAL DIVIDE WITHIN FGS

The notion of a cross-cultural divide is an interesting one since the notion of culture is not universally defined. Some would argue that it is also misunderstood and misused [12]. It appears that the notion of culture in the modern sense refers to language and communication styles, and approaches to art and the sciences, ontology, spirituality, and shared social customs and interaction. Notwithstanding the separation of language, it is on the basis of the latter point that of shared social customs that we wish to explore the cross cultural experience of a researcher coming into an environment of defined culture which is extensively different from the usual socio-cultural setting (or comfort zone) of the researcher.

At a pragmatic level, it is important just not to act in any way that the community might find offensive; and it would do no harm to demonstrate some token gesture of respect for customs and practice, which might be to greet the gathering in their mother tongue; and to be observant and tactful about allocating floor time and interrupting speakers, using silence and non-verbal expression as communicative devices; knowing what would be appropriate topics of conversation; and the use of humour and laughter as a communicative device [13].

There will be some risk of the data and information being misconstrued within a qualitative data gathering process where the researcher is not adequately orientated to the cross cultural context of the FGS. If the researcher is unfamiliar with the socio-political environment and every aspect appears to be novel, there may be a tendency to over-simplify or over-complicate the data capturing in an attempt to rationalise and comprehensively represent the situation (respectively); with experience it becomes easier to lift out the salient aspects that warrants treatment within the environment.

When dealing with socially disadvantaged communities, the solution sometimes appears to be apparent for an outsider who derives from a more affluent background; and such paternalistic approaches would not only be misinformed but also be completely inappropriate. Socially disadvantaged communities are complex societies that have to contend with a myriad of issues on an ongoing basis, many of which are simply insurmountable given the resource base of the community [14]. Jojola (2000) warns that development is not charity [3]; and communities-in-development should be the enablers of their own destiny. In addition,
external development participation in the communities should be based on principled and strategic approaches.

Not all participants within a FGS have the same capacity to engage the discourse. At one level it seems to be a statement of the obvious, while at another level it might be read as provocative, even contentious! The point that we want to make is that a researcher should not treat participants in a FGS as a homogenous group. The study accesses a perceived collective persona or identity of the community and is interested in the collective perspective of the community; but individual participant submissions and/or competencies should not be considered to be representative of the whole which then extends the collective persona debate of the previous section.

6. INTRA-GROUP DYNAMICS OF PARTICIPANTS WITHIN FGS

As illustrated in the FGS landscape model and discussed above, focus groups could be quite varied in their structural make-up. The management and leadership literature abounds with analyses of group dynamics and the principles of constituting effective groups [15, 16]. This is however not the purpose of raising the intra-group dynamics debate. The point that needs to be made is that the FGS is not the only game in town! The discourse that plays out during a FGS is just a window into the life of the community where often complex and long-standing struggles are waged around many different aspects of community life.

The FGS landscape model references the notion of the community political disposition. The rural communities of the former Transkei region of the Eastern Cape are generally politically aware; communities have defined perspectives about their traditional, local, and provincial government and are often quite critical of the quality of the service delivery that emanate from these structures; and there often is a pronounced tradition of community activism and political party association. Communities typically have been subjected to many development organisations to varying degrees of success. The extent of community politicisation of course varies from community to community. It is however important for the researcher to gain prior knowledge of the specific context of the communities that will be accessed.

Given the complexity of the socio-political environment, it is therefore recommended that the group dynamics that present within a FGS should be accommodated as opposed to attempting to simplistically correct it; participation is on a voluntary basis; and all contributions are respected and duly noted and should be declared at the outset as part of the ground rules for engagement. It is however the contention of this paper that the interpreter could play an important role in managing potentially volatile FGSs where the political tensions in the community would be difficult to be understood or to be contained by an outsider; and where there is some risk of the FGS collapsing and not yielding constructive data and information. The role of the interpreter who is entrenched in the affairs of the community could be invaluable to mitigate the risk of premature dissolution of the FGS.

7. ALTERED EXTERNAL IDENTITIES OF SOCIALLY DISADVANTAGED COMMUNITIES

In this section, we report without attempting to provide coherent academic articulation, on a phenomenon that we have observed on occasion during our engagement of communities. Communities would present on initial engagement of an external party, either a distinctly more pessimistic scenario or a distinctly more optimistic scenario of their social condition, relative to what we would regard as the bona fide social condition of the community. The bona fide social condition would come to the fore after spending time with the community, interacting with individuals and learning first hand of their plight.

It is understood that in the time typically available to present a case, that not everything can be said and only the key issues are prioritised and therefore might be somewhat overstated (or perceived to be overstated). Socially disadvantaged communities are continuously operating in survival mode, and it is therefore understandable that when the opportunity presents, that members of the community would want to present their case in a manner that would secure the most support. This would explain the occasional presentation of an overly pessimistic view of their social condition.
So, why is the case of the community occasionally presented in an overly optimistic way? The only logic that we could muster in this regard is to equate this anecdotally to when a new acquaintance is invited into the privacy of your home and you would try to show off your home in the best possible light! In this section, we too, may even have somewhat overstated the socio-psychological phenomenon of an occasional altered external identity of communities for strategic purposes. Jojola (2000) however succinctly declares that communities-in-development have no need to explain their condition to themselves [3].

There is however precedent to this phenomenon as reported by Bailur (2007), who suggests that the notion of community participation in rural information systems projects is “far more complex and contradictory” than what ICT4D literature in general leads us to understand [17]. Bailur (2007) reports on the experiences around the Our Voices Radio and telecentre in India, and illuminates on the challenges faced in achieving community participation and contextual appropriateness of the Our Voices Radio and telecentre rural development project as a result of a misalignment of purpose between the funding agency, the project management, and the community; and argues that open participation is often operationally thwarted by implementing rigid organisational structures and pursuing predefined missions that could present barriers to access by the community[17]. Bailur (2007) further reports on the so-called “co-optation” phenomena where “local communities tell project implementers what they want to hear” perhaps because of the skewed social power relationships and/or traditions dictating that local people do not offend outsiders. The lack of open community participation could then possibly militate against achieving contextual appropriateness in the design of the project [17].

The ultimate point that needs to be made is that researchers should not simply regard all submissions as being valid and there is always a need to ratify information.

8. PROPOSAL FOR A HIGHER FUNCTIONING INTERPRETER IN FGS

The primary role of the interpreter in a FGS is to partner the researcher in managing the session through its various stages, which typically involves - (1) an ice-breaker; (2) introduction of the panel; (3) recognising of any VIPs present; (4) providing information to participants; (5) hearing the initial reply from participants; (6) engaging the participants in the structured FGS process; and (7) concluding the process by summarising and providing details of further processes.

As mentioned with respect to intra-group dynamics, particular groupings of participants may present in the FGS as a direct consequence of prevailing socio-political conditions in the community. It is understood that within any FGS issues might arise on the day that may require clarification and may involve some decision making which typically is the domain of the researcher. It is however in regard of issues that have some deep rootedness in the socio-politics of the community that the researcher may not be adequately qualified to deal with during the FGS. This is where the proposal for a higher functioning interpreter comes into play.

In order to effectively manage the FGS in a politically loaded environment, decisions need to be taken on the fly in respect of many aspects, such as demographic gender and generational balances, the balance of political orientations, and agendas and prevalence of possible power and dominance or conflict dynamics. This is where a higher functioning interpreter could be very useful. An interpreter, who understands the community is able to moderate isolated or minority views, find common ground in the modernity versus traditional approaches debate, and may be able to understand the issues of the social breakdown that results in the manifestation of disparate groupings and would have some basis for moderating in the more serious politically clustered or conflicting groupings.

The researcher-interpreter relationship is central to capacitating the interpreter to perform a broader function than is probably the norm for interpreters. As mentioned before, the researcher-interpreter relationship needs to be healthy at an interpersonal level, but also the researcher needs to communicate clearly the research agenda to the interpreter prior to the FGS. In addition, the interpreter needs to inform the researcher of the prevailing socio-political disposition of the community prior to the FGS. The researcher has to ensure that the interpreter is knowledgeable or trained in conducting FGSs. If all the aforementioned conditions are met then researcher and interpreter could settle on an appropriate strategy for a forthcoming FGS. A FGS could then be conducted in one of several configurations. In order of escalating responsibility and competence
demanded of the interpreter this could be (1) a researcher-directed FGS, (2) a collaboratively managed FGS, (3) an interpreter-directed FGS, or (4) an FGS where the interpreter performs the dual-role of acting-researcher in data gathering and interpreter in providing the data feedback to the researcher. The latter strategy has not been tested in practice and is presented here merely as the ultimate extension of the role of the interpreter and would logically be deployed only in exceptional circumstances where any form of outside participation could be construed as interference. The first three strategies have all been tested in practice and also represent in sequence the emancipation of the interpreter through training and experience, which in a complementary manner would also release the researcher to focus on the non-verbal aspects of the exchanges within the FGS.

All having been said, the researcher-directed FGS will continue to be the dominant configuration, on the basis of what is presented here. The collaborative management of the FGS is clearly a desirable option, since this would allow the interpreter to act semi-autonomously to manage the flow of the discourse and provide regular précis of the discourse to the researcher. The researcher, on the basis of the précis, maintains the research focus of the FGS, and observes the non-verbal aspects of exchanges and synthesises the collective perspective of the community on the matters under discussion. The interpreter-directed FGS is a minority option that could be deployed in politically loaded FGS, as mentioned before.

9. APPLICATION OF FGS TO THE IS’BAYA PROJECT

This section demonstrates the effectiveness of FGS in providing relevant data that describes the social and enterprise experiences around the Is’baya project. A visual map, referred to as the Map of Potential Factors and Causes (MPFC), is presented as the outcome of FGS application towards modelling various social and enterprise activities describing the nature of the ICT4D effort within TSFE based on the proposed ICT deployment within the IVRP. The MPFC represents factors that were mainly identified through the FGS processes but also enhanced by personal experiences and insights of the researchers.

The ultimate purpose of the modelling of this study was to develop software tools that could be used to support the quest to uncover the generative mechanisms that explain the (predicted) experiences of communities and TSFEs around the deployment of ICT. The computation models will further support the realisation of an implementation strategy to determine the efficacy of ICT deployment within TSFEs in rural areas.

The central theme of the Is’baya project was the efficacy of its ICT project, which is then fittingly located at the centre of the map, as depicted in Figure 2 (below). The three main domains are represented in the diagram, namely the community, the farming enterprise, and the ICT project; each domain hosts a summary consideration, namely adoption of ICT by the community, performance of the farming enterprise, and potential of the ICT project (respectively).

The MPFC also feature considerations of dependency relationships linking various factors, for example the potential of the ICT project is shown to dependent on the availability of computer training for the community, the utility value of potential computer applications that could be brought to bear on the production enterprise, and the utility value of the internet with respect to content and the quality of connectivity; the utility value of computer applications depends the effectiveness of the management approaches deployed and the delivery cost of computer applications; et cetera.

Two clusters are identified within the community domain and the farming enterprise domain respectively; where these clusters are identified as those factors that are to be further explored towards establishing their interconnected and causal relationship with the summary consideration of each domain respectively, and also with the central efficacy theme; and this is the intent of this study henceforth. No further analysis will be conducted on the technical aspects of the ICT project itself, but it is not the intent to trivialise the importance of choosing appropriate technologies for a given application; to deal with all aspects of the socio-political, economic, and technical condition were deemed to be imprudent and since I am interested here in the broad causal relationships, the community and enterprise aspects were deemed to be the more interesting aspects. A computational modelling approach was chosen as my preferred strategy for examining these relationships;
and since computational modelling requires an objective framework, this necessitated that firm decisions were taken about the factors which were to be included in the modelling and how such factors were to be represented in the modelling.

The Map of Potential Factors and Causes (MPFC) is depicted in Figure 2 (below):

![Map of Potential Factors and Causes (MPFC)](image)

10. CONCLUSION

This paper presented argument for a critical approach to FGSs to bolster researcher confidence in the veracity of data gathered within the FGS by being aware of the potential risk to the credibility and confirmability of the data being compromised through misinterpretation of exchanges that take place within the FGS based on the respective roles of the researcher and interpreter and their interaction with the community on the basis of the researcher functioning within a cross-cultural divide, the intra-group dynamics of participants within FGSs, and the question of altered external identities of socially disadvantaged communities. The study proposes a strategy for a higher functioning interpreter within FGSs, and demonstrates the potential of FGS as a data gathering method.

Sen (1999) raises the notion of “development as freedom” and presents the interdependence of two concepts; the veracity of data gathered is one half of the concern, the other half being that all voices need to be heard, or as Sen suggests, to have the freedom to be heard within the development discourse [18].

The views of Grudens-Schuck et al. (2004) are therefore supported here that FGSs can produce high quality data and information if correctly structured [2]; and argues that a critical approach is indicated to navigate the process through the challenges of the socio-cultural divide; and the researcher has to be conscientious of the character, capacity and the underlying power dynamics in the community that produces the experiences observed during the FGSs.
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ABSTRACT

In despite of the importance of spin-offs to transfer research results from academia to industry, only a mere fraction of university patents is commercialised by new venture formation. This paper introduces a pedagogic tool named ‘Science to Market’ to commercially exploit unused academic patents through the creation of innovative businesses. The tool is embedded in entrepreneurship education and uses the creative potential of interdisciplinary teams. A number of implications and future prospects is drawn up.

Keywords: Higher education; Pedagogy; Patent commercialisation; Entrepreneurship Education; Students; Germany.

1. INTRODUCTION

Based on experiences gained through the I and II programmes\(^1\), a project entitled ‘A hotbed for ideas and entrepreneurs: commercial qualification of ideas from high-tech research’ was brought to life by the University of Applied Sciences, Jena with the help of III. This project focuses on the pre-start-up stage in the process of new venture creation. The project’s objective was to develop and establish an effective tool for generating new and sustainable business ideas. For this purpose, the aim was to detect and evaluate unused results from research institutions within the Jena region, as well as to set incentives for their commercial exploitation. The project duration was from September 1, 2007 to February 28, 2011.

The chief project partner was the Institute of Photonic Technology (IPHT), in Jena. This extra-faculty research institution focused on application-oriented system solutions in key technologies of light and photonic. The IPHT covers a broad set of innovative support, ranging from idea generation on basic research, to development of prototypes. Furthermore, the project was conducted in co-operation with the Friedrich Schiller University, Jena, the Technology and Innovation Park, Jena and the Chamber of Industry and Commerce East Thuringia in Gera. In addition, several other partners belonging to the Thuringia Business Start-up Network were involved.

Three main areas were defined to carry out project activities. The first area (idea generation and evaluation) aimed at fostering co-operation among universities and research institutions in Jena. It embraced development, testing and implementation of a pedagogic tool for evaluation and exploitation if unused research results. In addition, this first area also sought ways of extending and improving existing entrepreneurship-related educational concepts at the University of Applied Sciences, Jena. A second area (consulting and coaching) was dedicated not only to increasing the awareness among students and researchers, to provide initial consultancy services for individuals interested in creating a business. This involves the organisation of adequate public relation initiatives, installation of a ‘Product and Commercialisation Check’ for potential entrepreneurs and a continuous feedback-based enhancement of consulting and coaching activities. A third main area (co-operation und dissemination) comprised exchange of experiences with international partners, organisation of and participation in joint events with regional partners and the transfer of experiences gained through workshops, conferences and publications.

The remainder of the paper was structured as follows: Section 2 described the outcomes of an important component of the project. More concretely, it referred to a pedagogic tool entitled ‘Science to Market’ to

\(^1\) EXIST is a support programme of the Federal Ministry of Economics and Technology of Germany aimed at improving the entrepreneurial environment at universities and research institutions and at increasing the number of technology and knowledge based business start-ups (www.exist.de).
commercially exploit unused research results, embedded in entrepreneurship education. Then, Section 3 introduced an example for a business idea derived from ‘Science to Market’. Finally, Section 4 concluded and draw up prospects.

2. ‘SCIENCE TO MARKET’

2.1 UNDERLYING CONCEPT

Academic start-ups are of great economic importance [1]. In particular, spin-off companies are the entrepreneurial route to commercialise academic research and to foster their formation is today at the core of many national and local economic policies [2, 3]. Pirnay et al. [4] defines academic spin-offs as new firms created to exploit knowledge, technology or research results developed within the university, in which the founders have their origins in. Because of their catalysing role in knowledge creation and transfer, spin-offs from universities are some of the most promising channels to transfer research results to industry [5, 6].

There are, however, several indications that universities tended to possess a great number of research results, in particular patents, which had not been commercialised and for which no concepts for exploitation existed [7-10]. As a consequence, only a fraction of academic patents was effectively and profitably transferred into commercial applications. Moreover, if results were successfully transferred, the licensing-for-cash appeared a most prevalent strategy [1].

Against this background, the project was based on the insight there was a missing link between patented research results on one hand and their commercial exploitation by new venture formation on our other. The idea was to develop and implement a new pedagogic tool to bridge gap, whole sensitising university staff, students and researchers, to entrepreneurship. The tool was intended to utilise unused patents from universities and research institutions which seem promising enough to serve as a basis for the creation of innovative businesses. A critical review of existing literature and educational concepts indicated a lack of suitable approaches in Germany. However, several appropriate methods worth adapting and improving were found in other countries [e.g. 11, 12].

In the commercialisation process, the participation of researchers and faculty inventors was a critical determinant. Several scholars [13, 14] discovered that most science-based technologies remained embryonic and required additional development. Hence, because of their implicit knowledge, the active involvement and co-operation with researchers and inventors was widely considered as essential for a reasonable chance of commercial success [1, 13, and 14]. Interestingly, Haase und Lautenschläger [8] brought to light that staff at Thuringian universities were in fact predominantly interested in accompanying the commercialisation process of their research results. This stimulus should be embraced and used within the pedagogic tool.

2.2 DESIGN AND REALISATION

Consequently, the main motivators for creating the pedagogic tool were to meet the demand of research commercialisation and to further develop experiences described by other institutions. The tool should use the creative potential of interdisciplinary teams to transfer patented research results into innovative products or services. Simultaneously, it was relevant to foster participants’ entrepreneurial attitudes and skills of the participants. To discover if potential participants showed interest in such pedagogy, the Centre for Innovation and Entrepreneurship at University of Applied Sciences, Jena conducted a survey among 399 university students in the winter term 2007/2008 [15]. The main findings were:

- More than 90% of students showed interest in learning about evaluation and exploitation of business ideas;
- In excess of one third of respondents possessed viable business ideas and further developed; and,
- Pedagogic tool should be offered during a semester and include an option to gain credits for that participation.

Thus, the pedagogic tool was designed as a module of higher education, aiming at (1) the identification of potential entrepreneurs and the establishment of entrepreneurial teams and (2) the evaluation and development of commercial ideas from academic patents. More concretely, the pedagogic tool conveyed the
In Part I, the lecturer presents the objective and contents of the pedagogic tool. With the assistance of the faculty-inventor he introduces the selected patents and explains their technological background. This is linked with an on-site visit to respective laboratories. Subsequently, interdisciplinary teams are formed and the basics of conflict management are conveyed. The objective of the incorporated lectures is to provide students with knowledge and skills to obtain information, to recognise opportunities and to generate and evaluate ideas. This is completed by contents related to the basics of feasibility studies and the training of presentation techniques.

During Part II of the pedagogic tool, the groups were requested to analyse and evaluate patents presented to them. In doing so, they applied the knowledge acquired in the former section and developed different innovative business ideas from the patent through creativity techniques. Then participants presented at least three of such ideas, those with the highest commercial potential, and were given feedback from the inventor, as well as from an advisory board. The business idea to receive the highest score was further developed in Part III.

Part III aimed at conducting and presenting feasibility studies which, in co-ordination with the advisory board, ensured commercial relevance. More concretely, participants undertook analyses concerning market potential and the competitive environment while elaborating on appropriate marketing measures. The insight gained was incorporated in financial plans, the results of which served as a basis for evaluating commercial feasibility. Business ideas and respective feasibility studies were presented to other groups and the advisory board. During this phase, participants were offered an opportunity to discuss outcomes of their work and were assisted in the definition of the next steps.

After these three parts, the III project members remained in contact with the faculty inventor to discuss results and to shape further any commercialisation process. The business model elaborated during ‘Science to Market’ was steadily developed and improved within other lesson formats, such as business plan development seminars. In addition, individuals interested in the invention were offered a possibility to enhance it through subsequent research. Finally, if interest was indicated, the project team introduced the faculty inventor and/or the participants to co-operate work partners from Thuringian start-up networks and supported them in submitting business idea to the Business Idea Competition Jena-Weimar and the Thuringian Business Plan Competition, both organised on an annual basis.
theoretical foundation of entrepreneurship, creativity and idea generation, evaluation of business models, realisation of feasibility studies and business plan development. In practical terms, the teams of participants dealt, mostly autonomously, with patents placed at their disposal. They were supported by an advisory board, consisting of consultants, scientists and businessmen, to provide know-how and experience for evaluating their business ideas.

A pedagogic tool entitled ‘High-tech to Market’ was launched and run for the first time in the (European) summer term 2008. Participants were business administration and engineering students who acted independently. In this way, a total number of four groups dealt with two patents, one about superconductors and another on multiturn sensors both from the IPHT. In the autumn semester, the tool was offered to students from the Business Administration and SciTec\(^2\) Departments. As opposed to the initial configuration, students then worked in mixed and interdisciplinary teams. In subsequent semesters this system was maintained. In addition, students from the Mechanical Engineering Department were integrated.

Concern were raised that business ideas and commercialisable results could also be attained from non-high-tech areas. Therefore, from the summer term 2010 on, the pedagogic tool was renamed ‘Science to Market’. Today, it is a compulsory optional subject for courses of study at the University of Applied Sciences, Jena:
- Bachelor of Business Administration;
- Bachelor and Master of SciTec;
- Bachelor of Industrial Engineering; and,
- Bachelor of Mechanical Engineering.

2.3 CONTENT AND STRUCTURE

The entire pedagogic tool consists of several conjoined activities and divided into three main components, each lasting five weeks. As shown in Figure 1, they also integrate entrepreneurship-related contents, such as business start-up related knowledge, opportunity recognition and idea evaluation, and the transformation of product ideas into commercial concepts and plans.

Prior to starting the tool, a project team screened hitherto unused academic patents, and recruited the appropriate researchers or faculty inventors. In doing so, a lecturer co-operated with the Patent Information Agency of the University of Applied Sciences, Jena and with the Patent Exploitation Agency of the Ilmenau University of Technology. After the examination, a lecturer selects the most promising research results and co-ordinates researchers’ active involvement.

\(^2\) The SciTec (Science and Technology) Department of the University of Applied Sciences Jena comprises the areas precision engineering, physics engineering and materials engineering.
2.4 RESULTS AND OUTCOMES

By 2011, ‘Science to Market’ was offered to students and interested staff of the University of Applied Sciences, Jena eight times. A total of 106 individuals participated in the pedagogic tool. Eleven different research results from the University of Applied Sciences, Jena and the IPHT were used to build innovative business models and to evaluate their commercial feasibility. Some patents were processed more than once, as they involved different technological fields of application. Moreover, after receiving feedback from earlier semesters, some research results were further developed and re-used for ‘Science to Market’. Although most feasibility studies led to positive outcomes, up to 2011 no concrete business venture of yet been created to commercialise research results. Most students preferred to complete university studies before pondering the option of engaging themselves in entrepreneurial activities.

3. AN EXAMPLE FROM ‘SCIENCE TO MARKET’

In May 2009, the University of Applied Sciences, Jena filed a patent application, based on an invention from by four researchers. A year later, the respective patent was granted under the patent number DE102009021448B3. If patent protects a device and a process for peripheral processing of workpieces by a laser system. Through a peripheral mirror and an optical system, a laser beam impinges on a workpiece after several reflexions. In contrast to conventional peripheral processing of extrudates, the innovative aspect of this invention consists of the use of a laser beam for material treatment.

This new material processing clearly offers a variety of potential applications that appear theoretically interesting; however, in practical aspects it was impossible to achieve commercialisation in the short or medium term. For this reason, the patent specification was used for ‘Science to Market’ in the winter term 2009/2010. It was introduced to participants, who were requested to identify and evaluate a maximum number of practical applications. Outcomes were discussed in co-operation with the faculty inventors, the lecturer and the most appropriate case was selected for further commercial development.

The business idea for this hitherto unexploited university patent was to extend its application to the glass and plastic manufacturing industry and to create a venture the purpose of which would be to market a product within this sector that used patented laser processing technology. As the invention was still embryonic, work carried out by participants provided important stimulus for additional development and optimisation for practical application. The outcomes of ‘Science to Market’ also provided a basis for more intensive market study and for initiating co-operation with potential customers identified by the participants. Although in the short term no new businesses were created, ‘Science to Market’ set a cornerstone in the commercialisation process of this university patent.

4. CONCLUSIONS AND FUTURE PROSPECTS

The EXIST III project and its pedagogic tool ‘Science to Market’ makes an important contribution to the field of entrepreneurship education as it enhances participants’ entrepreneurial skills and competencies. From a methodological point of view, the tool encourages the introduction of experiential and activity-oriented learning at the University of Applied Sciences Jena. The evaluation of ‘Science to Market’ and its outcomes is an ongoing process, offering a possibility to draw varied conclusions. The interdisciplinary teamwork motivates active participation and brings forward ideas. The pedagogic tool is not only an appropriate instrument for sensitising individuals to entrepreneurship, but also contributes to the commercial exploitation of research results by creating a pool of potential business ideas. Overall, ‘Science to Market’ is an effective instrument to induce and promote entrepreneurship.

Outcomes also show however, not all research results or patents suitable to be dealt with in ‘Science to Market’. The reason lies in the heterogenic developmental stage. As already purported [13, 14], most science-based technologies require additional development. Many patents screened before running the tool lacked marketability and considerable research efforts needed before a suitable commercialisation approach could be considered. Furthermore, many technological solutions are too specific in their applications from which to develop product ideas. Instead of the faculty inventors’ involvement as a type of lecturer, their role should rather be of consultative nature. In this way, an additional positive effect was found, as the business
ideas and market analyses elaborated by the participants sensitised the faculty inventors to engage themselves in the commercial and entrepreneurial exploitation of their inventions.

In light of these considerations, it must be concluded ‘Science to Market’ surely allows development of innovative business ideas; however, they mostly represent a preliminary phase of the business model and require more development before application. This situation requires other and subsequent lesson formats to ensure a market-specific adaptation and the further improvement of the business ideas generated by ‘Science to Market’. The University of Applied Sciences Jena, in particular the Centre for Innovation and Entrepreneurship, had already made efforts to enhance entrepreneurship-related lectures in that direction.

In addition to this aspect, it seems wise to include contents related to teamwork and conflict management. Team efficiency was considerably lower when internal controversies or disputes occurred. This led to delays and decreased engagement in task accomplishment. Indicators are those led to lower the quality of the feasibility studies and reduced participants’ motivation. Hence, the challenge in the further improvement of the pedagogic tool is to better control such processes and increase the efficiency of ‘Science to Market’.

A noteworthy add-on to the pedagogic tool rests in the inclusion of a virtual learning platform, ‘Moodle’. This would enhance positive impact of the didactic and methodical approach for the conveyance of knowledge and its application. Likewise, the use of ‘Wikis’ or learning logs provide possibilities to visualise progress made by participants, especially during the group-individual teamwork phase. Lastly, the introduction of ‘Blended Learning’, i.e. the mixing of different learning environments, will involve reflexive phases to a greater extent and probably support an optimised development of business ideas.

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STUDY OF VENDOR-MANAGED INVENTORY PRACTICES IN SOUTH AFRICAN RETAIL INDUSTRY

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ABSTRACT

Vendor managed inventory (VMI) is a model for supply chain collaboration gaining ground in multiple industries around the world. This paper describes with the help of case studies how vendor managed inventory (VMI) model manages the needs of a retail industry supply chain in South Africa. The purpose of this paper is to explore the performance increase achieved by vendor managed inventory (VMI) under different levels of outside supply capacity, demand uncertainty, and lead time and also to investigate apparent differences among large and small sized enterprises in terms of objectives, obstacles and impacts of VMI in South African retail industry. The paper uses an exploratory multiple case study with data from four operational VMI dyads, evaluating both buyer and supplier perspectives. It is observed that large retail industries in South Africa have started adopting VMI for improving their business performance due to installation of effective enterprise resource planning (ERP) systems. Small and medium enterprises have communication barriers and limited financial resource to implement VMI effectively. The paper explores current practices with respect to VMI in South African retail industry. The analysis would be useful for the developing VMI adoption strategies in South Africa context.

Keywords: Supply chain, Retail, Small to medium-sized enterprises, Enterprise Resource, Planning, and Vendor managed inventory, South Africa

1 INTRODUCTION

The simultaneous integration of customer requirements, internal processes, and upstream supplier performance is commonly referred to as supply chain management (SCM) Tan et al, 1999[1] A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes retailers, suppliers, transporters, warehouses, manufacturers and customers themselves. Within each organization, such as retail, the supply chain includes all functions involved in receiving and meeting customer demand. These functions include marketing, operations, distribution, finance, and customer service.

By coordinating different suppliers, distributors and manufacturers along the logistics network or establishing business partnerships, SCM is concerned with finding the best strategy for the whole supply chain Simchi-Levi et al, 2003[2]. Information sharing is a very important issue of finding the best strategy for the whole supply chain. SCM success is enhanced by the relationship quality, information system (IS), and quality of information and communications system, Claassen et al, 2008[3]. Information sharing is recognized as a key requirement for collaborative inter-organizational relationship. Studies by Cannon et al, (1999)[4] suggest that a successful buyer-supplier relationship is connected with high levels of information sharing. The key solution to the bullwhip effect is efficient sharing of demand information, Li et al, 2005[5]. In spite of these advantages, retailers, do not desire to engage in information sharing. This is due to the fact that the primary beneficiary from information sharing is the manufacturers, not the retailers Lee et al, 2000[6].

In the face of a competitive South African market, supply chain members are now focusing on core competencies, and are attempting to achieve competitive advantage by managing purchasing activities and relationships with suppliers more effectively. Firms are utilizing their suppliers' processes, technologies, and capabilities to enhance competitive advantage Farley, 1997[7], the manufacturing, logistics, materials, distribution and transportation functions are coordinated within organizations. Many firms have reduced their supply base so they can more effectively manage relationships with strategic suppliers. Retailers are collaborating with their suppliers, mutually beneficial relationships with suppliers and viewing suppliers as
virtual extensions of their firm Copacino, 1996 [8]. In doing so, they have significantly increased their reliance on suppliers.

In a vendor-managed inventory (VMI) system the supplier is responsible for replenishment decisions on behalf of the buyer Chopra et al, 2001[9]. VMI has been implemented quite widely in the retail industry in recent years. VMI is a concept, which can be applied throughout the supply chain to improve overall productivity by reducing the idle inventory and is a dynamic model based on the customer needs.

Success of the VMI model completely depends upon the co-operation between customer and the supplier. Traditionally, customers place orders on their suppliers. By using this traditional model both supplier and customer face various problems in their operations. Since the suppliers have no advance information of requirements they resort to make forecasts and as a result carry unnecessary stocks. Secondly, the supplier is often faced with unexpected short-term demands for products, which leads to frequent changes to their production distribution schedules and thus additional cost. Using VMI system the customer no longer places any order but instead shares information with the supplier/vendor with the help of information technology (IT). IT based VMI system provides a broader view of inventory-holding locations and pipeline activity, which gives the supplier better information concerning the actual usage or sales of the product, current on hand inventory and details of additional marketing activity such as promotions. On the basis of this information the supplier takes responsibility for replenishment of the customer’s inventory.

The customer places no orders, but instead the customer gives an indication about the upper and lower limits of stock that they wish to keep on hand. It is the responsibility of supplier to maintain the customer’s inventory within the specified stock bands. That is, in a VMI system, the retailer’s role shifts from managing inventory to simply renting retailing space Mishra et al, 2004[10].

Growing competition and the rapid implementation of advanced information technology has encouraged retailers and suppliers to reengineer their supply chains and examine VMI models to reduce costs and improve efficiency. Retailers’ sharing of point-of-sale (POS) data using electronic data interchange (EDI) systems have become common practice. Vendor-managed inventory (VMI) has emerged in this context as a model that takes the collaborative efforts beyond information sharing and allows the supplier to apply some amount of control on the actual inventory control at the retailer. Wal-Mart and Procter & Gamble (P&G) represent one of the first large-scale successes of such VMI agreements. Their partnership began in 1985 and significantly improved P&G’s on-time deliveries to Wal-Mart while increasing inventory turns Buzzel et al, 1995[11].

Retailers with a competitive advantage are those that drive VMI system more strategically, creating new revenue opportunities, efficiencies, and customer loyalty. Collaboration between retailers and manufacturers can bring benefits to both parties. A well-focused VMI system can improve profitability, reduce waste, and contribute to more valuable relationships between retailers and their manufacturing partners Greenbaum, 2004[12]. Measuring the levels of collaborative practices assists chain members in identifying the shortcomings of their current levels and identifying possible initiatives to remedy them Shepherd et al, 2006[13].

An important problem in many distribution networks operated under the VMI paradigm is to determine the optimal quantities of material to be dispatched to each retailer from the local warehouse. Usually, the goal is to optimise the trade-off between maintaining excessive inventory at the retailers, which increases the operating costs, and not maintaining enough inventories, which can cause stock-outs and lost sales. In addition, one can not ignore the issue of transportation costs which can be reduced by shipping large batches that unfortunately tend to increase inventory-holding costs.

The supply chain management approach to cost minimization of inventory implies that a business can no longer compete in the marketplace by itself. This approach requires careful planning and coordination of all activities of the supply chain partners who are involved in the movement of materials and products from the supplier to manufacturer to distributor (wholesaler/reseller) to retailer and consumer. Managing inventory is considered to be one of the most important areas of supply chain management Ganeshan, 1999[14].
It is indicated that the most important benefits of VMI rest on transparency and demand visibility in the supply chain. Fundamental for obtaining transparency and demand visibility is the customer’s willingness to supply demand data. Similarly, the supplier must be able to apply this data for planning purposes, and these two elements are said to be essential for VMI success McBeath, 2003[15]; Disney et al, 2003[16]; Kulp, 2002[17]; Lapide, 2006[18].

2 RESEARCH OBJECTIVES

The present study is a sample study in South African retail industries and aims to find answers to the following questions:
1. What are the benefits and shortcomings of vendor managed inventory system in retail industries?
2. What is the significant difference in the understanding of success factors of VMI in retailers and suppliers/distributors?

3 RESEARCH DESIGN AND DATA COLLECTION

The first question above can be answered through a literature survey and discussions with experts in SCM. “Experts” in SCM are those who are using full or part academically or practically in their courses or work. Academic experts mostly publish their work in reputed journals or conferences, through which we can gain knowledge of various benefits and shortcomings. Also, certain professors were contacted to understand this. The experts using VMI practically were those retailers, manufacturers and distributors who are using VMI in their work. Most people from procurement and operations were contacted to understand this. The various benefits of vendor managed inventory as stated by many researchers are shown in Appendix 1. These benefits ultimately culminate in a radical change in the performance standard of the organisation and ensure continual growth in a competitive market situation. Borade et al, 2010[19], Vendor managed inventory system requires the organisation to integrate all its activities and functions in all respects, and at various levels, for total collaboration with its suppliers to be effective.

Although there is evidence that supports the benefits of VMI initiatives in retailers and suppliers, a large number of studies have shown VMI initiatives fail to show a significant impact on business/service performance. Researchers have also indicated that many small to medium retailers have encountered difficulties in implementing VMI due to cost constrains, [19]. Researchers within the SCM fraternity have suggested the shortcomings of VMI listed in Appendix 2. Organisations are more concerned about short-term business returns rather than long-term sustainability of business performance. To answer the second question set out in the last section, a hypothesis H0 was set and a questionnaire was prepared based upon the hypothesis:

H0. There are significant differences in the success factors of VMI in retailers and suppliers /distributors?

The questionnaire was based on the seven success factors and total of 150 were sent to four retailers and to four suppliers companies and the response rate was 40%. The suppliers included dairy (medium enterprise), chickens (small to medium), bread (medium enterprise) and vegetables (small enterprise), while the retailers included two large enterprises, medium small enterprises. The first eight questions in the questionnaire were related to background of industry, number of employees, sector of the business, type of industry, position of respondent. The variable questions were grouped into seven factors. Each factor is then divided into variables or statements. Each variable is measured on a Likert scale in the questionnaire. The contents of the questionnaire were decided after thorough discussions with experts and then subjectively judged by the researchers.

4 ANALYSIS OF DATA

The data collected were analysed by using SPSS Version 7.5 and Minitab Version 13 software in order to test the hypothesis H0 at the 5 per cent level of significance (the significance level based on the asymptotic distribution of a test statistic). A value of less than 0.05 was considered significant and was chosen to analyse the data. Table I illustrates the means, standard deviations and paired comparison for each factor for both
retailers and suppliers industries. The paired-samples t-test is a statistical test of the null hypothesis (i.e. there are significant differences in understanding the success factors of VMI in retailers and suppliers organizations in South Africa). It is used when the observations for two groups can be paired in some way. Pairing is used to make the two groups as similar as possible. The differences observed between the groups can then be attributed more readily to the variable of interest.

P-values are often used in hypothesis tests to either accept or reject a null hypothesis. The p-value represents the probability of making a Type 1 error, or rejecting the null hypothesis when it is true. The smaller the p-value, the smaller is the probability to make a mistake by rejecting the null hypothesis. A cut off value often used is 0.05, that is, the null hypothesis is rejected when the p-value is less than 0.05.

4.1 RANKING OF FACTORS

The respondents were asked to rank the factors in descending order of importance from 1 to 7. Rank 1 means the most important factor for vendor managed inventory system and rank 7 means the least important. The scores were then added together to determine the list of factors in a hierarchical manner. Table II illustrates the rank of each factor in both retailers and suppliers.

4.2 DISCUSSION AND KEY FINDINGS

From Table I, it can be seen that the p values of various factors are less than 0.05, except for Risk and reward sharing, which clearly rejects the null hypothesis (there is a significant difference in the understanding of success factors for VMI in retailers and suppliers). This observation shows that both sectors understand management commitment, responsiveness, employees training, customer satisfaction, effective communication and knowledge sharing as success factors of vendor managed inventory system.

Table I. Factors, mean, standard deviation, paired t-value and p-value for 5 percent significance level

<table>
<thead>
<tr>
<th>Success Factor</th>
<th>Mean Retailer</th>
<th>SD Retailer</th>
<th>Mean Supplier</th>
<th>SD Supplier</th>
<th>Paired Comparison t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>3.55</td>
<td>0.469</td>
<td>3.93</td>
<td>0.482</td>
<td>2.45</td>
<td>0.028</td>
</tr>
<tr>
<td>Effective communication</td>
<td>3.60</td>
<td>0.565</td>
<td>3.34</td>
<td>0.578</td>
<td>2.32</td>
<td>0.036</td>
</tr>
<tr>
<td>Risk and reward sharing</td>
<td>3.07</td>
<td>0.459</td>
<td>3.43</td>
<td>0.451</td>
<td>2.10</td>
<td>0.038</td>
</tr>
<tr>
<td>Management commitment</td>
<td>3.48</td>
<td>0.575</td>
<td>3.31</td>
<td>0.297</td>
<td>2.29</td>
<td>0.038</td>
</tr>
<tr>
<td>Employees training</td>
<td>3.67</td>
<td>0.458</td>
<td>3.24</td>
<td>0.479</td>
<td>2.80</td>
<td>0.014</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>3.48</td>
<td>0.575</td>
<td>3.15</td>
<td>0.297</td>
<td>2.29</td>
<td>0.038</td>
</tr>
<tr>
<td>Knowledge sharing</td>
<td>3.65</td>
<td>0.588</td>
<td>3.27</td>
<td>0.564</td>
<td>2.31</td>
<td>0.037</td>
</tr>
</tbody>
</table>

However risk and reward sharing ranked seventh (Table II) in both sectors and also there is a significant difference between the means of both industries (Table II). From Table II it is clear that risk and reward sharing in the company has the least importance in both retail and supplier for vendor managed inventory. However, the literature review showed that risk and reward sharing within the whole organisation is very important for effective and efficient operations. Better risk and reward sharing could reduce misunderstandings and confusion regarding the requirements from internal and external customers. Top management is responsible for risk and reward sharing and explaining VMI goals and policies to the employees of companies. Also, the participation of top management in the process of VMI can motivate employees to take an active part in VMI activities. These results for risk and reward sharing reflect the culture of companies and the nature of team work and other problem solving activities in an organisation. Figures 1 and 2 and show the scores of each factor in the retail and suppliers, respectively, on the basis of which they were ranked.

5 CONCLUSION AND DIRECTIONS FOR FUTURE WORK

The study reported in this paper was carried out with the help of questionnaire sent to retailers as well as suppliers to understand the benefits, shortcomings and significant differences between the understandings of both sectors regarding the success factors of vendor managed inventory system.
Table II. Ranking of success factors

<table>
<thead>
<tr>
<th>Success Factor</th>
<th>Ranking in Retail sector</th>
<th>Ranking in Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Effective communication</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Knowledge sharing</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Management commitment</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Employees training</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Risk and reward sharing</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 1. Scores of factors for retailers

Figure 2. Scores of factors for suppliers
In total, 60 questionnaires were received from both retailers and suppliers. A total of seven factors consisting of 35 variables were considered in the questionnaire. It is found that all seven success factors are considered to be important for VMI practices in South African retailer industries as compared to suppliers. Both sectors have different priorities for VMI, but both described risk and reward sharing as being not so important, which is contradictory to the literature review but seems correct when compared with the findings of various researchers.

It was found that both sectors understand the importance of knowledge sharing and effective communication to VMI so ranked it the same. Future work can be carried out in the following directions:
1. The number of responses can be increased by involving more organisations at an all-South African level.
2. The number of factors can also be increased after discussion with pioneers in the field.
3. The implementation of VMI can be carried out on the basis of these factors after making a systematic plan.

6 REFERENCES:


APPENDIX 1. BENEFITS OF VMI TO RETAILERS AND SUPPLIERS

- Improved competitive position.
- Increased profitability.
- Increased productivity.
- Increased quality of delivery.
- Less inventory cost.
- Increased teamwork.
- Encourages teamwork.
- Satisfied internal and external customers.
- Revenue improvement.
- Operational improvement.
- Continuous improvement.
- Trained workforce.
- Reduced lead time.
- Development of managerial ability of leaders.
- Easy tasks of management for retailer.
- Data entry errors are reduced due to computer to computer communications. Speed of the processing is also improved.
- Both parties are interested in giving better service to the end customer. Having the correct item in stock when the end customer needs it, benefits all parties involved.
- A true partnership is formed between the Manufacturer and the Distributor. They work closer together and strengthen their ties.
- Stabilize the timing of Purchase Orders - PO's are now generated on a predefined basis.
- Visibility of the Distributor’s Point of Sale data makes forecasting easier.
- Promotions can be more easily incorporated into the inventory plan.
- A reduction in Distributor ordering errors (which in the past would probably lead to a return) Visibility of Stock Levels helps to identify priorities (replenishing for stock or a stock-out?). Before VMI, a manufacturer has no visibility of the quantity and the products that are ordered. With VMI, the manufacturer can see the potential need for an item before the item is ordered.

APPENDIX 2. SHORTCOMINGS IN VMI

- Lack of top management commitment.
- No supporting infrastructure.
- Lack of synergy between programmes and overall business strategy.
- Poor management leadership.
• Lack of focus on the process.
• Fear of change.
• Inconsistent management commitment from department to department.
• Lack of rewards and recognition.
• Initial costs are very high.
• High technical skills are required
• Benefits more the downstream players
• The goal is to have an improvement in Fill Rates from the manufacturer and to the end customer. Also, a decrease in stock-outs and a decrease in inventory levels.
• Planning and ordering cost will decrease due to the responsibility being shifted to the Manufacturer.
• The overall service level is improved by having the right product at the right time.
• The manufacturer is more focused than ever on providing great service.
BEST PRACTICE & FUTURE SCENARIOS
SUSTAINABILITY IN ROMANIAN HIGHER EDUCATION

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ABSTRACT:

This paper aims to realize a diagnosis of the Romanian Universities from the sustainability point of view. A study has been carried out in order to identify the current situation, as seen by some management officials from several Romanian universities, and another research was conducted on students' perception and awareness level regarding sustainability. The study aims to find out the extent to which the concept of sustainable development (sustainability) is known and implemented in Romanian higher education. The main obstacles in implementing the concept are identified and some major changes that are needed for the transformation of Romanian education in terms of its sustainability are proposed.

Keywords: sustainable development (sustainability), Romanian higher education, university management, student perceptions.

1. INTRODUCTION

Earth’s exploitation is threatening its very existence. Structural problems like depletion of resources, clean water, poverty and malnutrition are threatening the safety and stability of modern society. (Taoussanidis, 2010) The concept of sustainable development refers to economic growth that can meet the welfare needs of our societies, on short, medium and especially long term. It is assumed that development must meet the needs of the present without compromising the ability and resources to future generations. Today, almost everything is carried out under the banner of sustainable development: education must become sustainable; industry and agriculture develop sustainably, research must support sustainable development; water resources (or other resources) must be used sustainably, and yet, is this concept really understood, in its whole complexity and depth?

The concept of sustainable development as defined by the report of the UN Commission on Environment and Development (1987), says that there should be a mutual dependence between the three main ways to achieve this goal: education, scientific research, political action. It was clearly stated in the report of the World Commission on Environment and Development (1987), convened under the aegis of the UN and headed by former Norwegian Prime Minister, Mrs. Gro Harlem Brundtland. Commission's conclusion is that sustainable development and environmental protection can be compatible if the world could achieve a proper reform in economic theory and practice.

The commission defines sustainable development as "development that meets the needs of the present generation without compromising the chances of future generations to meet their own needs and aspirations." (United Nations General Assembly, 1987) Sustainable development aims to achieve three types of approaches to solving the three categories of objectives: economic, social, environmental. (Fig. 1)
Education is the most effective means available to a society to meet the challenges of the future, sustainable development being one of the interesting and necessary challenges. (UNESCO, 1997) Progress increasingly depends on more than research ability, innovation, and adaptation to new generations. Access to education is a sine qua non requirement of youth participation in socio-economic and cultural life at all levels of society. Obviously, education does not entirely resolve contemporary issues but should be part of the effort to create new relationships between society members and to generate an increased respect for the needs of environmental protection.

The United Nations declared the period: 2005-2014 The decade of education for sustainable development, arguing that education for a sustainable society "enables people to acquire knowledge, values and skills to participate in decisions ... that will improve lives currently, without destroying the planet in the future" (http://www.un-documents.net/ocf-11.html).

Education is not confined to academic instruction, i.e. its formal aspects. It includes non-formal and informal sides, without neglecting the role of family and local community. The vast community of educators is a very important human resource but is not used for the needs of sustainable development and whose contribution can be valuable in all local communities.

What if higher education was to take the lead, as it did in the race for space or in the fight against cancer, to prepare students and provide information and knowledge to develop a just and sustainable society?

2. OTHER APPROACHES OF SUSTAINABILITY EDUCATION:

Education is one of the key mechanisms through which we become human beings that act and interact on the basis of a common culture and one of the key ‘producers’ of culture and the way we see reality. It is, at the same time, and because of that a vital condition for realizing sustainable development.

In an essay entitled "The Role of Higher Education in Achieving a Sustainable Society", Tony Cortese said that "... [higher education] has the unique freedom to develop new ideas to analyze society and to engage in bold experimentation and to help create new knowledge"(Cortese, 1995, p.5). Universities in particular are designed to develop students to their so-called dynamic qualities allowing them to analyze, build and operate with a high degree of autonomy and self-determination, if not in their personal lives, at least in working life. At the same time, universities should develop for their students, skills that will allow them to handle uncertain situations, and vaguely defined, with norms, values, interests and conflicting, or at least divergent situations of reality.

Despite the questions we have regarding "sustainability" as an organizational structure of higher education, we see a great educational potential that can and should be valued by higher education institutions (Fig. 2).
Figure 2. Impact of universities in sustainable development (by Cornell University - http://www.sustainablecampus.cornell.edu/climate/)

The focus is on engineering, more than on the natural and physical sciences or on social science, because the activities that implement scientific advance are generally rooted in engineering. Engineers were once able to initiate engineering projects, able to transform real need into design and finally material form. However, “the full scope of the social responsibility of engineers has been seriously curtailed, and hence impaired, by the socially, intellectually and culturally subordinate role of engineers in modern society” (Taoussanidis, 2010).

Sustainable development engineering education is about giving engineers an understanding of the issues involved as well as about raising their awareness of how to work and act sustainably. The resulting concept is that “the engineer should be 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”. (Allenby et al, 2009)

3. DIAGNOSIS OF THE CURRENT SITUATION IN ROMANIAN UNIVERSITIES

3.1. UNIVERSITY MANAGEMENT

In order to answer to the nowadays society needs and to create the conditions for “a relevant and responsive educational system to the specific needs of the economy”, the Romanian Executive Unit for Financing Higher Education and Scientific University Research (UEFISCSU) initiated the project “Improving University Management”, its goal is being to promote updated knowledge, modern techniques and actual management instruments for the higher education institutions across Romania. (http://www.management-universitar.ro/)

The module “resource management and sustainability”- within this project, developed and supported by members of the Centre of Competence in University Management - Sibiu, coordinated by “Lucian Blaga” University of Sibiu, aims to be a useful tool for the Romanian universities in their transitions to become strong and sustainable universities. Its content defines the concept of sustainability and shows how a university should evolve to become sustainable.

In training sessions held in the module, which were attended by officials with managerial competences from several Romanian universities, in addition to the plenary presentation of the concepts and issues specific to this module, participants were asked to take part in some group exercises for analyzing their university, based on structured questionnaires. The analysis of the current situation of Romanian universities in terms of sustainability and identification of necessary changes were the main objectives of the research made in these exercises.

To guide participants, the team has developed questionnaires with open questions, whose interpretation will be presented below.
3.1.1. Understanding of the concept

When asked:”Is the concept of sustainable development well known and understood?” most participants (45%) answered that the concept is partially understood. The subjects have different understandings and interpretations of the concept according to their knowledge and experience (Figure 3).

Respondents have argued that awareness started from environmental aspects of sustainable development. At this point, there are increasing attempts to include the concepts of sustainable development and sustainability in institutional management. In terms of including these concepts into institutional management, we find that the concepts are not understood, and students and teachers do not properly understand the role that they have in their development. Perhaps the senior management of universities is aware of this concept, but it is little known to other members of the university. This fact blames the insufficient transparency or lack of communication between the different structures of universities. In curriculum development, or applications projects, the concept has been associated with the idea of medium and long term results, not just short. Other participants said it is a fairly new concept, and they are just beginning to familiarize themselves with it.

3.1.2. Implementing sustainable development principles

As seen in Figure 4, in most cases sustainability is only partly included in the vision, mission and strategic objectives of universities. Respondents argue that sustainability is included in the vision, mission and objectives only in a declarative way in many universities in Romania or even if it is present in the vision (“piecemeal, not unitary”), it is not stated in the documents regarding the university policy. They also say that in situations in which sustainability is included in the vision and mission of the university, even if not materialized in specific forms of sustainability, it can't be found in the university's strategic objectives and it doesn’t have allocated resources. Only 11% of respondents said that sustainability is part of the vision of university management and is included in the mission statement and objectives.
When asked about the extent to which sustainability is included in strategic plans, operational plans and budgets of their universities, 45% of the participants in the training sessions said they do not allocate special resources for sustainable development, while 22% say that the strategic plan and operational plan contain elements of sustainable development, but in the budget there are no resources assigned distinctively to sustainable development, but funds are allocated for the accreditation of study programs in the field, from the university’s own budgetary and financial sources. (Figure 5)

Figure 5. Sustainability in the Budget and Strategic and Operational plans

Figure 6 presents the inclusion of sustainability into the curriculum and research. It is noted that 31% of those surveyed responded that their universities teach subjects which address (mention) the concept of sustainable development and in 18% of cases there are programs of study (in the field of chemistry, economics, public administration, environmental engineering) providing subjects related to sustainable development. Only 12% said that their universities have even master programs dedicated to sustainability. 17% of participants said that their universities have research contracts for sustainable development, while
22% said that departments or research centers on sustainable development already exist or are under development.

Regarding the construction and procurement policies, the majority of respondents (47%) said they did not have enough information, or refused to answer this question. In 29% of cases, university campuses have buildings with thermal insulation and 12% have alternative energy installations. Another 12% said that sustainability is a factor to be taken into account when purchasing or building something in the university but have not said anything concrete. (Figure 7)

Sustainability is present in the lives of students in different forms. 31% of the respondents said that students are involved in selective waste collection and recycling, 23% said that their universities run education projects, organizing programs and workshops that include promotion and education in the spirit of sustainable development. Research circles and research topics related to sustainability are other ways in which students come into contact with that concept. It is also specified that student organizations are beginning to have "timid concerns" towards sustainable development, or engage in voluntary actions to clean up various green spaces. 9% of participants said their universities did not do anything to integrate sustainability in student life. (Figure 8)
The relationship of the university with the community is poorly described by respondents. Most say that their universities have partnerships with local communities and try to attract European funding to projects aimed at community issues. It is pointed out that, unfortunately, the local community doesn’t have an understanding regarding the need to implement the idea of sustainable development in the collective mentality and daily actions.

3.2. STUDENTS’ EFFORTS AND PERCEPTIONS REGARDING SUSTAINABILITY

More and more people are aware of sustainable development. Education for sustainable development is a concern for the world where university can make a contribution. Students who are the majority in a university, their knowledge, awareness and actions will play an important role to promote sustainable development. To emphasize students' perception on the concept of sustainable development, at the Engineering Faculty from "Lucian Blaga" University of Sibiu, a research was conducted on this issue, as a result of the increased concerns of the university on the topic sustainability in higher education. The purpose of this research was to make a comparison between freshmen (students in the first year of studies) and seniors (students in the last year of studies) on the knowledge and awareness about sustainable development. This comparison, will explore if students’ knowledge and awareness influences their actions.

3.2.1. Methodology:

The method of data collection is based on applying a questionnaire to the students of the Engineering Faculty of Sibiu. The target group is made up of freshmen and senior students with a sample of 86 students from the first year and 70 fourth year students. The students who completed the questionnaires were chosen randomly. Between 5 and 10 students out of each specialization were asked to take part in the research. Data collection was carried out directly by the operators in the faculty.

In this study, the questionnaire is the main method to collect data. As an approach of data collection, questionnaire is a flexible and popular tool to gather first hand source. The questionnaire was adapted after a questionnaire developed at University of Gavle, Sweden. [2] Questions were developed to meet the objectives, had a clear structure and topic. In preparing the questionnaire there were used both open and closed questions.

3.2.2 Results

According to the information gathered during this research we concluded that very little is studied in college about sustainable development. We observed a difference between first year students and fourth year students, when asked if they were told about sustainable development or if they studied this concept in any discipline (see Figure 9 and Figure 10.)
Did any teacher mention anything about sustainable development?

Also, there is the small number of university students who were involved in projects to protect the resources (Figure 11). And of those who were involved, 20 students were studying Environmental Engineering, the other 13 are enrolled in different specializations. It is interesting to observe that all the students enrolled at Environmental Engineering were involved into projects to protect the resources. The reasons for not participating into these projects (as seen in figure 13) were: “I didn’t have the chance”; “I wasn’t asked”; “I wasn’t interested in this topic”.

Were you ever involved into projects for protecting the resources?

Specialization of those involved in projects for protecting the resources

Why didn’t you participate?
I and IV year students say college awareness on sustainable development is poor (fig. 14) and that the easiest method of information is an optional course in the faculty for those interested or involvement in practical activities (Figure 15).

![Figure 14](image1) The awareness level of the population, regarding sustainability – as seen by students

![Figure 15](image2) Best information methods in the opinion of students

Activities and habits of students, related to sustainability and protecting the resources are presented in figure 16. The questionnaire contains a set of statements that aim to reflect student’s daily activities and efforts regarding sustainable development. They were given options to describe the frequency of these activities in their daily routine (1 is never, 2 is seldom and 3 is often). As seen in figure 16, the students were asked if they sort their waste, save water when showering, save energy and reuse shopping bags.

![Figure 16](image3) How often do you make the following activities?

3.2.3 Interpretation

Human beings are already aware of how serious are the problems that they cause to the Planet, and know the sustainability of human life has been threatened. Since then, sustainable development awareness increased and more widely public concern has gradually spread across the world. It is believed that education will be an effective and comprehensive approach to spread the knowledge and awareness about sustainable development to the public.

Education is the most effective means available to society to challenge the future. Progress depends increasingly on research capacity, innovation, and the ability to adapt of new generations. Education for sustainability is an emerging area of understanding that we must all commit ourselves to, to allow browsing to a sustainable future. This new form of education aims to be transformative, to engage both teachers and students in the process of becoming active participants and decision makers in their journey towards sustainability. To facilitate this process, teachers learn new skills, including ways of collaboration, negotiation and building partnerships with those works.
In order to promote sustainable development, university tries to improve students’ knowledge and awareness through curricula, relevant policies, programs, and training etc. It is hoped that the knowledge and awareness will affect students’ action on supporting sustainable development.

Besides considering sustainability to be important, students consider that it’s necessary that the following measures should be taken:

- Application of general principles of sustainability at the individual level,
- Integration of sustainability into the policies of organizations,
- Enforcement of judgments of Talloires Convention in all universities.

To explain the distribution of scores, there was intended to compare demographic variables: year of study, the average of the grades from all years of study, residence, gender and average monthly income per family member. These relations have been pursued for the discovery of trends in the chosen sample, showing both explanations of observed phenomena and points of departure for further more detailed studies.

The main difference between the students from different years of studies is noted in the perception of effort for environmental protection, therefore the everyday behavior, which is higher for seniors, compared with freshmen. This difference may be explained by changing the curriculum from theoretical and abstract level, towards a level of synthesis and integration, or the students becoming more mature. Another explanation can be the fact that the seniors are more aware of the concept (see figures 9 and 10).

There is a steady upward trend of the approach and the commitment to sustainability, proportionally with the increasing averages of grades for the years of study. Therefore the scores of students with high average marks were significantly higher than of students with very low grades. Gender and residence, urban or rural, does not explain any difference in distributions and sample averages.

It is noted that low-income students are concerned about social issues and high-income students are concerned about economic issues. Also it is noted that the higher the income is, the more concerned towards sustainability, and especially environmental issues, the students are. This can be explained by the fact that the effort to support sustainable activities is often more expensive.

4. THE MAIN OBSTACLE TO IMPLEMENTING SUSTAINABLE DEVELOPMENT

The officials with managerial competences from several Romanian universities, who took part at the training module described above (see point 3.1) were also asked to identify which are the main obstacles to implementing sustainable development in higher education (Fig. 17).

![Identify the obstacles to implementing sustainability](image)

*Figure 17. Obstacles to implementing sustainability*
Lack of financial resources was cited by most of the participants, as the main obstacle to implementing sustainability. No communication or ineffective communication between the organization's structures, which leads to lack of coverage of understanding the importance of sustainable development issues for the future of humanity, is another problem, identified by 19% of participants. Backward mentality of the people, and inertia or resistance to change appear as major causes with 15% share each, according to people participating in these group activities. Lack of a favorable organizational culture is viewed by 12% of respondents as an obstacle to the implementation of sustainability, being associated with lack of tact in change, meaning that change is ordered.

5. THE MAIN CHANGES REQUIRED

Asking them to identify the main changes needed to transform their universities into sustainable universities, the participants identified the following:

- Defining a new vision, mission, strategy and objectives of the university;
- Introduce the concept of sustainable development in as many programs of study;
- Seminars organized by the university to local communities (public awareness), obviously it means a better cooperation between universities and municipalities / county councils (it is an issue that concerns us all);
- Increased transparency of information within the university;
- The emergence of a department to develop the concept of sustainable development of the university;
- Allocation of specific resources for sustainable development - specific budget and trained personnel;
- Changing the organizational culture - the values and mentality of citizens;
- Taking the best practices, adapting them to their own situation and dissemination in the community;
- Treating the subject as a priority in all curricular subjects;

6. CONCLUSIONS

The educational system in any country, developed or developing, must be conducted to transform society into a fair one, in which both students and institutions to reflect on how they live and work today. The system must also support the population or the students in making "informed choices" and creating ways to work for a sustainable future, in this changing and challenging world.

Universities need to develop programs of study, curricula, pedagogical approaches and extra-curricular activities and academic and campus life so as to cause students to develop values, knowledge, skills and thought to contribute to the sustainable development of the entire society. Sustainability must become an integral part of planning, activities, facilities design, procurement, investment, and student life and all these efforts must be closely related to the curriculum. Student life is the content, the context and the binder for such learning.

We need to re-invent education in such a way that it will contribute to a new culture that is in line with the principles of sustainable development such as, a respect for indigenous peoples and their culture, a knowledge of the state of the natural environment, an understanding of global dynamics, and the protection of routes of transmission of culture, knowledge and skills to future generations.

7. ACKNOWLEDGEMENTS

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BUILDING PRINCIPLES OF SUSTAINABLE BUSINESS INTO ENTREPRENEURIAL VENTURES – A PEDAGOGICAL APPROACH FROM THE UNIVERSITY OF CAPE TOWN

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ABSTRACT

The School of Management Studies at the University of Cape Town (UCT) has developed an innovative and highly collaborative teaching approach that equips postgraduate Management students with the requisite skills to develop and deliver a live business project. The focus of the live project is on the triple bottom line of people (social responsibility); planet (environmental sensitivity) and profit (financial accountability). This innovative teaching approach comprises a collaborative effort between students, convenors of the Business in Context and Business Communication courses and small business owner-managers. The model was developed in an attempt to prepare students for challenges in the workplace and to offer technical support to small businesses (SMEs) in order to increase their competitiveness.

The paper will set out the rationale for the approach to teaching and explores ways in which business and academia can cooperate to tackle sustainability issues. It describes the design of interventions, amplifies the need for collaboration between academic departments and highlights the mutual benefits for both universities and participating small businesses as both aim to remain relevant and sustainable in the 21st century.

Key Words: Triple bottom line: social responsibility, environmental sensitivity, financial accountability; entrepreneurial venture; competitiveness and live business project; sustainability practices and pedagogy, group awareness and innovation, collaborative teaching approach.

1. INTRODUCTION

The Business in Context (BIC) course is the core course for the Postgraduate Diplomas in Entrepreneurship, Marketing, Sport and Tourism. The course is presented by the School of Management Studies, in the Faculty of Commerce at UCT and appeals to a wide range of students, many from non-Commerce backgrounds. The principal focus of the course is to help students develop and apply critical intellectual skills required for playing a meaningful and proactive role in building a sustainable social and economic future in South Africa. Members of the Professional Communication Unit (PCU) at UCT act as teaching partners on the course and work alongside the BIC convenor to achieve these objectives [1].

The aim of this paper is to describe this innovative and collaborative teaching approach which seeks to equip this diverse group of students with the skills and competencies necessary to develop and deliver a live business project. The paper will provide a brief overview of the courses and theoretical framework before describing the research project in more detail and evaluating its benefit to all stakeholders.

2. OVERVIEW OF COLLABORATIVE BUSINESS IN CONTEXT (BUS4067F) AND BUSINESS COMMUNICATION COURSES (BUS4073H)

Students are required to study key aspects of developing a sustainable business in South Africa, with particular regard to the so-called ‘triple bottom line’ of business namely People (social responsibility), Planet (environmental responsibility) and Profit (financial accountability). The course covers the leadership and management of scarce resources in the South African and global business environment and the following themes run throughout the course:

- exploring the “Dinokeng Scenarios” and their impact on both business and private citizens in South Africa;
developing creative problem solving techniques;
• developing business driven action-learning techniques;
• learning how to build effective teams;
• learning effective professional communication, and
• developing an understanding of what it means to be a transformational leader in South Africa.

Students are also exposed to challenging contextual aspects of conducting business in South Africa, such as Broad Based Black Economic Empowerment (BBBEE), Corporate Social Investment (CSI), environmental implications and responsibilities of conducting business, business ethics and the entrepreneurial mindset.

One of the key competitive advantages of the course is the emphasis placed on group work in live projects. The backbone of the course is the group-based Strategic Research Project, where students are required to develop a relationship with a small to medium size business and then design and deliver a rigorous research project that measures the extent to which the business delivers on their triple bottom line objectives.

Students are also encouraged to adopt a class charity every year and then work in their groups to design and deliver a fundraising campaign for their charity. The BIC Class of 2010 raised R60 000 for the Emasithandane Children’s Home in Nyanga. The Class of 2011 raised R55 000 for The Cape Leadership College in Mitchells Plain.

Both the Strategic Research Project and the Class Charity Project are group-based and rely heavily for their success on the students’ ability to develop and deliver effective group dynamics which will be discussed in more detail in a later section. Both projects are live projects, where students engage with actual business owners around challenging strategic issues relating to the sustainability of their business, or engage with actual donors and beneficiaries as they raise money for a worthy cause. Through a series of well-timed theoretical input lectures, students are supplied with the necessary theory. They are then required to metabolise the theory and apply it to their project related group work.

The second key competitive advantage of the course is the highly effective collaboration with the PCU. This collaboration aims to elevate students’ ability to conduct effective research, scope and collate their research and present it in a professional written format. Students work to develop critical reasoning skills, including the ability to analyse, construct and present logical arguments, to research and understand key business issues and to form independent and research-based opinions about contentious issues of business theory and practice.

Before giving a more detailed description of the research project, the concept of sustainable business practices and pedagogy requires further clarification.

3. SUSTAINABLE BUSINESS PRACTICE AND PEDAGOGY

Sustainability in business is not a new concept but was characterized in the past by a singular focus on increased profitability [2]. What is more recent in the last couple of decades is the focus on a triple bottom line. Resource husbandry and good governance are not now considered simply ‘nice to have’ but essential. Globalisation, coupled with recessionary woes, climate change debates and other textured complexities of an interconnected society, requires that our graduates understand the nuances of accountability both cognitively and practically in the workplace. Students also need to understand that focusing on people, planet and profits is not only the responsibility of big business. There are still too many business owners in South Africa who consider the phrase ‘socially responsible business’ a contradiction in terms. Harkening back to [2] their argument is that the principal role of any business is to maximize value for its shareholders. Others argue that sustainable business practice falls to large successful businesses and is far too expensive for small to medium sized business to indulge in. However, entrepreneurs and small business enterprises (SME’s) have much to offer in times when innovative thinking is a requirement of survivability and business success. According to [3] “businesses both large and small are now actively competing to provide workable solutions not only to business problems but also to the pressing and dire global social and environmental challenges facing our planet in the 21st Century”. [4] contends that “you cannot run a linear system on a finite planet indefinitely”. As consumers become increasingly more educated and their access to information increases exponentially, big business is increasingly being blamed for the destruction of natural eco-systems and the over-pollution of
the planet. There is growing realisation that current levels of consumption, natural resource exploitation and pollution are unsustainable and businesses are being pressured to reconsider the way they conduct their business. One such example is South African retailer, Woolworths, who, with its “Good Business Journey”, has made a significant capital investment in reducing its environmental [5]. Peter Bahouth, former Executive Director of Greenpeace, contends that without business taking a key leadership role in advocating social responsibility, we will fail in our efforts for a better environmental future.

The question then remains: How do we teach sustainable business practice? “A major part of that effort is having a well-developed vision and a well-practiced value system that defines what it means to be a responsible business and a good corporate citizen” [3]. The second challenge is helping students to understand that building a sustainable business makes good business sense. Today more than 350 of the world’s Fortune 500 companies report on their corporate social responsiveness. Thirdly, by encouraging active, experiential problem solving, both in the classroom and as part of their research projects, students are encouraged to wrestle with real-life challenges of building a sustainable business. As academics and practitioners, we can facilitate this advocacy by teaching not only what we know or think we know but engaging with new knowledge and new ideas in challenging times and exploring these practices with our students. Embedding our teaching in topical and practical work-based issues involving sustainable business practices allows us through this research project to contribute to sustainable pedagogy.

4. DESCRIPTION OF RESEARCH PROJECT

In the collaborative BIC/PCU project assignment students are commissioned to identify a small to medium size business that employs a minimum of 10, maximum of 50 people. In particular, groups are required to conduct an in-depth analysis of the extent to which the business demonstrates a commitment to sustainability and the triple bottom line.

The people component includes working conditions, staff incentives, Broad Based Black Economic Empowerment (BBBEE) and corporate social investment (CSI). Under planet, students include the business’s environmental policy and practices regarding waste, energy and pollution. Regarding profit the groups are required to demonstrate profitability of the business. In addition, they are required to establish whether there is a relationship between the business’s profitability and its success with people and planet. In their final report groups evaluate and draw conclusions on all their findings and make short and long-term recommendations to their chosen business.

In carrying out their investigation, students need to show sensitivity to company policies and related ethical issues. The collaborative report assignment has a number of deliverables that cumulatively lead to the final product – the sustainability report for the client. In brief, the deliverables for the report are:

- Group contract: this document outlines the norms, values, role and responsibilities of members of the group. It also indicates objectives of the project and points the way ahead;
- Signed Memorandum of Understanding (MOU): the MOU is negotiated with the chosen business and must be signed by both the business and the group;
- Proposed Research Methodology: this includes a research plan that outlines how the client’s business is going to be investigated in terms of sustainable business practices;
- Extended Topic Outline: this will indicate the projected order of information. It comprises the major and minor findings of the investigation, the implications of these findings in the conclusions and both short and long term recommendations.
- Final Sustainability Research Report and Cover Letter

These deliverables serve as interventions meant to assist students with the process of compiling their sustainability reports on their chosen SMEs. These interventions impact positively on the quality of reports produced by allowing facilitators to provide feedback on the process throughout. The other incentive is the BIC/PCU Award for Effective Reporting on Sustainability in Business sponsored by GetSmarter, an online education company based in Cape Town.

Some of the report topics are as follows:
- Triple Bottom Line sustainability report presented to iCologie.
- Triple Bottom Line sustainability analysis for Green Home: Conclusions and Recommendations for the future.
- Report on Heartworks’ commitment to current and potential sustainable business practices.
- Investigation of the sustainability of Societi Bistro.
- Sustainability report of the Teaching Biology Project.
- Analysis of Greens Constantia and the extent to which the business demonstrates a commitment to sustainability and the triple bottom line.
- An investigation into Cécile and Boyd’s sustainable business practices based on their Triple Bottom-line.
- An overview of Aromatic Apothecary’s sustainable business practices.

Although groups are required to identify the small to medium size business they would like to investigate, their investigation is at the invitation of the business whose payoff, in part, is sight of the completed report. The BIC/PCU collaborative research project is a typical illustration of how academia and business can work together as a team to enhance innovative and sustainable business practices.

5. GROUP PROCESS AND INNOVATION

The objectives of the communication aspect of the BIC/PCU collaboration are not only to develop competency in traditional areas of report writing and presentation, but also to develop the practice of building relationships that are robust and accountable and the practice of reflecting regularly on process.

Since students work in groups to achieve course outcomes, it is critical that students are able to translate their theoretical understanding gained in the BIC lectures of the importance of ‘people’ into their direct relationships and embodied experience within their groups. As reflected above, the students’ very first deliverable is therefore a Group Contract. Emphasis here is placed on the process by which this is achieved. The contract must be negotiated among the whole group and include provision for group conflict so that there is genuine ‘buy-in’ and joint responsibility for fulfilling the contract from every group member. Similarly, as their second deliverable, students are required to develop a Memorandum of Understanding with key stakeholders at the business which they select to be the focus of their study. Both these documents clearly delineate roles and responsibilities, time frames and process steps highlighting the principle and practice of accountability which is so critical within the sustainability discourse.

In the last ten years, not only has the diversity in the environment found new appreciation, but also diversity among people and within groups and in particular the critical role this plays in innovation. For example, in order to stay competitive, multinationals such as Novartis take diversity and inclusion seriously not only in who they employ but also in establishing an external Diversity and Inclusion Advisory Council (DIAC) which is internationally renowned. In the practical workshops around working in groups, processes to actively encourage and include diverse voices within groups are emphasised and practiced. These workshops also draw on indigenous African practices such as the lekgotla process.

It has been well documented that the ability of teams and organisations to learn will determine their sustainability and success in a global context. Awareness of process, and building feedback and learning into process, is another critical part of the collaboration. Groups are encouraged to be reflective and to build regular reflection into their group process. This allows for the group to be able to learn as it goes. Typically, they make innovations and small corrections and calibrations, not only in the way that they work together as a group, but also on their key deliverables for the BIC/PCU collaboration. Reflecting on the progress of their key deliverables involving research methodology and the final written report is not limited to the groups, however. Students are given numerous opportunities to consult and gain feedback from the lecturer-consultants on their work in progress. Feedback and comment and critical moments in the draft stage can

1 Report topic of the group that won the 2011 PCU/BIC Award for Effective Reporting on Sustainability in Business sponsored by GetSmarter.

2 In Setswana lekgotla refers to a meeting of community leaders where crucial issues in society are discussed. Such meetings are held on a fairly regular basis. The traditional leader of the tribe or clan and his advisers usually draw on the insights from the lekgotla.
mirror actual business environments and dramatically improve the quality of the final deliverable and the sense of group achievement.

6. COLLABORATIVE LEARNING

The strength in a collaborative team lies in its small size, the complementarity of skills, the specific teaching purpose, and the mutual accountability and responsibility of team members [11]. The BIC/PCU collaboration is highly experiential and represents a cooperative teaching and learning transaction between stakeholders who are experts or, in the case of students, becoming experts in their own right. As such it is an example of collaborative educational practice that combines to accomplish multiple educational and social goals. The variety of expert participants: teaching staff, business professionals and students come together to negotiate shared meaning and as such align to a convergence model of communication with all participants in the negotiation responsible for sense-making [12]. These participants come together in a teaching-learning partnership; [13] describes such situated practice, where thinking, beliefs, actions, values and attitudes around sustainable business practice are taken on, as dialogical and transactional. These complex integrations of verbal, visual, numerical and practical actions emphasise the character of collaborative learning as engendering social, mental and practical literacies [14]; [15]; [16]. The importance of deep as opposed to rote or superficial knowledge accumulation and enhancing emotional as well as intellectual development is now well documented [17]; [18].

Collaboration encourages the sharing of a variety of communicative codes and forms an opportunity for students “to explore contemporary issues in the world and specifically technological, scientific and ethical knowledge implicated in the concept of sustainable development” [19]. As an open-ended problem-solving framework, collaboration, co-operation and experience are harnessed, allowing students to develop knowledge based on informed reasoning and analysis. The collaborative approach thus leads to a composite ‘3-D’ rather than flat learning approach because it stimulates and feeds the process from all angles allowing for theoretical knowledge accumulation and practical multi-skilling in an accelerated time frame [20]; [18]. Instead of simply listening to or reading about the subject matter before doing an assignment, students in a collaborative learning situation are creatively ‘assaulted’ by seeing/listening, thinking/feeling, assessing/doing in a just-in-time, ongoing fashion [18]; [21]. Exactly because it involves embodied action, the learning-in-doing implied in the collaboration is more powerful than relying on memory and purely cognitive abstractions such as in rote learning of facts and simply being told important generalisations (passive learning) in teacher-led instruction [22]; [21]; [15]. The apprenticeship-type character of embodied collaborative learning is the way in which mental networks (or patterns) can develop effectively for use in future learning and action [21]; [23]. This characteristic aims to allow students to generalise their learning to future applications. The benefits for all stakeholders are, however, manifold.

7. CHALLENGES AND BENEFITS OF RESEARCH PROJECT

7.1 STUDENTS

The benefit of this form of project work is that students receive actual work-related experience. They test academic theory in practice and keep what works. They also build their networks, develop much deeper insights into the world of business and understand better the challenges inherent in the working world. Students practise their business skills in a controlled, highly supported and scaffolded environment [24] and experience first-hand the complexities of and barriers to developing sustainable business practices. Despite difficulties on and off the course, positive comments of students outweigh negative sentiments. In 2010 and 2011, 72% and 74% of students respectively ‘strongly agreed’ or ‘agreed’ on overall course effectiveness and collaborative efforts. The following comments of students on the BIC/PCU collaboration give an indication of their positive attitude towards the collaboration, in particular, and its significance in their overall diploma:

“A course that really makes an effort to connect to the “real world” is always welcomed.”

“It was our most involved and therefore stuck out. It is memorable and engaging. I prefer this style of learning over anything else in my diploma.”
“This is probably one of the most valuable courses I have done. I have gained valuable insight into the world I live in.”

“It was good to combine as it helped build more into other courses of the diploma. Lectures prepared us for the report we were going to write. I got good insight.”

“The Course gives students an idea of what to expect in the world of business.”

“Combining the courses was inspiring because we were evaluated on one deliverable that was relevant to both.”

“Great course, great lectures – Very focused application of current business thinking around future business trends.”

“Practical application provided by PCU for theory learnt in BIC – very helpful and an excellent structure for this course.”

“The Course is brilliant and relevant. I love the hands on experience.”

“PCU helped me in understanding requirements for the BIC project.”

“The course is extremely helpful and insightful bringing forth provocative issues that expose you to some of the world’s hidden truths.”

Some students expressed ambivalence on the effectiveness of the BIC/PCU collaboration to overcome anxieties associated with complexities of and barriers to developing sustainable business practices. Their obstacles in the BIC/PCU live business project relate to quantity of work, tight deadlines, regulated structures, inconsistent treatment, varied perceptions and collaborating with others (internal and external) – all of which reflect real-life business challenges. Some of their comments were:

“The class was too big to really relate to, but I was able to gain knowledge by working with some of the fellow students.”

“I did not gain much from BIC/PCU as not enough time was given on each topic in the collaboration.”

“The focus should be more on applicability to course versus language lessons for competent students. The PGDip should have incorporated PCU into SMP [Strategic Marketing Project] for business plan writing.”

“I think most students underestimate the importance of the BIC/PCU lectures. Most are also completely unaware of how bad their writing is. A guest lecturer could use some examples from the lecturers on PCU/BIC to just emphasise how important letter writing etc. is in real businesses. This might help the class get more involved e.g. some CEO could come in and show actual examples of bad reports written by job applicants or employees.”

“Incredibly relevant course material. Some students found that the material was too abstract, but I found that the course material was great preparation for thinking as executives and leaders.”

“Structure of the course was too rigid. It should be more flexible and interactive.”

“It was a useful course but the information about what was to be delivered and marking was extremely inconsistent.”

2010 student comments, both positive and negative, led to some course revisions in 2011. We kept all the draft and final deliverables but added a group contract (personal team contract), to allow students to grapple with team attitudes and behaviour and heighten ‘buy-in’ to the group process. The marking process of the final report was also adapted to increase consistency between BIC and PCU staff. Adding a team
presentation component in 2012 is a further consideration as this would allow teams to present their findings to the actual client which would add another experiential dimension to the course collaboration and strengthen workplace ties. Students often provide unsolicited positive comments once working when in hindsight they realize that even some of the negative experiences – particularly in group work – have positive spinoffs. As students expand their business networks, many of them go back to their business owner to work as interns during the vacation, thereby further increasing their actual work experience and learning how to deal with on-the-job tensions and obstacles.

7.2 SMALL BUSINESS OWNERS

Business owners and students are required to scope their specific projects around the most pressing needs of the business. The course convenor sets out clear parameters within which the project must be delivered. The projects must be as useful as possible to the business owner, who in effect becomes the client in a consulting job. Business owners not only have access to more mature postgraduate students who will soon be entering the job market, but get to assess the students’ capabilities over a period of three months, as they work with students to deliver their projects. The benefit to the business owners is if they adopt the research project in a strategic manner, they can get an inordinate amount of postgraduate research done without incurring any cost. It is for this reason that student teams do not struggle annually to enlist business volunteers for this project. The challenge, however, is that business owners receiving negative feedback may choose to ignore student findings.

7.3 UNIVERSITY OF CAPE TOWN

The benefits to UCT and higher education are substantial. UCT is seen to be actively supporting small businesses as they face the everyday realities of building a sustainable business in South Africa, yet the business-end of any costs related to the research project are carried by the business. UCT builds a network of small to medium-size business owners, many of whom are UCT Alumni. The university is also seen as actively promoting the development of sustainable business principles throughout its surrounding community, thereby increasing awareness of critical issues such as: ‘sustainable consumption’; ‘development without growth’ and ‘the impact of business on the environment’. In the 90s, UCT became a signatory of the Talloires Declaration which encourages tertiary institutions to incorporate sustainability into the curriculum; this collaborative course not only aims to embed sustainability into the core curriculum but to build collegial and committed partnerships both within the institution and the broader community. This is in itself a continuing challenge for both public and private sector institutions, grappling with many other socio-economic priorities.

8. CONCLUSION

For the first time in human history, human beings are capable of determining the well-being of the earth and all of its inhabitants [25]. Our track record to date in managing this enormous responsibility has been less than satisfactory. The resultant crisis in environmental and social sustainability has led to the development of a broadening social movement that demands a new social paradigm, a new way of life, where human beings and their business ventures go back to being in tune with both their community and their environment. Due to a skills crisis in South Africa, postgraduate students may soon find themselves in senior management positions making critical decisions related to the environmental and social impact of their business. If they understand the language of sustainable business, grapple with critical issues and espouse a commitment to building their business in a sustainable manner, real strides are possible in future generations.

Higher education has a significant role to play in the development of this new social paradigm and it is a role we need to take seriously if our children and our grandchildren want to enjoy the same quality of life that we do. We consider shifting paradigms a must for higher education in the 21st century.
9. REFERENCES


PROBLEMS OF CONSTITUTING UNIVERSITY CENTERS FOR INTELLECTUAL PROPERTY EXPLOITATION, FROM THE PERSPECTIVE OF THE INNOVATIVE – ENTREPRENEURIAL EDUCATION.

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ABSTRACT

The present paper offers an analysis of the concept of doctoral and research university, from the perspective of its transformation into an entrepreneurial university.

One of the instruments of this transformation is the audit of innovation management performance, which is presented as a case study applied in the University POLITEHNICA of Bucharest.

Another instrument is represented by the concept of “University Center for Intellectual Property Exploitation (UCIPE)”, which is presented in a real application, which was done for a project financed by The European Union in Romania.

There is presented a model for constituting and organizing a UCIPE and there is shown its influence on the modification of the university curricula, by introducing the concepts of the innovative – entrepreneurial education.

Keywords: Intellectual Property, University Centers, Innovative – Entrepreneurial Education.

1. INTRODUCTION

“Interuniversity Virtual Community for science, technology, innovation and intellectual property exploitation” is a project co-financed by the European Social Fund, through the Program for Human Resources Development 2007-2012. The project belongs to the priority axis 1 - „Education and professional formation for economic growth and for the development of the knowledge society”, major field of intervention 1.2 – “Quality in Higher Education”.

The project “Interuniversity Virtual Community for science, technology, innovation and intellectual property exploitation” is the result of a partnership between the Ministry of Education, Research, Youth and Sports, three universities from our country (University Politehnica of Bucharest, University of Craiova, University of the West of Timisoara), Institute de Recherche en Electronique, Micro-technology, Instrumentation et Systems (IREMIS) from Rouen, The Red Point and Gold Agama Consulting.

This project is one of Romania’s strategic instruments, whose purpose is to provide qualified and efficient support necessary for implementing the education reform in the university environment, by directing the mentality towards the innovative entrepreneurship, based on the exploitation of the intellectual property, by creating three pilot centers for the intellectual property communication and exploitation, which should prepare the students and the teaching staff at the beginning of their career according to the labor market’s demands, how to deal with the entrepreneurship, innovation and technologic transfer. In order to develop these competencies, the project will build a common interuniversity platform for the intellectual property communication and exploitation and a virtual network for scientific communication and research.

The project’s general objective refers to the education and professional formation in order to support the economic growth and the development of the knowledge society by developing the quality of communication, by improving the services offered to the students and professors, so as to increase the students’ insertion on the labor market, to develop the life-long learning flexible routes, to increase the
access to education and formation, and by promoting the virtual networks for science, technology, innovation and exploitation of the intellectual property in universities.

This will be achieved by means of a set of specific objectives, of which we can mention: to prepare the teaching staff and the university students so as to be able to create a common knowledge base and to use the virtual platforms, to create the instruments and the methodologies for testing, recording and validating the data concerning the channels for intellectual property exploitation, and to develop virtual laboratories for studying at universities.

Among the specific objectives there are the following: to create channels in order to exploit the intellectual property, to communicate and to inform the university research team members, the consortium’s students and professors, by elaborating instruments and methodologies for the data testing, recording, validation so that the data could be consulted and tested.

Thus, a first component of the project is the institutional construction one, respectively, to create the Pilot Interuniversity Center for the Communication and the Exploitation of the Intellectual Property, which means to design the centre, to elaborate the juridical and administrative documentation, to create the internal structures, to allocate staff, to create the operating infrastructure and to elaborate one’s own methodologies. A second component of the project is the one referring to the IT professional formation and in the field of innovation, of the technological transfer and of the intellectual property exploitation, which leads to the formation of the necessary staff for the center and to the improvement of the innovation environment of the partner universities.

A third component is represented by the creation of the common interuniversity platform for the intellectual property communication and exploitation, which becomes one of center’s operational instruments. The improvement of the innovation environment in universities requires the creation and the functioning of university structures for innovation, technologic transfer and for intellectual property exploitation, in the context of the elaboration and implementation of the policy in the field of quality, of organizing the „quality” function, of implementing and ensuring techniques, methods and instruments specific to quality management[1].

The main results of the project’s implementation will be:

- To create a pilot center for intellectual property communication and exploitation in each partner university with the purpose of improving the access to quality education.
- To create three virtual libraries, one in each partner university and a portal for science, technology, innovation and exploitation of intellectual property.
- To elaborate and lecture five new courses from the fields of innovation, entrepreneurship, technologic transfer and exploitation of intellectual property, according to which there will be prepared the target group participants.
- The project is addressed, first, to the students from the Romanian universities, since they are the direct beneficiaries of this initiative. Also, the project is addressed to the teaching staff involved in the development of the university curricula, to the university managing, monitoring and assessment staff, responsible for the quality of higher education, and also to the specialists involved in the elaboration of the higher education policies.
- The implementation of the three components will determine the improvement of the communication between the partner universities, society and the economical-social environment and will represent the success of the project. In this way the virtual interuniversity community will become a good practice model for the national university environment.

2. AUDIT OF INNOVATION MANAGEMENT PERFORMANCE

At the University POLITEHNICA of Bucharest (UPB), the RDI management is provided through the Direction for the Scientific Research Management. Here, we have a Technological Transfer Center (TTC POLITEHNICA), which is responsible for the implementation of the UPB innovation policy. The specialists who elaborated it established the structure of the survey by starting from defining UPB as a research university. The research university is a category which was introduced by Carnegie Classification of
Institutions of Higher Education in order to identify those universities which developed extensive research activity. From the year of 1994, in the Carnegie Classification, the Research University was defined as an institution which:
- Offers a large range of specializations.
- Is qualified for doctoral studies.
- Gives main priority to scientific research.
- Awards annually 50 or more titles of doctors in sciences.

In 2000, Carnegie Foundation renamed the research university as “The Doctoral and Research University”. By analyzing the evolution of the UPB research revenues and the evolution of the doctoral theses number presented at UPB together with the other criteria, the authors of the survey determined the UPB rank within the university typology because the university type determines the audit method. According to these definitions, the authors of the survey identified UPB as a doctoral and research university. The UPB innovation strategy is implemented through the Technological Transfer Center – POLITEHNICA. Mission TTC POLITEHNICA represents the development of the innovative potential and of intellectual property valorification of University POLITEHNICA of Bucharest (UPB), of technological information of the economic agents, of the technologies transfer and of the quality management in order to increase the enterprises competitiveness.

The purpose of TTC POLITEHNICA is to offer facilities and informational and technological services to the UPB faculties and research centers and to the economic enterprises, in order to increase competitiveness and durable economic development.

The performance audit according to the International Audit Standards INTOSAI represents an assessment or an independent examination of the degree in which an activity, a program or an institution function efficiently and effectively by observing profit. The purpose of the performance audit is that of offering relevant information in what regards the implementation manner and the consequences of the public activities. The performance audit represents an independent and objective examination or assessment of the degree in which a program or an activity of a public entity function efficiently and effectively in the conditions of observing profit.

In 2009, the auditor did an audit survey of the University POLITEHNICA of Bucharest in order to analyze and assess the way in which the UPB innovation is supported and encouraged on the basis of an audit for innovation management performance [8]. In order to do this survey there were investigated the following fields of the UPB innovation management:
- Innovation leading potential.
- Knowledge creating potential.
- The capacity to innovate and integrate in a relational system.
- The performance of the innovation activities.
- Intellectual property exploitation.

By means of this survey there were audited the research, development and innovation activities (RDI) taking place at the University POLITEHNICA of Bucharest (UPB). During the auditing process there were investigated the fields and the problems presented in the table below:

<table>
<thead>
<tr>
<th>Field</th>
<th>Audited Problems (planned objectives)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Innovation leading potential</td>
<td>I.1. The staff involved in research, development, innovation (RDI)</td>
</tr>
<tr>
<td></td>
<td>I.2. The staff involved in promotion, marketing, prognosis and in the monitoring of the economic environment</td>
</tr>
<tr>
<td></td>
<td>I.3. Supporting innovation at UPB</td>
</tr>
<tr>
<td></td>
<td>I.4. UPB professional prestige</td>
</tr>
<tr>
<td></td>
<td>II.1. RDI self-financing</td>
</tr>
<tr>
<td></td>
<td>II.2. RDI public funds financing, including European funds</td>
</tr>
</tbody>
</table>
II. Knowledge creating potential.

III. The capacity to innovate and integrate in a relational system

IV. The performance of the innovation activities.

V Intellectual property exploitation

The main results of the audit concerning the UPB innovation management.

I) Innovation Leading Potential

I.1. The staff involved in research, development, innovation (RDI).

At University POLITEHNICA of Bucharest, the staff involved in the research activity is made up of teaching staff, full-time employed researchers, students and external and collaborators. In the Strategic Plan, UPB provided the support of the research efforts, for the departments, chairs, centers and the RDI teams. During 2002 – 2008, the researchers number grew constantly, without having a spectacular dynamics, and the number of the teaching staff (C) involved in RDI activities grew rapidly, the involvement degree (PI) getting stabilized at the value of 53 %, starting with 2006 (fig. 1).

![Figure 1](image)

I.3. UPB Innovation Supporting.

The supporting capacity for the phases of the UPB innovation process is determined by:

a) Resources:

- RD equipment and laboratories – physical resources available for the innovation activities and technological transfer;
- The Human Resources - access to sufficient staff, having the adequate preparation and the necessary experience for implementing ITT activities (doctors, teaching staff, researchers, students, PhD students, technologists etc.);
- Information Access – the capacity to find the necessary information.
b) Formulation of the strategy and of the projects for innovation and technological transfer (ITT):
- The capacity to formulate ITT strategy in each phase of the ITT process based on the knowledge and the experience of the RDI teams (it is a measure of the intellectual capital);
- The awareness degree – the care for the access to external information which can influence the formulation of the ITT strategy;
- Acknowledgement Importance – the capacity to identify / acknowledge the impact of the external information importance on the ITT strategy;

c) Implementation of the strategy and of the ITT projects:
- Organization – the organization structure supports each phase of the ITT implementation strategy.
- Organizational culture, the set of the dominant attitudes at the organization level is adequate to each phase of the ITT strategy implementation and ITT projects implementation.
- Communication - the methods of formal and informal communication are adequate to each phase of the ITT strategy implementation/ ITT projects implementation.

I.4. UPB Professional Prestige.

In 2007, the number of participations in the editorial collectives of the ISI acknowledged publications (or included in international data bases) and in international editorial collectives was of 389, while the number of participations in the editorial collectives of the nationally acknowledged publications (B category in the CNCSIS classification) was of 684.

In figure 2, one can observe the dynamics of these professional prestige indicators.

![Figure 2](image)

II. Knowledge creating potential.

II.2. RDI public funds Financing including European funds.

University POLITEHNICA of Bucharest participates in projects competitions financed from national and European non-reimbursable funds. In the analyzed period, the funds obtained by UPB presented an accelerated increase dynamics.
Starting with 2006, after applying the 2007 - 2013 RDI Strategy adopted by the Romanian Government, the UPB external and national revenues coming from RDI have been increasing substantially, as it is shown in figure no. 3.

![Figure 3.](image)

In the context of this RDI revenues increase, the percentage of the RDI (P) expenses, by public sources financing out of the total RDI expenses, reached values between 88.8 – 90 % and is shown in figure 4.

![Figure 4](image)

II.4. The Capacity to bring in financing sources

The capacity to bring in RDI internal and external financing sources is represented by the funds brought in internally and externally per RDI staff, (mil. RON / person).

In figure 5 there is pointed out the evolution of the staff capacity to bring in RDI financing sources.
The capacity of the staff to bring in RDI internal financing sources grew accelerated, especially under the impact of the 2007 – 2013 RDI Strategy approved by the Government and there also grew the staff capacity to bring in RDI external financing sources. UPB innovation capacity in partnership with SMEs, the cooperation and the collaboration with other institutions (universities, INCDS, ITT entities) are not statistically monitored at the UPB level. In general, the RDI projects are promoted by consortiums formed between UPB and these institutions and according to the evolution of the number of gained projects one can have an image of these partnerships’ dynamics. In figure 6 there is presented the evolution of the number of innovative projects gained by UPB, between 2002 – 2008.

In the analyzed period, UPB gained in partnerships circa 300 projects / year, a fact which shows a good cooperation and collaboration with other economic and RDI institutions. Moreover, in 2008, in UPB there functioned 41 RDI entities (research centers, technological and business incubators, technological transfer centers, etc), of which:

- research centers: 38;
- technological and business incubators: 2;
- technological transfer centers: 1.
IV. The performance of the innovation activities.

IV.1. Participation in the making of new de / modernized products or new/ modernized technologies for the market

The distribution of the average multiannual percentage of the new or modernized products/ technologies out of the total of the RDI results is shown in figure 7.

The high percentage of the services and surveys shows a low degree of exploitation of the research results.

IV.2. RDI Activities

The percentage of the RDI revenues out of the total of the UPB revenues is of 44 % in 2007, 45 % respectively in 2008. In figure 8 there is shown the evolution of the RDI (NCDI) results number per researcher (PE).
As the researchers' number increases, the RDI results number per researcher decreases—a fact which reflects a decrease of the research “efficiency”. The main cause of this situation is represented by the dissemination of the RDI activity among the many UPB centers. A concentration of the activity by merging these centers and forming an RDI institute within UPB which could improve the research “efficiency” at UPB. Another result of the research is represented by the patented inventions. In figure 9 there is presented the evolution of the patents’ number (N) per researcher (PE).

Together with the increase of the researchers’ number there also grew the innovative productivity.

*The Summary of the audit fields and criteria*

The auditors investigated the audit fields and criteria which are presented synthetically compared with the planned objectives, according to the table below.

<table>
<thead>
<tr>
<th>Field</th>
<th>Number of planned objectives PO</th>
<th>Number of achieved objectives OR</th>
<th>Efficiency Calculation *)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI – Innovation Leading Potential.</td>
<td>4</td>
<td>2</td>
<td>0,5</td>
</tr>
<tr>
<td>PCC- Knowledge Creating Potential.</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>CI – Capacity to Innovate and Integrate in a relational system.</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PI– Innovation Activity Performance.</td>
<td>4</td>
<td>2</td>
<td>0,5</td>
</tr>
<tr>
<td>VPI - Intellectual Property Exploitation</td>
<td>5</td>
<td>1</td>
<td>0,2</td>
</tr>
</tbody>
</table>

*) Calculation Formula:

\[
\text{Efficacy} = \frac{\text{Obtained results}}{\text{Planned results}}
\]

In figure 10 there is presented the general diagram which shows the UPB innovation management performance, by means of efficacy.
3. ORGANIZING AN “INTER – UNIVERSITY CENTER FOR INTELLECTUAL PROPERTY EXPLOITATION”.

According to the audit done at University POLITEHNICA of Bucharest (UPB), in order to increase the innovation capacity and to promote the entrepreneurial spirit, there was outlined a series of strategic measures which should lead to increasing the UPB potential for innovation and intellectual property exploitation, as follows:

a) The improvement of the organizational structure by directing the activity towards the services of technological transfer which develop the UPB innovation potential and which are highly demanded on the market. This fact requires to direct the activity towards new projects and programs, whose objectives should be the following:

- To develop and use the electronic networks connected with the industry, in order to create data bases about the technical problems of the companies; to facilitate cooperation between these and the university research centers in order to effectively deal with these problems.
- To start and do projects in the innovation field and technological transfer field.
- To coordinate and organize workshops, conferences and seminars for the university, local communities and industry in order to raise their awareness on the problematic of innovation and technological transfer.
- To provide support for young researchers so as to be able to apply their ideas, by using innovation specific instruments.
- To provide technical and legal support for the investors who acquire patent licenses and to facilitate communication between these and the inventors.
- To do training and consultancy in the field of internal and international legislation regarding intellectual property.
- To organize trainings and to develop the curricula for the innovative – entrepreneurial formation.
- To assess juridical and legally the ideas, the scientific articles and the university’s research results, in order to determine the type of legal protection which can be promoted.
- To examine technically the innovative ideas in order to determine the applicability, the known stage of technical and the connections with the technical requests which are stipulated in the legislation regarding intellectual property.
- To elaborate the patents applications according to the legal methodology, in order to obtain national and international protection.
- To elaborate the necessary documents for the technological transfer, such as confidential clauses, license contracts, statements under signature, obligations etc.
- To assess the intellectual property in order to determine the predictable economic value of the innovative idea, by using the optimal method for each case.
- To provide intellectual property marketing in order to obtain the most advantageous license.
- To promote the university’s PI offers in the local, regional, international economic environment and among the industrial enterprises.
- To develop cooperation and communication with the economic agents at a local, regional and international level.
- To create a favorable environment for the intellectual property exploitation and for the development of the technological transfer.
- To promote the strategic partnerships in fields such as: research, development, institutional construction and specialized training.
- To provide the marketing for the university’s offer and RDI potential in the local, regional, or international economic environment.
- To collaborate with research support- networks and to develop strategic relations with research institutes and economic agents for the university’s fields of research and development.
- Elaboration of practical guides for research – development and of documents regarding the university’s policy in this field.
- To provide follow-up on the university’s RDI projects ongoing.
- To include the university’s research centers in similar networks.
- To inform on the financing sources and opportunities for the university’s projects.
- To develop the university’s RDI capacity by organizing trainings, courses workshops and seminars.

b) **Multiplication of the financing sources is done by:**
- The permanent increase of the extra budgetary revenues;
- the increase of the complementary financing by: legal taxes, revenues coming from the economic agents, revenues coming from services, from the scientific research, consultancy, editorial activities, donations and sponsorships, associations, interests etc.
- The setting and application of the financial autonomy principles in what regards innovation and intellectual property exploitation;
- The efficient use of the budget allocated resources for innovation and intellectual property exploitation according to the global financing principle;
- The identification of the areas and means of cutting down on expenses;
- The identification and bringing in of new financing resources including capital-risk funds.

By means of the project „Virtual Interuniversity Community for Science, Technology, Innovation and Intellectual Property Exploitation”, there was created a „Pilot Interuniversity Center for Communication and Intellectual Property Exploitation” - POLITECH”, which is destined to applying this strategy for increasing the potential of innovation and intellectual property exploitation

**The center’s activity**

The POLITECH center’s objectives are the following:

a) To increase the UPB potential of communication and intellectual property exploitation and to disseminate the findings of science and technology.

b) To develop the economic and informational partnership.

c) To increase the technological documentation degree.

d) To increase the economic agents potential for absorbing technology.

e) To prepare/ improve the innovative human resources.

f) To increase the number of SMEs applying new technologies.

g) To introduce total quality management in the field of innovation.

h) To develop the innovative informational networks.

i) To introduce in education the principles of the entrepreneurship, innovation and technological transfer.

j) To increase the public’s knowledge in the fields of science, technology and intellectual property exploitation.
**Center’s Activities**

The center’s activities deal with projects and programs.

<table>
<thead>
<tr>
<th><strong>Innovation Program:</strong></th>
<th><strong>Intellectual Property Program:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- To develop and use the electronic networks connected with the industry, in order to create data bases about the technical problems of the companies; to facilitate cooperation between these and the university research centers in order to effectively deal with these problems.</td>
<td>- To do training and consultancy in the field of internal and international legislation regarding intellectual property.</td>
</tr>
<tr>
<td>- To start and do projects in the innovation field and technological transfer field.</td>
<td>- To organize trainings and to develop the curricula for the innovative – entrepreneurial formation.</td>
</tr>
<tr>
<td>- To coordinate and organize workshops, conferences and seminars for the university, local communities and industry in order to raise their awareness on the problematic of innovation and technological transfer.</td>
<td>- To assess juridically and legally the ideas, the scientific articles and the university’s research results, in order to determine the type of legal protection which can be promoted.</td>
</tr>
<tr>
<td>- To ensure support for young researchers so as to be able to apply their ideas, by using innovation specific instruments.</td>
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<tr>
<td>- To ensure technical and legal support for the investors who acquire patent licenses and to facilitate communication between these and the inventors.</td>
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</tr>
<tr>
<td><strong>Cooperation and Communication Program</strong></td>
<td><strong>The RDI Support Program</strong></td>
</tr>
<tr>
<td>- Promotion of the university PI offers in the local, regional and international economic environment among the industrial enterprises.</td>
<td>- Ensuring of marketing with regard to the offer and the RDI university potential in the local, regional or international economic environment.</td>
</tr>
<tr>
<td>- Development of cooperation and of communication with economic agents at local, regional and international level.</td>
<td>- Collaboration with support - network of research and the development of the strategic relations with research institutions and with economic agents in the university’s research and development fields.</td>
</tr>
<tr>
<td>- Creation of a favorable environment for intellectual property exploitation and the development of the technologic transfer.</td>
<td>- Elaboration of practical guides for research – development and of documents concerning the university’s policy in this field.</td>
</tr>
<tr>
<td>- Promotion of strategic partnerships in fields such as research, development, institutional construction, and specialized training.</td>
<td>- Follow-up on the university’s RDI projects ongoing</td>
</tr>
<tr>
<td></td>
<td>- Co-opting of the university’s research centers in similar networks.</td>
</tr>
<tr>
<td></td>
<td>- Informing on the financing sources and opportunities for the university’s projects.</td>
</tr>
<tr>
<td></td>
<td>- Development of the university’s RDI capacity by trainings, courses, workshops and seminars.</td>
</tr>
</tbody>
</table>
The POLITECH center’s activities are the following:

a) Communication, technological information and monitoring, elaboration of papers, reports, analysis and surveys for the SMEs’ technological information.
b) Documenting by means of access to data bases, elaboration of specialized reports in order to support decisions.
c) The selective or complete translation of the papers, translations of the documentation concerning new technologies or products, scientific articles etc.
d) Organizing trainings, courses on intellectual property and information methods.
e) Editing of specialized publications, editing and printing of magazines, manuals, technology books.
f) Technological audit, elaborating of expertise and technologic audit surveys in order to assess performance and opportunities.
g) Consultancy for the elaboration of the R-D projects offers, giving consultancy on the field’s specific methodologies and technological level.
h) Cooperation and consultancy on intellectual property, giving consultancy on the exploitation of the intellectual property rights.
i) Elaboration of feasibility studies and of business plans for SMEs investments.
j) Editing and multiplication of documentation materials, magazines etc., services of Xerox copying and multiplications of documentation materials, magazines, brochures, folders and others.

In order do these programs there was conceived the following center diagram.

Center Diagram

The POLITECH center mission is to develop communication and to exploit the UPB intellectual property, to inform the economic agents on scientific and technologic issues, to transfer technologies and quality management in order to increase competitiveness among the enterprises from the fields of energy, environment, renewable energy, materials, communications and informatics.
The main activity principles of the POLITECH Pilot Interuniversity Communication and Intellectual Property Exploitation Center are the following:
- POLITECH promotes the culture of intellectual property exploitation and of the other results coming from the UPB scientific research.
- POLITECH uses the most diversified means for intellectual property exploitation, including contracts cooperation with the private sector, the systematic protection of the rights of intellectual property, the licensing of these rights and the creation of spin-offs.
- The benefits resulted from the commercial exploitation of the UPB patents will be shared between the university and inventors, according to a guide approved by the university.
- POLITECH monitors the copyrights protection referring to all UPB publications and books.

4. BIBLIOGRAPHY


IMPROVING ORGANISATIONAL PERFORMANCE THROUGH ADVANCED BUSINESS EDUCATION

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ABSTRACT

This paper addresses competitiveness and productivity issues facing business in today’s connected, mobile and information-based society.

In South Africa, competitiveness has declined steadily. The World Economic Forum’s Global Competitiveness Index ranks South Africa 34 in 2001 and 54 in 2010, meaning that the ability of South Africa to compete in international markets is worsening. South Africa has also slipped in the ITU Development Index, dropping from place 77 in 2003 to 92 in 2009. Key outcomes of these statistics are the deteriorating ability of South Africa to transition into a knowledge economy, and adverse effects on the country’s ability to create new industries and reduce unemployment.

Research conducted by the writers suggests that ineffective and sub-optimal use of information assets plays a major role in this critical situation. In a large number of cases, information management projects do not fulfil expectations or they simply fail. Decisions regarding the acquisition and deployment of information and knowledge management assets rest with senior executives, and they are not always appropriately informed about the impact on the organisation of emerging information management developments. A communications gap exists between the business executives and the information technology specialists. This paper describes a recently-launched course that will equip these executives to extract maximum return from their investment in information technology.

The structure of the course and how information technology is used for strategic business decisions is outlined, including the impact that correct adoption of the principles and strategies covered in the course can have on the organisations financial performance. Specific instances where the principles and strategies have been applied successfully are illustrated.

While this course is of major importance to a country with declining performance, it has equal relevance to organisations globally that need to maintain their performance in internationally competitive markets.

Initiated by research in South Africa and internationally, the Master of Business Systems (MBS) has been developed by Hochschule Wismar (HSW) and Innovation Africa (IA), and, as a joint project by Cape Peninsula University of Technology (CPUT), IA, and HSW, is on its way to become a success story.

Keywords: Business systems, Information Technology and Leadership, Business Processes, Business Informatics, Master degree programme, business education, higher education

1. INTRODUCTION

Between mid 20th century and the early 21st century the economies of the world shifted dramatically from the traditional resource-based model to one based on knowledge and intellectual capital (Figure 1).
South Africa, in common with many other countries, faces the challenge of making the transition to knowledge economy. According to the Global Competitiveness Index, South Africa has dropped in ranking from position 34 in 2001, to 45 in 2008 and 54 in 2010. In Africa, South Africa has slipped from position 1 to position 4, behind Tunisia, Mauritius and Morocco in terms of technological readiness. This is indeed a serious decline in competitiveness that impacts on the ability of the country to enter new international markets and build new globally relevant businesses. The Competitiveness Index is also used as a measure of the ability of the country to make the transition to a knowledge economy. It can also be argued that the transition to a knowledge economy is a precursor to a low-carbon economy as improved competitiveness implies better use of resources and improved organisational efficiency (see figure 1). The Global Competitiveness Index in effect measures the set of institutions, policies, and factors that set sustainable current and medium-term levels of economic prosperity, and point to a failure to extract maximum return on investment in information technology by executives.

A recently-launched course in the Faculty of Business at the Cape Peninsula University of Technology (CPUT) in South Africa in collaboration with Wismar University (Hochschule Wismar –HSW) in Germany will equip future executives and leaders to make meaningful decisions and more realistic and effective business forecasts using the power of emerging information technology developments.

This course, the Master of Business Systems (MBS), will equip executives with the power to derive maximum benefit from investments in information technology. It will also add value to the South African National System of Innovation (SANSI) by providing a fertile ground to promote a culture of entrepreneurship to facilitate economic growth, thereby growing the knowledge economy.

It is expected that the South African government’s willingness to invest in R&D will also complement and derive benefit from the MBS programme. World Bank (2011) reports show that the ratio of gross expenditure on R&D (GERD) to gross domestic product (GDP) in South Africa has grown from a low of 0.69% in 1997 to 0.87% in 2004/05, but is still short of the government’s target of 1% (Figure 2).

University/industry collaboration, as offered by the MBS, is a vital aspect of effective research as it leverages capacity resident in the university for practical application by business and industry.
Studies by IBM, Desai (2009), highlight that 1 in 3 business leaders frequently make major decisions with incomplete information or information they don’t trust. Half of all business leaders don’t have sufficient information from across their organisations to do their jobs, and some 60% of organisations don’t share critical information with partners and suppliers for mutual benefit.

Clearly there is a problem with the way organisations manage information and knowledge resources, and research conducted by the writers Laemmel, Silberberg (2008) points to the need for a fundamentally new approach to executive education. This new approach must foster university/industry collaboration, and address the key business issues of organisations today.

2. ADDRESSING COMPETITIVENESS THROUGH ADVANCED EDUCATION

The issues of competitiveness and productivity described above must be addressed if the organisation is to be successful. Current executive education programmes are aimed at upgrading the business knowledge of technical staff. However, a major gap exists in terms of giving senior executives the insight into their organisations that is essential for making effective decisions regarding the use of costly physical as well as knowledge assets. Given the highly competitive global environment of today, coupled with the game-changing effect of emerging information management technology, organisations are compelled to re-think and re-align their information management strategies if they are to remain relevant and successful. A new path is required to equip the business executive to master these issues.

Factors expected to have significant impact on the organisation in the near future are identified as strategic by Kernochan (2011), and others. These factors are likely to disrupt business or its use of information, as they often require major financial investment, the consequences of delayed adoption of emerging technology can be severe, and the problems associated with the implementation of new technologies are frequently unrecognised. Examples include developments in cloud computing, mobile applications and media tablets, social communications and collaboration, video, next-generation analytics, social analytics, fabric-based infrastructure and computers, ubiquitous computing, storage class memory, and context-aware computing.

Research by McManus and Wood-Harper of the British Computer Society (2005) reveals that some 85% of information management projects fail, where failure is defined as delayed, over budget or not meeting the project specification. A more important measure, delivering the business case, is generally not considered. This poor statistic prevails despite the best efforts of undergraduate IT courses and the business schools to inform organisations about effective deployment of information assets.
A new programme, aimed at senior business executives, is built from scratch to address these strategic issues. Its origins trace back to the development of the National Qualifications Framework, a model developed in conjunction with ISETT SETA and SAQA, but not published, and used to analyse and measure existing qualifications. This model defined the job functions and skills needed to direct an organisation successfully in the current business environment, and directed the development of appropriate courseware. Registration of the qualification with local and overseas authorities required the input of representatives from industry and business, which confirmed that the programme addresses a need not covered by existing executive education programmes.

3. COURSE GOALS AND OBJECTIVES

A new course must address key issues that inhibit top performance. These include the effectiveness of communication internally and externally, the ability to handle the flood of information that overwhelms most organisations today, the challenge of disruptive change, and real problem of putting new ideas, concepts and processes into practice. These are discussed below:

3.1. COMMUNICATION

Communication between business executives and technical professionals and as identified by Neunteufel (2010) is a recognised and critical problem, whose roots can be traced back to the education pathways followed by each group.

This fundamental problem, described as the normative style of communication of the typical business executive, and the deterministic style of the technical professional, is a major cause of misunderstanding between the two groups. Given the accelerating pace of technological development, and the increasing complexity and risk of doing business, this communication breakdown will undoubtedly increase, clouding the organisations understanding of the benefits of emerging technology, and leading to further failure of implementation. As described above, delayed and failed adoption of emerging technology is a factor expected to have a significant impact on the organisation.

The new course explores this gulf, and enables more effective communication within the organisation.

3.2. INSIGHT

Organisations today face serious problems with regard to the acquisition, storage and use of relevant information. Common issues are the exploding volume of data, the demands of new business models and processes coupled with limited resources, and expensive and inflexible infrastructure.

Studies by IBM, Desai (2009), demonstrate that business leaders frequently make major decisions with incomplete information or information they don’t trust:

- 1 in 3 Business leaders don’t have sufficient information from across their organisations to do their jobs.
- 1 in 2 Organisations don’t share critical information with partners and suppliers for mutual benefit.
- 3 in 5 of CIOs cite business intelligence and analytics as the way they will enhance their organisation’s competitiveness.

Typically, the organisation must manage the reams of data generated by their customer relationship management systems, online ad campaigns, Web sites, search campaigns, and e-mail marketing efforts. To give an example, by analysing this data, marketers can answer important questions such as which search terms are most valuable to their businesses, which cross- and up-selling techniques are most effective for their existing clients, and which messaging and environments are effective in converting new customers. This type of insight is core to driving a successful business. Many other examples can be given.

The new course includes instruction in the application of data management systems, computer models for business decisions, and knowledge management, designed to enable business executives to implement advanced business intelligence and analytical processes. It will allow them to manage pervasive information, analyse it to gain insight, predict risks and opportunities, and drive faster, smarter decisions and actions.

The quest is to gain insight from information.
3.3. INNOVATION AND MEETING THE CHALLENGE OF DISRUPTIVE CHANGE

New technologies affect everything, from how knowledge is created and the way an organisation is structured, to building new businesses in fields where there may be no competitors. These advanced and emerging technologies can slash costs and dramatically increase the organisation’s ability to develop innovative solutions and products. However, to reap these benefits, the organisation must prepare itself for the full effect of such technologies.

The challenges are both technical and managerial. There is a need to exploit early information, and to combine new and old technologies so that they can complement each other. There is a need to capture business ideas with real commercial potential, and there is a need to determine how the organisation can deliver the new concept effectively and profitably.

Built into the course are modules that examine the role of information technology in business and how organisations can structure their business processes to take advantage of the capabilities of potentially disruptive new technologies. The purpose of these modules is to equip the business executive with the knowledge of emerging technologies and the power to communicate effectively with the technical professionals tasked to bring new concept to fruition.

3.4. APPLICATION

While the course has high academic content, it is designed specifically to develop the participant’s ability to address problems encountered in the real world. A major part of the course is the business project, conducted in the workplace. This project is intended to give practical application to the theoretical concepts studied in the course, and will allow the participant to provide tangible value to the organisation. Direct application of project management techniques and the development of software-based business solutions is provided. The work-based component also facilitates the understanding of the impact of enterprise systems and the need for organisational transformation to enable successful implementation of information- and knowledge-based solutions. That such transformation is essential is amply demonstrated by the success of Gerstner (2002) at IBM, in his book describing IBM’s historic turnaround from near bankruptcy to the world’s leading services organisation. Many other examples of the need for organisational transformation given the power of emerging information technology are available, but are the topic of another paper.

4. MASTERS OF BUSINESS SYSTEMS COURSE

The new and innovative course outlines above has been registered in Germany and in South Africa. The MBS is a two-year part-time course during which participants acquire the knowledge and skills needed to restructure organisations and improve their performance.
Teaching from the course has already been applied to business issues with considerable success. These include knowledge management, decision making tools, analysis and design of business processes or systems analysis and design in general.

5. APPLIED KNOWLEDGE AND STUDENT'S THESES

In Germany we have a long tradition of co-operation between industry and universities: Companies and organisations contact universities and offer topics for internships as well as for Bachelor or Master Theses. Thus, we will transfer our experiences gained in our Bachelor and Master programmes into the Master of Business System’s programme.

All our Business Informatics degree programmes at Hochschule Wismar focus on the application of theoretical concepts to real world problems in companies or organisations. Business Informatics itself is both a formal science as well as an applied science. Both aspects are included in our programmes. While the theory modules address new developments, their practical application in business is always emphasised.

Co-operation between industry and university begins already in undergraduate courses and will be extended in the Master’s programmes: In a higher semester of the Bachelor’s programme an internship is mandatory. Students apply their knowledge and work in a company. We recommend that our students try to identify a topic for their Bachelor thesis out of these workplace experiences. Most of our students continue in a Master programme and continue to work part time for a company as well. This is again a source for topics to be addressed in a thesis work.

Since Business Informatics uses computer science to solve business related problems there is a broad variety of possible topics:

- Analysis and design of business processes,
- Systems analyses and development or implementation,
- Adaption and extension of enterprise resource planning system’s (RP) applications,
- Business intelligence including data warehouse or data mining,
- Web applications design and development,
- Information and knowledge management,
- Development of knowledge based solutions for business problems,
- Process automation and optimisation,
- and many more.

Students generally identify a topic for their theses. In particular, students in our distance learning programmes mostly find problems directly at their workplace. This has many advantages:

- Students analyse the information technology used at their workplace. With a critical view on existing solutions they identify space for improvement.
- Students often want to apply the technologies introduced in the modules to their workplace environment: companies or organisations will benefit a lot since new technologies will be introduced at low cost.
- The organisation itself may suggest topics for master theses. The student can then evaluate approaches and their implementation, and address problems; tasks that staff generally have little time for because of day-to-day routine.
- Academics in turn profit from such applied research: the usability and usefulness of new techniques can be evaluated without disruption to the organisation, and new areas of research that could benefit the organisation can be identified.

The thesis topic should not be suggested by a single student nor by the organisation. Academic guidance is essential. Our faculty, together with the applicant and, if necessary the organisation work out the topic the student will work on in his master thesis.
So far no problems have been observed in the process of co-operative elaboration of theses topics. So in average industry provides us several offers per month for our students. Of course the number of offers is related to the general economic situation. Our experiences show that there is always a need for addressing problems in the area of information technology in business. We will establish a similar co-operation between industry and degree programme in our Master of Business Systems programme.

6. STUDENTS’ THESES TOPICS

A few examples will be discussed in order to highlight the influence of the theses’ work for the development of organisations. All the topics have been executed by students in their final semester and they address real world problems in their workplace environment. Technical or programming related tasks are rather seldom. The variety of topics reflects the possible application fields as well as the possible occupational fields for graduates in Business Informatics.

Knowledge management continues to be a priority topic in students’ theses. In every company or organisation there is room for an improvement of the company’s handling of knowledge. In 2010 Mark Schmitt did research on evaluation of knowledge management approaches and suggested and auditing approach for the IT support department at a German bank, Schmidt (2010). In the same year Ronny Bendig, Bendig (2010), analysed the opportunities for a Wiki system in an energy supply company. He based his work on a questionnaire asking employees and managers about their opinion about the importance of knowledge management and about possible approaches. While a lot of companies are still discussing the introduction of a knowledge management other companies try to improve their approaches. The headquarters of DrägerMedical, world-wide known for their medical equipment, is located in Lübeck, North Germany. They use a semantic wiki system enriched by a graphical process modelling tool to define therapy processes and workflows. Hence accuracy and correctness are of highest priority. Gritje Meinke identified possible anomalies in process models and implemented algorithms for an automated anomaly check, Meinke (2011).

Business Process, their analysis, re-engineering, and modelling, are another key aspect addressed in various theses: In 2010 Dohnke (2010) analyzed the Business Process Modelling Notation (BPMN) in order to discuss the question: Is the BPMN suitable for modelling control processes in the machine building and plant building industry.

Enterprise Resource Planning (ERP) systems have been another rich source for theses’ topics. Often interface problems have been addressed: How can other software interact with or extend the ERP system. Often SAP is used as an ERP system. Axel Rudolph, Rudolph (2010), developed a strategy for an implementation of a document management system (CMS) which interacts with the existing ERP system in the company: a housing industry company. More technical was the work done by David Hausmann: he developed a framework for a parallel processing of mass data in SAP systems, Hausmann (2010).

Various software engineering problems have been addressed. In most cases strategic or management questions have been addressed while programming tasks are rather seldom or even not acceptable as a topic for a master thesis. Sebastian Oelschlägel developed a strategy for the integration of different company-wide software systems. Enterprise Application Integration (EAI) is the headline and various tools claim to solve software integration problems. He suggested a migration process based on the Websphere Message Broker (IBM). Service Oriented Architecture (SOA) is in the focus of the thesis by Sebastian Rehberg, Rehberg (2010).

All business applications are based on data. Data is handled in data bases, data warehouses, or more general a business intelligence approach is used. In 2010 Björn Moll analyzed the availability of data in a medium-size service company and applied state of the art data warehouse techniques to improve the information management in the company. He designed a data warehouse for accounting purposes, Moll (2010). 2011 Sebastian Kuhrau, Kuhrau (2011), did a research on data mining in industrial production. As a result he did some experiments following the CRISP-DM model and showed how data mining could be integrated in the production process. Ulf Kersten, Kersten (2010) identified in his work possibilities for data mining in a logistics company.
The above mentioned topics are a subset of the problems students have worked on in their theses. Other theses focus on topics in the area of web applications like e-commerce or IT management in general.

7. CONCLUSIONS

Theses addressing real world problems bridge the gap between theory and praxis, the gap between science and workplace and can boost the transfer of technology from university into industry or society. Students at the end of their studies address problem which they have identified at their workplaces. Thus a thesis is a final step in a workplace based distance learning degree programme. The positive experiences we have gained in our degree programmes in Business Informatics will be applied in our degree programme Master of Business Systems. Participants can make us of their workplace experiences in their studies and vice versa return academic insights into their companies or organisations. All the three parties involved benefit from the approach: students increase their personal knowledge and their personal skills, companies profit from the analysis and suggestions developed during theses work and faculty get to know real world problems and can include them into their research work.

Existing post-graduate business courses do not adequately address the needs of business today. While research conducted by the writers suggests that ineffective and sub-optimal use of information assets plays a major role in the lack of competitiveness and declining productivity of organisations and countries, little has been done by academic facilities to address this issue.

The newly developed course described in this paper recognises the critical impact of emerging technology on productivity, and gives the business executive effective insight into business operations and the ability to boost returns on information asset investments.

The pedagogic approach adopted by the Master of Business Systems has been successful, with students combining workplace challenges with their studies. The course therefore successfully addresses the competitiveness issues identified above as follows:

By using information assets more effectively, organisations, and the country, become more competitive, thereby generating jobs and new enterprise.

By providing relevant executive education, more effective business leadership is enabled.

By linking student’s studies with practical business applications and academic guidance, relevant research output is encouraged.

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FROM THE LABORATORY TO PRODUCTION: WHERE IS THE DISCONTINUITY?

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ABSTRACT

The bulk of research output comes to a dead end right in the laboratory and never mature to commercial undertaking. A few projects break through; however, the time to full commercialisation is far too long. The majority of research outcomes are consigned to shelves forever, succeeding only as far as meet the research quotas or satisfy the scientific curiosity of investigators. Developing countries in particular cannot afford any research drudgery that has no real economic value. Industry has specific objectives and sees no business sense in bankrolling ill-fated research activity. The present paper explores the bottlenecks along the research process and the possible causes of long transition research output to leave the laboratory.

Key words: Research output, industrial application, commercialisation, economic value
Theme: Research and development and its role in industry and commerce

1. INTRODUCTION

Universities and other research institutes carry out research throughout the year building inordinate volumes of project reports. However, the projects that graduate to tangible commercial value i.e. patents or industrial innovation are very few and far between. What then is the purpose served by the volumes of research? On face value, technological advancement and product quality are results of sustained research. If research output does not live up to its expectation, where is the discontinuity? This paper investigates some of the bottlenecks along the research-application value chain. Bold decisions would have to be made at policy level to bridge the yawning gap between activity at research institutions and industrial needs.

2. THEORETICAL FRAMEWORK

It has been noted that scholars appear to have forgotten what really matters in society; consequently their research output falls out of phase with industrial practice. Academics seem to publish favourite topics that may be at variance with needs of industry. In Australia studies have shown that industry and university links are rare because the cultural divide between academia and the industrial sector is an impediment to collaboration [1]. Research managers try with difficulty to promote industry-university relationships [2]. The mismatch between research institutions and industry is caused by the insulation of research centres from industry resulting in incongruent goals. In this respect, research tends to be driven by curiosity and self-worth, while industry is more concerned with market needs and public worth [3]. The rift between science and practice exists because research and industry live in different worlds [4]. On the academic side, the prevailing cultures and incentive systems tend to accentuate the irrelevance of most scholarly work because of incompatibility with industrial perspectives. On the side of industry, managers make decisions that are not subjected to scholarly inquiry or peer review processes, and rarely seek academia to help with practical insights.

The dissonance between the research-industry is a universal phenomenon as observed in the western world. The “European Paradox” for instance refers to the perceived failure of the European Union to rip full tangible benefits of science [5]. The “American Paradox” on the other hand is a dichotomy of low volume of scientific publications despite the US world-leadership in funding research and development. Commercialisation of research output is disproportionally low considering the high volumes of research output. This exemplifies what Lee in 2005 referred to as “too many surveys, too little passion” in relation to research effort versus accrued benefits thereof [6]. The problem is more pronounced in the developing world. Knowledge spill-overs from universities and other public research institutions are viewed as essential for innovation in industry. Studies examining the impact of such spill-overs have been confined to the West,
and there are no comparable studies using empirical data from countries like Japan [7]. The Western World and China have managed the knowledge transfer by putting in place initiatives and business models for effective transition of science to production. In some Europe’s most developed countries, public and public-private support platforms have been created to link research and industry by codifying scientific knowledge into transferable format, thus bridging the research-to-market gap, often known as the “death valley” [8]. Simplifying research codes (or technical jargon) to industrial level makes the research output user-friendliness.

Industry–academia partnerships are fraught with uncertainty [9] that has to be solved in order to align academia with industry via establishment of formal structures such as Cooperative Research Centres to improve productivity through knowledge creation and innovation in primary industry are recommended [10]. In Austria for instance, an individual Erich Wimmer for many years played the role of mediator between academia and industry [11]. The Italian wine industry has recently undergone a radical technological modernisation in which scientific research has become an extremely prominent part of industry [12]. In China strategic alliances between industry-university are considered to be crucial innovative ability. The Chinese government in this regard is promulgates guiding policies that create favourable environment for congenial industry-university research cooperation [13]. Successful industry university cooperation has been demonstrated by Tsinghua and Zhejiang Universities where the collaborating independent enterprises have achieved the synergistic “1 + 1 > 2” effect in innovative ability resulting in superior operational performance and market competitiveness [13]. Advocacy and lobby have been instrumental in the formulation of such focused policies for strategic alliances. Strategic thrust in policy is required in the following areas [13]:

1. Charting strategic path based on independent innovation to convert economic growth by creating a scientific outlook to the development of enterprises
2. Establishing entrepreneurial universities to champion national innovative systems and creating conditions for organisational innovation by satisfying enterprise needs for science
3. Perfecting universities’ technological innovation assessment systems as performance indicator for researchers and technical staff
4. Promoting organisational innovation based on both dominant and recessive knowledge trait which involve quick transfer of technological knowledge and minimise transaction costs and fostering mutual learning
5. Establishing perfect financial systems with favourable tax breaks and open knowledge which stimulate production
6. Encouraging duplex intellectual property right system between universities and enterprises
7. Establishing laws and regulations that empower universities to have independent right in technological transfer so as to expedite efficient development of industry-university strategic alliance

China has however faced challenges in commercialising nanotechnology research results. Hence Chinese patenting and product development in nanotechnology has been weak despite its considerable research output [14]. Patenting of intellectual property a key performance indicator for universities appears to be one of the sources of conflict with the norms of open science which is the essence of knowledge dissemination and advancement [15]. Industry may also at times want to protect proprietary knowledge as intellectual property with patents and trademarks for competitive advantage [16]. In Australia barriers to industry-research partnerships were found to include massive paperwork and debilitating bureaucracy in the registration of intellectual property [2].

Research is a costly undertaking and research institutions require financial support to procure equipment, machinery and consumables, as well as student scholarships. It is through perceived benefits that industry, government and foundations can inject funds into research [17]. Industry as the long term beneficiary has a duty to lobby government and funding agencies to support research institutions financially [11]. In the US, government contributes more to research and development than industry and private agencies [5]. Lately China Taiwan, South Korea, and Singapore have accentuated investment into research and development, as evidenced by a sharp increase in scientific publications form South East Asia [5]. With the increased support in research, institutions on their part have an obligation to demonstrate that public and private are spent for tangible benefit in the form of publications and patents [18]. However, some sections of the public of the
may be sceptical whether such output is worthwhile return on investment particularly when the cost of research continues to rise to questionable levels [19].

As the average age of professions at universities continues to rise, the next generation will probably face serious knowledge or skills gaps [20]. A survey conducted in India by McKinsey Global Institute revealed that multinational corporations find only 25% of 350 000 Indian graduate engineers produced annually are employable, whereas a NASSCOM report forecasts a paucity of 500,000 knowledge workers in 2010 [21]. In Pakistan although higher education has expanded rapidly in order to meet the increasing demand for engineers in the telecommunications sector. However, the educational expansion was not synchronised with the requirements of the industry because co-operation between the industry and education sectors. Higher education degree programmes in Pakistan are precisely focused on producing quality graduates with refined technical and mathematical skills, while the telecom sector is in principle a service provider and a consumer market that mainly requires engineers for operation and maintenance related activities [22]. Therefore the skills imparted by the education sector are excessive to the needs of the telecommunications sector. Consequently, the underutilisation of skills has resulted in dissatisfaction and frustration among the telecommunications engineers.

Researchers often take a narrow research focus for instance using a positivistic framework emphasises on the numeric values that often fail to address the complex multi-faceted phenomenological problems vexing practitioners [23]. Furthermore, the lack of communication does not help in addressing the industrial problems. Industry on the other hand may not be ready to accept new knowledge probable due to low skills level in the company. Unless an organisation invests in human capital development it may not be amenable to technology transfer. Some of the factors stifling growth in organisation include [24, p 39]:

1. Silos in organization where there is a compartmentalised structure that stifles organization-wide talent management processes
2. Reduced skills development cycles where current performers are benchmarked as predictors of future potential at the exclusion of the diverse skills within the entire workforce.
3. Cutting skills development budgets and shortening training periods.
4. Lack of cross-functional experiences for staff to gain exposure in several functional areas to become well-rounded senior executives who see the big picture.
5. Lack of formal mentoring from external professionals as substitutes for inward-looking mentoring, coaching and development of high-potential managers.

In companies with in-house R & D the innovation gap can be caused by investment decisions made by executive who are far removed from actual research and development [25]. Bridging the sustainability gap between theory and practice can be achieved through continuing education of workforce with the support of universities [26].

3. SURVEY CASE STUDIES OF TWO SOUTH AFRICAN UNIVERSITIES
In the present study respondents were drawn from the flowing groups:

1. Final year students currently working on a research project in metallurgy
2. Recent Bachelor’s degree graduates that gone through the process
3. Recent Master’s degree graduates

Two universities in Gauteng (names withheld for confidentiality) were chosen and the sample of respondents was considered to adequately represent broad views held among research students and graduates in metallurgy at the two institutions. Most student projects at the two universities are industry based. The university supervises the academic process of research while the industrial counterparts provide mentorship to students on the industrial processes, sampling, etc.

A questionnaire was sent by electronic mail to approximately sixty respondents to complete on-line. The wide range of questions sought to establish the research process and value of student projects to industry after the student has graduated and left university. The motivation of project and method of project allocation to students were investigated to determine the whether the student was allocated a project in
consideration of student field of interest. It was essential to establish the industrial application of the research results and whether the student was employed within the same company to advance the research output at the production.

4. RESULTS OF THE CASE STUDIES

4.1 RELEVANCE OF PROJECTS FOR INDUSTRIAL APPLICATION

Most projects were initiated from technical problems faced in industry industrial liaison. Student on placement and employment were allocated appropriate project from their company in consultation with the industrial mentor and the supervisor. Therefore the majority of projects were found have direct relevanceto industrial application. Students employed by the company therefore were well placed to implement research results after final university event of graduation. However, in other cases where students were neither sponsored by those host companies nor employed, the onus was with the industrial mentor to implement the research findings. This was rarely possible given the usual preoccupation with routine work. Students ending up in a work environment different from the research work can only make one publication, before the work is consigned to the ever-increasing collection of student projects.

4.2 STUDENT RESEARCH INTEREST

In most cases students have a wide choice of industrial projects from which they one within the scope of their interest. In case of employed students, projects arise from the technical problems they have encountered at work. Master’s degree students however tend to get whatever is laid on the supervisor’s desk by industry. It has been observed that with such projects the student interest is compromised because the lecturer ‘dangles a carrot’ in the form of a company bursary. Company bursaries tend attract students towards work that may not be in particular areas of interest, resulting in half-hearted commitment to research work. Students in this category hop elsewhere after submitting the dissertation even if the sponsoring company may wish to employ them. Student research interest can be demonstrated by willingness to proceed with the same research themeto a higher degree. The fact that some students graduate and fail to get employment tends to kill their research interest and dampens confidence in the chosen career. It is quite devastating for young engineers to have set foot in industry during research, only to leave of industry jobless.

4.3 PROJECT FUNDING AND STUDENT SUPPORT

Companies have no obligation to fund the projects or to give subsistence stipends to students. They can only do so by choice and hence some students struggle financially and are only driven by the desire to acquire the degrees. Companies that do not assist students financially essentially gain research output at no cost other than providing samples and allowing student to work on company premises. Such companies are very unpopular with students. Once the project is completed students seek alternative employment with another company, and the research comes to a dead end.

4.4 ADVANCEMENT OF RESEARCH ACTIVITY

Students that carry out research while employed at a company are best placed to implement results of research or even take research further to a higher degree. On the contrary, university based students allocated industrial projects prefer take up a new research area for a higher degree, divorced from the previous. Therefore continuity of projects in terms of implementation is dependent on the employment status of the student and the level of support afforded a student during research. In South Africa, research funding is mainly from government and big companies that have in-house research and development divisions. Access to private funds depends on such factors as the reputation of university, expertise of supervisor and consistency of research thrust with company interest.

4.5 POST-GRADUATE RESEARCH

Given a choice, most respondents would rather get a job in industry than take up higher degree research work with university. University research is only considered as the last resort when students have failed to secure
job s. The chances of attracting a fully-fledged engineer from industry to work on research at university are extremely slim. This state of affairs negates the industrial transformation that would require young researchers as foot soldiers. When professors retire, they leave behind an intellectual gap because of the absence of succession plans for continuity. Therefore if the perceptions about further education remain negative, the prospects of sustained university-industry strategic alliance in South Africa are bleak.

4.6 UNIVERSITY-INDUSTRY ALLIANCE

The strategic alliance between universities and industry is mainly linked to student projects. To a lesser extent, industrial liaison meetings organised by universities also built relations between university staff and industrialists. Joint research appears to be more amenable to industry than university consultancy. It is not quite clear whether this is due cost factors or scepticism of industry to sole research by university.

5. DISCUSSION OF RESULTS

Industry is more attuned to university-industry alliance to work on industryinitiated projects rather than laboratory results generated by exclusive university effort. No matter how good they may look, industry may not be ready to replace current practice with laboratory novelty because of the associated uncertainty. Breaking a flask during experimentation in the laboratory is a minor incident. However, blowing up a reactor during trial and error with unproven technology is a costly catastrophe. Industry would not wish to take big risks with commercial production. Thus, strategic alliances appear to be the more favourable model for knowledge or technology transfer from university to industry.

In the German model of technology transfer, the university professors and lecturers would have had a stint in industry prior to joining the university. Consequently they continue with industrial liaison and initiate developmental projects working in collaboration with industry. In South Africa university staff are encouraged to interact with industry, which would make their teaching more practical and research more relevant. However, most university staff never leave the ivory tower of academe.

Research institutions and industry tend to focus on divergent goals. First, cutting edge research pursued by researchers may be far ahead of industrial needs that may only require basic research or routine investigations. Cutting edge research may seem irrelevant to industry in the developing world. Second, ownership of patenting and intellectual property is often a contentious issue. Third, publishing papers in journals and presenting at conferences may conflict with confidentiality of relating to company secrets or what the companies may perceive to be proprietary technical know-how. These different focal points need to be reconciled.

Questions arise therefore on the benefits of advanced research conducted by local universities. Some critics may argue that a developing country with a host of social problems such as poverty, disease and lack of basic needs would be extravagant when it finances ‘rocket science’ research at the backdrop of poverty. However, the counter argument is that basic research alone will not raise the profile of the university on the world stage. Consequently universities are forced to carry out basic research to satisfy local industrial needs while also undertaking hi-tech research to hoist the university banner. South Africa cannot be left behind in scientific advancement by research. Selected centres of research excellence have to be resourced with world class research equipment so as to engage in top research activity. Other institutions can concentrate on teaching and basic research to support local industry.

6. RECOMMENDATIONS

The following recommendations are made from the study:

- Establishing university-industry strategic alliances to promote collaborative research as well as industrial liaison so as ensure relevance of research output and appropriateness of technology transfer
- Raising the profile of university profession to attract young professionals who can succeed the aging university staff
• Encouraging the science park model as a strategy to retain students, particularly for higher degree
graduates around their projects and promote entrepreneurship in university curricula
• Developing a two-tier research system where only a few special centres of excellence can be resourced
for cutting-edge, world-class scientific excellence while others focus on teaching excellence and basic
research for domestic industry
• Designing university rankings based on a two-tier system with distinct performance measures such as;
Tier 1: student throughput, student awards, industry-university projects implemented etc.
Tier 2: Number of publication, patents, international exhibitions and awards
• Expanding the role of technology stations to include intermediate pilot testing mini-plants between
laboratory and production plant
• Advocating for continuing education of industrial staff via programmes such as Merseta in order to close
the educational gap for purposes of facilitating concordance in the university-industry collaborative
research

7. CONCLUSION

The study has exposed several challenges that need to be confronted before the university-industry industry
alliance can be beneficial. South Africa is an emerging economy with a host of elementary problems that
may divert attention from cutting edge research. A scramble for research facilities by all university would
lead to duplication of facilities leading to underutilisation. The government cannot afford such luxury.
Appropriate policies have to be adopted to effectively use resources effectively by establishing centres of
university specialisation; a few for top level research and rest for teaching excellence. Technology transfer
can be a widespread activity teaching universities also focusing on basic research appropriate for local
industry. Adopting the science parks concept, with a touch of entrepreneurship could turn a merely academic
project to a commercial undertaking. Typical success stories include the technology corridors such as Boston’s
Route 128 or Silicon Valley, where developmental funding from private equity have stimulated start-ups based
on university research. If theory be proved right, each of the tripartite stakeholders in the cycle will get a fair
share viz;

1. Government finances research
2. University supports industry
3. Industry declares profits
4. South African Revenue authority gets a portion

8. REFERENCES


A DEVELOPMENT OF INSTRUCTIONAL STRATEGIES AND MATERIALS FOR GREEN MANAGEMENT COURSE

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ABSTRACT

How business firms “Go Green” to make a deliberate attempt to create a sustainable environment has caused attention worldwide. Environmental friendly is to reduce and minimise the risks facing human beings, animals and plants on the earth. Various approaches to reduce carbon footprint overlap have become a major issue of businesses and industries as they produce products and affects services. Different from the traditional view, business firms should not only make profits for owners and stockholders, but also need to observe business ethics and social responsibility according to the concerns of customers, community and government. Today, environmental protection is more emphasised.

Human resources are the most important assets to an organisation. Employees require qualified professional knowledge and skills to work effectively and efficiently. Indeed, management needs a proactive perception of “green” to lead and implement that concept. But is education prepared to educate students to be able to handle “green” related work? According to literature review, a gap remains between schools and workplace on green related competencies and with a lack of well accompanying developed teaching materials for equipping skills required for green related jobs. The purpose of this study was to develop the instructional strategies and materials according to a previous study of green management competencies for colleges and universities to educate students to meet workplace requirements.

The focus group meeting and Fuzzy Delphi Technique were applied to establish green management competencies in a previous study. Eight domains including 38 competencies were validated by experts of focus group meeting. In addition, 13 Fuzzy Delphi Technique experts rated the priority of the 38 competencies, and each was weighting importance. Therefore, researchers developed a series of eight units containing 16 lesson plans of green management competencies integrated into a management course for colleges and universities curricula.

Study results indicated the eight units including 16 lesson plans contained various teaching strategies, classroom activities, cases studies, power points, websites, video programme, and supplemental
materials for green management concepts. Based on the findings, conclusions and recommendations would be made to provide for higher education to educate students and provide a business training programme to equip company employees with green management competencies for further study.

Keyword: green management, sustainable management, instructional strategies and materials, higher education

1. INTRODUCTION

What is “green management”? It is management practice which considers the balance of environmental protection and enterprise benefit. People perceive green management as a combination of environmental protection and business management, as well as helpful meeting with environmental regulations [6]. King indicated enterprises can optimise a production process through green management. Green management has been widely used in several industries such as electric power, manufacturing and high-tech [7]. When improved, environmental protection and competitiveness occur together, win-win opportunities are available through environmental regulation [8]. In fact, some enterprises implement green management for social responsibility; however, many enterprises are forced to do so [9], because enterprises survive by meeting the needs of stakeholders, such as customers, retailers, suppliers and shareholders [10].

It caught enterprises’ attention of a need to be sustainably developed on environment topics [11]. Many enterprises’ awareness of green management increased. Environmental protection problems caused by humans’ economic activities have increased the pressures and demands for implementation of environmental practice [12]. Under these circumstances, enterprises concerns are not only for profitability. Competitive position and future advantages are also important; all should be included in strategies of enterprise [13]. The idea of environmental strategies are important is agreed [14]. People perceive green management as a powerful strategy influencing the enterprises’ performance [8]. To gain competitive advantages, design products to be environmental friendly is a given [15]. As a result, more and more enterprises execute green management either voluntarily or forced because of legislation. Though there are still several reasons to boost green management in enterprises, such as managerial attitude [16] and perception of environmental regulations [14] nonetheless, stakeholders are one of the important pressure to develop proactive environmental activity of firms [17, 18, 19]. Green management has been widely accepted and implemented.

Most organisational skills occur through school education. Therefore, education plays a critical role for preparation of workforce. Worldwide environment has seen a rapid structure change. Curricula and instruction development should be based on industry requirements for green management [20]. Schools increase public awareness and knowledge on environmental issues or problems. In doing so, environment education provides students with the necessary knowledge and skills to make informed decisions and take responsible action for protecting the environment [21]. Therefore, how do schools provide capable green management skills in those equipped for the workplace? It has become a crucial issue in today’s global
competitive business world [22].

The results of this study could be a reference for higher education instruction and businesses/industries corporate training.

2. METHODOLOGY


According to the eight domains and 38 competencies of green management, researchers surveyed related textbooks, journals, magazines, handouts, and websites as resources to develop lesson plans, including suitable teaching strategies and materials. In addition, a focus group meeting with six experts from academia and enterprises relevant to theory and practical experiences of green management served as expert validity. Finally, the lesson plans, teaching strategies, PowerPoint presentations (PPT) and handouts were revised according to experts’ comments at focus group meetings. Systematical instructional strategies and material were developed for green management classes.

3. RESULTS AND DISCUSSIONS

Results indicated eight units including 16 lesson plans contained various teaching strategies, classroom activities, cases studies, power points, websites, video programmes, and supplemental materials for green management concepts (Table 1).

<table>
<thead>
<tr>
<th>Domains/Units</th>
<th>Lessons</th>
<th>Competency Indicators</th>
<th>Defuzzification Value</th>
<th>α=0.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Organization, Management &amp; Managers, Development and Evolution of Management Thoughts</td>
<td>Lesson 1-1</td>
<td>(1) Green policies planning</td>
<td>0.6632</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Green workplace spirit</td>
<td>0.6683</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3) Green morality</td>
<td>0.6157</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lesson 1-2</td>
<td>(4) Corporate responsibility</td>
<td>0.7630</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5) Green persistence</td>
<td>0.6808</td>
<td></td>
</tr>
<tr>
<td>2. Management Environment</td>
<td>Lesson 2-1</td>
<td>(1) Environmental management</td>
<td>0.6771</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Green risk decision making</td>
<td>0.6958</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3) Green law conceptuality</td>
<td>0.7433</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lesson 2-2</td>
<td>(4) Green adaptability</td>
<td>0.6597</td>
<td></td>
</tr>
</tbody>
</table>
### 3. Operation Management

<table>
<thead>
<tr>
<th>Lesson 3-1</th>
<th>(1) Green supply chain management</th>
<th>0.6771</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Green process management</td>
<td>0.7734</td>
</tr>
<tr>
<td></td>
<td>(3) Green technical skills</td>
<td>0.6998</td>
</tr>
<tr>
<td>Lesson 3-2</td>
<td>(4) Green productivity</td>
<td>0.7630</td>
</tr>
<tr>
<td></td>
<td>(5) Green techniques transferability</td>
<td>0.6295</td>
</tr>
</tbody>
</table>

### 4. Marketing Management

<table>
<thead>
<tr>
<th>Lesson 4-1</th>
<th>(1) Green marketing</th>
<th>0.6863</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Green market segmentation</td>
<td>0.6326</td>
</tr>
<tr>
<td>Lesson 4-2</td>
<td>(3) Green product promotion</td>
<td>0.6647</td>
</tr>
<tr>
<td></td>
<td>(4) Green product pricing</td>
<td>0.6265</td>
</tr>
</tbody>
</table>

### 5. Human Resource Management

<table>
<thead>
<tr>
<th>Lesson 5-1</th>
<th>(1) Green talent selection</th>
<th>0.6295</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Green training</td>
<td>0.7630</td>
</tr>
<tr>
<td></td>
<td>(3) Green manpower utilization</td>
<td>0.6403</td>
</tr>
<tr>
<td>Lesson 5-2</td>
<td>(4) Labor-management relations</td>
<td>0.6683</td>
</tr>
<tr>
<td></td>
<td>(5) Green performance appraise</td>
<td>0.7530</td>
</tr>
</tbody>
</table>

### 6. Financial Management

<table>
<thead>
<tr>
<th>Lesson 6-1</th>
<th>(1) Green benefit evaluation</th>
<th>0.6808</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Green disclosure</td>
<td>0.6808</td>
</tr>
<tr>
<td></td>
<td>(3) Full cost evaluation</td>
<td>0.6597</td>
</tr>
<tr>
<td>Lesson 6-2</td>
<td>(4) Green auditing</td>
<td>0.7630</td>
</tr>
<tr>
<td></td>
<td>(5) Environmental control management</td>
<td>0.6597</td>
</tr>
</tbody>
</table>

### 7. Technological Management

<table>
<thead>
<tr>
<th>Lesson 7-1</th>
<th>(1) Green Innovation</th>
<th>0.7530</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Green product commercialization</td>
<td>0.7433</td>
</tr>
<tr>
<td>Lesson 7-2</td>
<td>(3) Green product design</td>
<td>0.7630</td>
</tr>
<tr>
<td></td>
<td>(4) Green knowledge management</td>
<td>0.6482</td>
</tr>
</tbody>
</table>

### 8. Enterprises Globalization and Development

<table>
<thead>
<tr>
<th>Lesson 8-1</th>
<th>(1) Environmental-oriented Value</th>
<th>0.7530</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) International market analysis</td>
<td>0.6683</td>
</tr>
<tr>
<td></td>
<td>(3) Globalized vision</td>
<td>0.7734</td>
</tr>
<tr>
<td>Lesson 8-2</td>
<td>(4) Sustainable development mission</td>
<td>0.7843</td>
</tr>
<tr>
<td></td>
<td>(5) Green concept promotion</td>
<td>0.6998</td>
</tr>
</tbody>
</table>

Each unit contained two lesson plans. Each plan has 50 minutes including two to three green management competencies. The teaching objectives include cognitive domain, affective domain, and psychomotor domain comprising objectives and performance objectives. The teaching activities consisted of three major steps: preparation activities, developmental activities and comprehensive activities. First step: preparation activities covered teacher and students who should prepare before a lesson. The teacher’s part prepared PPT, handouts and facility. Students may need to preview the lesson, do some assignments before or brought along some related information. A second step was developmental activities containing: Motivation, highlight topics and explain content parts. Motivation was an important element at the beginning of each lesson increasing
student interest. Normally, a short video, story, news, case, role-playing, and Q&A were good start to catch student attention; however, they needed to be related to topic. For example, Unit 4, Lesson 4-1, asks students to report the green marketing related news (assignment given in advance) and share their comments. Unit 4, lesson 4-2, plays a green store video: green store touch—“Order furniture” bring “green” to customers, then discussions with students if they are aware of green stores around their environment. If it can be continued applying to the lesson content, it would be a motivation activity. The highlight topics present what main topics would be taught. Then, a major part of each lesson was to explain content and a need to match performance objectives. The last step was comprehensive activity. Before closing the lesson, the content of each lesson was summarised; Q&A, and assignments or tests were frequently used.

Each lesson was designed to integrate green management competencies to content, such as unit 4 (Table 2). All activities were related to performance objectives. It provided ready-to-use teaching materials: PPT (Fig. 1), handouts (Table 3), case study, websites, video programmes and references. The major teaching strategies contained several methods, such as lectures, group discussions, Q&A, braining storming, creative thinking, case studies, e-learning and etc. It depended on the topics and the competencies of green management applied to different lesson. Teaching resources consisted of computer, beamer, whiteboard/blackboard, photos, microphone and etc. The teaching evaluation depended on various formative evaluations, such as Q&As, tests and assignments. Also, it had limited time for each sub-activity. In general, the lesson plans covered green management content teaching plans, strategies, resources, and ready-to-use material.

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Name</td>
<td>4-1 Marketing Management</td>
</tr>
<tr>
<td>Instructor</td>
<td>Jack Wu</td>
</tr>
<tr>
<td>Class</td>
<td>Year 1, Class 1</td>
</tr>
<tr>
<td>Advisor</td>
<td>Ling-Yu Melody Wen</td>
</tr>
<tr>
<td>Number of Students</td>
<td>40 students</td>
</tr>
</tbody>
</table>

3. National Sun Yat-sen University Department of Business Management (2009). National Sun Yat-sen University Department of Business Management. Taipei: Future Career Management Corporation

The four rules--green marketing
Green Life information Web

Students Level and Lesson Introduction: After the teacher explains marketing concepts, the students have a preliminary understanding of marketing, and be able to integrate green concept into marketing content. This unit will introduce the concept of green marketing, to life as a theoretical derivation of examining the implementation of enterprise’s green marketing degree.

Teaching Methods: Lecture, group discussion, Q&A, brain storming

Teaching Resources: Computer, beamer, microphone, PPT, photos, handouts

Green Management Competencies Indictors:
1. Green marketing - The ability to apply green methods (ex. reused paper, e-commerce marketing) to promote the positive image of a firm.
2. Green market segmentation - The ability to identify the potential for green consumers, segment existing green markets, find out what is best for enterprise green product development, and green products of other companies had the ability to differentiate.

<table>
<thead>
<tr>
<th>Teaching Objectives</th>
<th>Unit Objectives</th>
<th>Performance Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Domain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Understanding the meaning of green marketing.</td>
<td>The students are able to</td>
<td>1-1 Explain the definition of green marketing management.</td>
</tr>
<tr>
<td>2. Understanding the meaning of market segmentation.</td>
<td>1-2 Explain four successful elements of a successful green marketing management.</td>
<td></td>
</tr>
<tr>
<td>3. Learning how to identify green products.</td>
<td>1-3 Explain the importance of green marketing.</td>
<td></td>
</tr>
<tr>
<td>4. Gain a deeper experience of life and feelings toward green market.</td>
<td>2-1 Explain meaning of market segmentation.</td>
<td></td>
</tr>
<tr>
<td>5. Explain the importance of green marketing.</td>
<td>2-2 Explain the four methods of green segmentation.</td>
<td></td>
</tr>
<tr>
<td>Psychomotor Domain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affective Domain</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Teaching Activities

<table>
<thead>
<tr>
<th>Perf. Obj.</th>
<th>Teaching Activities</th>
<th>Teaching Methods</th>
<th>Teaching Media</th>
<th>Teaching Evaluation</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Preparation Activities</td>
<td>Teacher: prepares PPT, handouts, and needed facility. Students: prepare green marketing related news.</td>
<td>Lecture Q &amp;A</td>
<td>Microphone</td>
<td>5’</td>
<td></td>
</tr>
<tr>
<td>II. Development Activities</td>
<td>Lectures</td>
<td>Microphone PPT</td>
<td>2’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Motivation</td>
<td>Ask the students to report the green marketing related news (given this assignment in advance) and share their comments.</td>
<td>Lecture</td>
<td>Microphone</td>
<td>2’</td>
<td></td>
</tr>
<tr>
<td>2. Highlight Main Topics :</td>
<td>(1) Describes the purpose and meaning of green marketing management four elements.</td>
<td>Lecture</td>
<td>Microphone</td>
<td>2’</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) Explain the meaning of green market segment and segment method.</td>
<td>Lecture</td>
<td>PPT</td>
<td>2’</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) Lead the students recognize various green marks and understand the meanings of environmental protection marks</td>
<td>Lecture</td>
<td>Handout</td>
<td>9’</td>
<td></td>
</tr>
<tr>
<td>1-1 (1) Describe the meaning of green marketing management: Green marketing is a management process to identify, predict and match to the needs of consumers and society, as well as can bring profits and sustainability.</td>
<td>Lecture</td>
<td>Microphone PPT Handout</td>
<td>Be able to describe the definition of green marketing management</td>
<td>2’</td>
<td></td>
</tr>
<tr>
<td>1-2 (2) Describe the four successful elements of green marketing management</td>
<td>Lecture</td>
<td>Microphone PPT Handout</td>
<td>Be able to describe four successful elements of a successful green marketing management</td>
<td>9’</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Credibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relevance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effective messaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Differentiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 (3) Explain the importance of green marketing</td>
<td>Lecture</td>
<td>Microphone</td>
<td>Be able to</td>
<td>3’</td>
<td></td>
</tr>
</tbody>
</table>
Green marketing values the needs of customers, understand the importance of customers satisfaction, marketing basic idea, but more emphasize the environmental protection.

- Provide Nokia and McDonald as examples to emphasize the importance of green marketing.
  - Nokia: use smaller box to save cost and transportation fee,
  - McDonald: without the golden M mark reduces the napkin’s weight and save more than 100 cargo spaces.

<table>
<thead>
<tr>
<th>Perf. Obj.</th>
<th>Teaching Activities</th>
<th>Teaching Methods</th>
<th>Teaching Media</th>
<th>Teaching Evaluation</th>
<th>Time</th>
</tr>
</thead>
</table>
| 2-1        | (4) Describe the differences between green industry and green products  
  - Green Industry  
    Use green production mechanism reduce the pollution during the production process.  
  - Green products  
    Be able to “recycle, low pollution, save resource”.  
  - Green industry doesn’t produce the green products for sure; Some products are green products, but it doesn’t me it is green enterprises. | Lecture | Microphone PPT Handout | Be able to distinguish the differences green industry from green products | 3’ |
| 2-1        | (5) Explain the meaning of market segmentation:  
  In order to attract customers who really want to buy products with green marks; therefore, product design should have green marks to easily identify and consume, also target market is clear and information is easier to pass to customers. | Lecture | Microphone PPT Handout | Be able to describe the meaning of market segmentation. | 3’ |
| 2-2        | (6) Explain the grades and concepts of green products  
  - First class-- Green Mark  
    There are spontaneous, multiple criteria, the third verification of those plans. Product meets pre-set set of specifications, and through third party inspection permit, the special issue of the mark overall environmental preferability.  
  - The second class--Manufacturers declare the environmental demands  
    Use of recycled materials, recyclable, low pollution energy and other conditions or province, by the product manufacturer, importer, distributor, retailer of the product of self-declared environmental claims and such products have no special mark.  
  - The third class--Environmental declaration  
    The third environmental product declaration is based on pre-set group of parameters, and product life-cycle assessment, after a third-party verification, in product sales, | Lecture | Microphone PPT Handout | Be able to describe the first class of green products | 2’ |

2-1 | Be able to describe the second class of green products | 2’ |

2-2 | Be able to describe the third class of green products | 2’ |
indicating their quantitative environmental information. Finally, integration of green products to be described by the above categories and competitors to differentiate green products.

<table>
<thead>
<tr>
<th>Perf. Obj.</th>
<th>Teaching Activities</th>
<th>Teaching Methods</th>
<th>Teaching Media</th>
<th>Teaching Evaluation</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>(7) Explain the meanings of Green Marks and demo different countries Green Marks.</td>
<td>Lecture</td>
<td>Microphone</td>
<td>Be able to identify various Green Marks</td>
<td>3’</td>
</tr>
<tr>
<td></td>
<td>- Green mark is &quot;low-pollution, recycling, resource saving&quot; products that is a sign.</td>
<td></td>
<td>Photos</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Taiwan's Green Mark: green circle design on behalf of clean, unpolluted earth, green leaves, on behalf of the concept of green consumption, the English name for the &quot;Green Mark&quot;.</td>
<td></td>
<td>Handout</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Shows the national green marks and its three different units issued by the Green Mark.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-1</td>
<td>(8) Group discussion</td>
<td>Group discussion</td>
<td>Microphone</td>
<td>Be able to identify various green marks</td>
<td>10’</td>
</tr>
<tr>
<td></td>
<td>Pick up few objects in the classroom or from students selves, then identify if they are green product and distinguish the green marks.</td>
<td>Brain storming</td>
<td>PPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture</td>
<td>Handout</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### III. Comprehensive Activities

1. **Summary**
   Green marketing management, why enterprises need to promote green market management and green market segmentation.

2. **Assignment**
   Ask the students to survey the same products with and without green market, and compare, analyze the different of the prices.
Table 3: Unit 4 Lesson 4-1 Marketing Management-handouts
1. What is green marketing management?
2. Four methods of a successful green marketing
3. The importance of green marketing
4. The differences between general products and green products
5. A green products and green industry boundaries
6. Why do we need green market segmentation?
7. Green procurement concept
8. Green marks around world

9. Green marks of Taiwan
   (1) Save energy mark:  (2) Green mark:  (3) Save water mark:
3. CONCLUSIONS AND RECOMMENDATIONS

“Green” has become a popular trend worldwide. All industries and schools should face the challenges of environmental protection. How does one maintain a friendly environment and enjoy a green life? Pay more attention to the save the earth? Everyone should have an obligation to do so. Especially, enterprises play a critical role through product and services processes. Businesses/industries “Go Green” need employees to have green management competencies to implement tasks. Therefore, the instructional strategies and materials of green management are required to educate skills through education.

This study has a two-year research background to integrate experts’ theoretical bases and practical experiences to develop systematically instructional strategies and teaching materials into management course for higher education. The eight units with 16 lessons are based on the green management competencies from the Fuzzy Delphi Technique and focus group meeting. The result of this study developed almost 200 pages of lesson plans and handouts. In addition, the PPT, websites, and videos ready-to-use supplemental materials could assist teachers deliver green management concepts into management classes. The contribution of this study was to help individuals become green consumers. It was crucial to promote the Green Mark and carbon labeling systems, encouraging the public to practise green consumption in the aspects of food, clothing, housing, transportation, education, and entertainment. The Green Mark logo and carbon label was intended to help consumers identify products, putting less impact on the environment and human health, thus making these products their first choice (Environmental Protection Administration, R. O. C., 2011). Moreover, an individual could also become green management skilled to do a “Green Job” for enterprises and society. Based on the product life cycle, protection of overall environment and excellent service, individuals were responsible for different organisational function positions and could prevent, limit, reduce, and correct environmental impact toward water, air, and soil to incorporate all solutions and resolve problems related to waste, noise, ecology and generate product and service [24].

This study has developed systematically instructional teaching strategies and materials for green management competencies. Further research could implement the experimental research to verify materials and make further improvements. After that, this study could provide for higher education to educate students
and for business training programmes to equip employees with green management competencies and for further study.

4. REFERENCES


5. ACKNOWLEDGEMENT

The authors would like to express their deepest appreciation and respectful acknowledgement to the expert participants for their time and expertise and to the National Science Committee, Executive Yuan, R. O. C. for providing the funding for the project (NSC99-2511-S-264-001) without whose cooperation this work would not have been possible.
ENGINEERING’S RESPONSIBILITY FOR THE FUTURE OF THE ENVIRONMENT: PLANNING CHINA’S ENERGY FUTURE

HAROLD P. SJURSEN
New York University Polytechnic Institute, New York, NY USA

ABSTRACT

Graduate engineers working in the coal industry in China were asked to consider the environmental impact of China’s energy future from the standpoint of:

- Growing demand
- Economic planning
- The benefits and dangers of new technologies
- Geo-political realities

This discussion addresses the specific role and responsibility of engineers in this complex scenario. The business and technical perspectives will both be considered. It is based upon the results of a graduate seminar taught to 14 mining engineers from the Xi’an coal institute during the summer of 2011.

1. INTRODUCTION

China, due to its geographic situation, political position throughout Asia, international economic influence, growing military capacity and for many other reasons has risen to the top of the global agenda. But perhaps the most important fact that will affect everyone around the world is the extraordinary growth of China as a nation of consumers who want and soon will expect automobiles, air conditioners, fully equipped modern kitchens and many other energy-consuming amenities as a matter of course. Today the per capita consumption of energy in China is about 6.5% of what it is in the United States while the population is about 5 times as large. If in its progress toward modernization China begins to consume at anywhere near the rate of the United States the environmental impact will be beyond imagination. The response to this potential impending disaster, although technological applications and innovations alone will be insufficient, must include the best efforts of engineers. But what does this mean? What aspect of engineering is crucial? Will innovations developed by engineers be the primary way by which they will contribute to the common good? What are the responsibilities of engineers?

This discussion is based upon the views and opinions of a group of Chinese engineers working in the coal mining industry. They are acutely aware of that without careful planning and adjustments to the status quo in their industry water and air pollution and global warming will all increase to unacceptable levels. They also expressed a perhaps naïve hope that China could learn from best practices in the West and thus diminish the environmental problems.

The impact of China’s energy production and consumption is a matter of interest and concern around the globe. The scale of both and the consequent contribution to environmental pollution and global warming make China’s energy policy an international matter. China’s recent rate of economic growth, if it continues, will change its current relatively low per capita energy consumption to a level typical in Western consuming nations such as the United States. The environmentally negative impact of this growth will be especially great due to China’s present (and according to virtually all scenarios) continuing dependence upon coal as the chief source of energy. Coal burning power plants continue to be the dominant source of electrical power in China, and although the expansion of capability in all alternative means of energy production including wind, solar, hydroelectric and nuclear is being aggressively undertaken, it is impossible economically for these to replace coal as the major source. Increased reliance upon other carbon based energy sources might have less environmental impact than coal burning and the expansion of their use in China could contribute to the improvement of air quality due to lower particulate matter, CO and CO₂ and other gasses emissions, but the overall negative impact on global warming still might not be significantly abated.
In China decisions about its energy future will likely have a disproportionate impact on the global environment.

The questions raised here are twofold: 1) Can technical advances ameliorate significantly the potentially devastating environmental impact of China’s growing energy consumption? 2) What economic model can best support the transition from a coal based energy system? These fairly straightforward questions, in the case of China, elicit an *aporia* of circumstances derived from competing traditions, local practices, the enduring impact of an over-managed economy, uneven levels of technical capacity, and the extraordinary opportunity for short-term profit in China’s rapidly expanding new economy. The overall result is that the prospect of a rationally managed system to optimize China’s energy future is daunting and the best efforts of engineers may be lost in the current miasma. In light of this pessimistic outlook the topic to be pursued is: *What are the responsibilities of engineers in China to protect the environment in the midst of modernization and the inevitable great expansion of energy consumption?*

### 2. THE CURRENT STATE OF THE PROBLEM

It is difficult to obtain reliable current statistics of China’s energy production and use, and they are often inconsistent. Simmons (ca 2006) reports China’s consumption in comparison with some other countries. The breakdown of energy sources (calculated on the basis of number of BOE consumed) shows China’s heavy dependence on coal.

To assess the likely future of energy consumption in China one has to project the likely model of development. One might assume that precedent cases of the other Asian “tigers” such as South Korea or Taiwan would be instructive. This sort of prediction, however, is perhaps not warranted, as the analogy between China and South Korea or Taiwan is limited. Cold war politics and the economic benefits of American military spending in the region, as well as geographic compactness, contributed to meteoric rise of those nations. These factors obviously do not apply to China.

Much of the current situation in China is rightly said to be unprecedented, at least in scale. It is the large scale of all things Chinese – inward migration and growth of megacities, for example – that makes the impact of all trends both hard to grasp and worrisome. It is also the case that in a free market context, where there will be winners and losers, that the success of China will create disadvantage elsewhere. This rising tide will not raise all boats. Although the prospect seems unthinkable war cannot be ruled out as a possibility.

When it comes to environmental impact all are either winners or losers and thus the path of China’s development is one of universal concern demanding global cooperation. Since the management of natural resources, the consumption of energy, and the protection of the environment all involve engineering the responsibility of engineers the situation in China becomes a central concern of the global engineering community.

In the United States the National Academy of Engineering has identified what they designate as the “grand challenges” of engineering in the 21st century. Three of the fourteen specifically refer to energy and environment: “Make solar energy economical,” “Provide energy from fusion,” “Develop carbon sequestration methods.” Do these challenges actually point to the responsibilities of engineers in the face of the incipient crisis posed by China’s energy future? What needs to be done by engineers in the next two decades?

We must take account of the current state of energy consumption in light of human needs and aspirations. It is reasonably clear that advances in solar energy technology, however great and however economical, will not in this time frame eliminate our great dependence on carbon-based fuels. The same is obviously true for fusion energy technology. If engineers were to take these approaches as their sole responsibility for China’s and the world’s energy future our problems would not be solved but only increase.
### Comparative Energy Consumption

<table>
<thead>
<tr>
<th>Country</th>
<th>Oil</th>
<th>Natural Gas</th>
<th>Coal</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>Total BOE (Million)</th>
<th>Population</th>
<th>Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHINA</td>
<td>19%</td>
<td>2%</td>
<td>77%</td>
<td>--</td>
<td>2%</td>
<td>4,992</td>
<td>1,190</td>
<td>4.2</td>
</tr>
<tr>
<td>India</td>
<td>32</td>
<td>7</td>
<td>57</td>
<td>1%</td>
<td>3</td>
<td>1,435</td>
<td>900</td>
<td>1.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>59</td>
<td>34</td>
<td>6</td>
<td>N/A</td>
<td>1</td>
<td>438</td>
<td>190</td>
<td>2.3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>55</td>
<td>37</td>
<td>6</td>
<td>N/A</td>
<td>7</td>
<td>187</td>
<td>20</td>
<td>9.4</td>
</tr>
<tr>
<td>Taiwan</td>
<td>52</td>
<td>5</td>
<td>26</td>
<td>12</td>
<td>--</td>
<td>836</td>
<td>44</td>
<td>19.3</td>
</tr>
<tr>
<td>South Korea</td>
<td>60</td>
<td>4</td>
<td>20</td>
<td>N/A</td>
<td>1</td>
<td>405</td>
<td>21</td>
<td>19.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>22</td>
<td>7</td>
<td>4</td>
<td>N/A</td>
<td>--</td>
<td>788</td>
<td>58</td>
<td>13.6</td>
</tr>
<tr>
<td>Japan</td>
<td>57</td>
<td>11</td>
<td>17</td>
<td>13</td>
<td>2</td>
<td>3,304</td>
<td>125</td>
<td>26.4</td>
</tr>
<tr>
<td>United States</td>
<td>40</td>
<td>25</td>
<td>23</td>
<td>8</td>
<td>4</td>
<td>16,425</td>
<td>261</td>
<td>62.9</td>
</tr>
<tr>
<td>TOTAL WORLD</td>
<td>40%</td>
<td>23%</td>
<td>28%</td>
<td>7%</td>
<td>2%</td>
<td>57,527</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The reason for the comparison among these countries is to consider alternative models of development and to raise the question of which, if any, of the Asian models China will follow.

It is noted that China’s dependency on coal is 77% while Japan’s is 17% compared to the United States at 23%. In 2010 China, according to data from the National Bureau of Statistics\(^4\), increased energy consumption by 5.9% as factories increased production to fuel the world’s fastest-growing major economy. Economic growth accelerated to 10.3 percent in 2010, the fastest pace in three years, as industrial production rose, boosting demand for fuel and electricity. Crude oil consumption expanded 12.9 percent last year while power use gained 13.1 percent, according to the bureau.

Natural gas demand rose 18.2 percent and coal consumption gained 5.3 percent, the bureau said. China aims to reduce energy use per unit of GDP by as much as 17 percent in the five years ending 2015, after failing to meet a target to cut consumption by 20 percent in the 2006-to-2010 period.\(^5\)

With these realities in mind, questions posed to a graduate seminar on China’s Energy Future (membership consisted of 14 coal mining engineers from Xi’an) were:

1. In the near and middle term will China reduce significantly its level of dependence on coal as an energy source?
2. When, and at what level, will the per capita consumption of energy stabilize in China?
3. Will clean energy sources (hydroelectric, wind, and solar) have a major impact on levels of pollution in China within the next 20 years?
4. To what extent will technological innovation and efficiency contribute to the improvement of air and water quality in the next 20 years?
5. Are the projections of the central government in the next 5-year plan regarding improvements in air and water quality and the overall reduction in energy consumption realistic? And finally
6. What are the particular responsibilities of engineers in consideration of the above?\(^6\)

The short answers create a level of concern for the global environment that lacks an obvious path to corrections. Briefly, the seminar’s consensus on the above was that coal will be the predominant energy source in China for quite some time to come, and that per capita consumption is likely to continue growing simply because more and more people are getting on the grid. They don’t believe that clean energy sources will have a significant impact because they don’t believe, for a variety of reasons (technical, economic, geographic) that their utilization will be very great. Technology may help if appropriate measures are taken in coal burning electric power plants, which currently are a major source of acid rain in China. There was no consensus on the projections contained in the next 5-year plan – although there was a great deal of skepticism within the group.

There is growing interest in China in developing coal based methane (CBM) resources, which on the one hand would provide a cleaner burning fuel than coal but, on the other, poses many environmental risks to air and especially water quality due to the nature of the extraction process.

The question of the responsibility of engineers to protect the quality of the environment in the future cannot be answered on the level of technical capacity alone. Macro-economic, political, commercial and managerial issues all influence the possible solutions available and engineers will need to be participants on all of these
levels. Our discussion will focus on engineering and business responsibility, bracketing out the macro-economic and political dimensions of the problem.

3. CHINA’S DEPENDENCE ON COAL

In China the challenge of producing enough electrical power to serve its large and rapidly modernizing population and the problems of air and water pollution coincide to a large extent with the issues of the development and utilization of coal. Coal fired electric power plants are the dominant source of electric power in China. It is not feasible to replace existing coal fired power plants with alternatives including nuclear power plants (expensive and take many years to build), hydroelectric (available sites insufficient but ecological impact issues and cost), and wind (areas where wind generators could function to produce a significant amount of power are too distant from the centers of demand to be efficient). If coal fired power plants are to be the predominant source of electricity in China in the foreseeable future, then the fundamental technical questions become:

- How to reduce emissions into the air of CO, CO₂, NOₓ and SO₂ as well as particulate matter?
- How to increase the efficiency of the thermal plant in order to reduce the quantity of coal needed to produce a given amount of electricity?

The first question is addressed to a great extent by the choice of the type of coal burned as bituminous (soft) coal produces more of the undesirable emissions than anthracite (hard) coal does. However, in China the extraction of anthracite, even though new fields have recently been discovered, is limited. The reasons for this fall mostly under the categories of macroeconomics and geopolitics and so will not be addressed here.

The data show both the predominant use of bituminous coal overall and its almost exclusive use in electricity plants. The obvious lowering of emissions and consequent improvement in air quality that would result from major conversion to anthracite could happen as a result of national policy directives, but the political desire to keep the cost of electricity low for consumers (the present rate may be already too low given the actual cost of production) will probably overrule and mandate to switch to anthracite in thermal power plants. There are technical issues that would have to be faced for anthracite extraction to be efficient in China, but these potential engineering tasks are moot given the political-economic situation.

Coal mines in China are located mostly in the North West part of the country as well as inner Mongolia and are often small operations using inefficient or antiquated drilling equipment. This means that the possibility of extracting anthracite is more difficult and costly. The retooling and upgrading of coal mines themselves in China is a first requisite for the improvement of air quality. Not all coal fields can provide anthracite and so it will be necessary to close some mines and explore in new mine fields as well. Efficient drilling equipment capable of extracting the more clean burning hard coal is available, although may require modification for use in specific geological circumstances. Thus the problem in China is the cost of acquisition and the need to adapt some designs that have been used successfully elsewhere (in Europe and the United States, for example).

The transportation of extracted coal creates another environmental stress. Much is transported by truck creating additional carbon emissions and contributing to traffic congestion. The placement of power generating plants near coal mines would help alleviate this aspect of the problem, but the present state of the
electric distribution grid is incompatible with this approach. The construction of a “smart” electric power grid that could service all of China would go a very long way toward improving environmental conditions as well as providing (the primary objective) a consistently reliable supply of electric power throughout the country. This is because a smart grid, in addition to adjusting to variable demands or loads at different times and in various places, with sometimes unpredictable periods of high demand, would also accommodate wide variations in supply, thus making for example wind generated power a feasible source. Since, as mentioned, the regions where wind power could be generated are far from the centers of heavy demand, the transmission lines would have to be exceptionally efficient to prevent excessive loss due to resistance. Such a grid is at best a very long time in the future, however it is imperative that the necessary expansion of electric transmission lines at least be compatible with smart grid technology. As a smart grid is developed incremental benefits will be realized.

3. CARBON EMISSION REDUCTION

Under any circumstances thermal power plants need to be constructed to reduce those gaseous emissions that contribute to acid rain and global warming. China has embarked on a program to reduce greatly carbon based emissions.

China’s growing demand for energy – and its dependence on coal – has seen its carbon emissions increase more than 50% since 2000. One of the most important sources of global carbon dioxide emissions is the combustion of fossil fuels for power generation. Power plants contribute more than 40% of the worldwide anthropogenic CO₂ emissions.

An effective way to control the global warming problem is to reduce carbon dioxide (CO₂) emissions. This can be done by carbon sequestration technology. Carbon Capture and Storage (CCS) is a technology that can capture up to 90% of carbon dioxide (CO₂) emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing CO₂ from entering the atmosphere. Furthermore, the use of CCS with renewable biomass is one of the few carbon abatement technologies that can be used in a 'carbon-negative' mode – actually taking carbon dioxide out of the atmosphere. The CCS chain consists of three parts; capturing the CO₂, transporting the CO₂, and securely storing the CO₂ emissions, in the underground of depleted oil and gas fields or deep saline aquifer formations.

First, capture technologies allow the separation of CO₂ from gases produced in electricity generation and industrial processes by one of the three methods: pre-combustion capture, post-combustion capture and oxyfuel combustion. CO₂ is then transported by pipeline or by ship for safe storage. Millions of tones of CO₂ are already transported annually for commercial purposes by road tanker, ship and pipelines. The U.S. has four decades of experience in transporting CO₂ by pipeline for enhanced oil recovery projects. The CO₂ is then stored in carefully selected geological rock formations that are typically located several kilometers below the earth's surface.

At every point in the CCS chain, from production to storage, industries have at their disposal a variety of process technologies that are well understood and have excellent health and safety records. The commercial deployment of CCS will involve the widespread adoption of these CCS techniques, combined with robust monitoring techniques and government regulation.

4. ACID RAIN

There has been a program to reduce SO₂ emissions from coal based power plants in China that has proved effective. Yet despite the apparent success of this program the problem of acid rain is not addressed. For this reason the effort is now being undertaken to reduce the emission of NO₃ gases.

According to the nitrogen oxide prevention and control technology of thermal power plants, low nitrogen oxide combustion technology should be the first choice of nitrogen oxide control technology in coal-fired power plants. When the nitrogen oxide emission concentration or the total quantity of the emission cannot reach the emission standard after using low nitrogen oxide combustion technology, the denitrification facilities should be equipped. Through the research for the combustion process of nitrogen oxide formation mechanism and control methods, the low nitrogen oxide combustion technology was developed abroad. This technology is mature. The investment and the operation cost are low, and has formed three types including...
low nitrogen oxide burner, air staged combustion technology and fuel staged combustion technology. In “emission standard of air pollutants for thermal power plants”(second drafts), nitrogen oxide emissions will be limited below 100 mg/m. Due to the present construction of coal-fired power plants in the prevention and control of nitrogen oxide has just started, and the complex of flue gas denitrification system, high technology and expensive investment, it is difficult to form our country independent intellectual property rights of the flue gas denitrification technology in short term. At present the nitrogen oxide emission concentration of our country boilers with the advanced low nitrogen oxide combustion devices is about 200 mg/m. For the domestic factories, it requires country coordination to overcome the technical difficulties of the denitrification. The denitrification cannot follow the footsteps of the desulfurization that was imported but not absorbed. The good news is, a few domestic environmental protection enterprises have a certain amount of denitrification ability and technology, and there are some good independent intellectual property rights. Some technologies have been applied. Such as the stereo staged low nitrogen oxide combustion technology that includes vertical air staged combustion, fuel staged combustion and air staged combustion on the horizontal direction. The technology that is specific to China’s coal has reached the international advanced level.

5. THE RESPONSIBILITY OF ENGINEERS

The measures described in these examples require the support of engineers. If engineering comprises four functions, conception, design, implementation and operation (CDIO), then in China the present responsibility of engineers to the environmental crisis being exacerbated by coal burning electric power plants should be focused in the implementation and operational phases. It is simply the case in China that far too often best engineering practices are not being implemented, operational standards are inconsistent and maintenance is irregular and shoddy.

The reasons for poor implementation and operation are many, but largely economic and managerial. Economic, in this case, is not only a matter of macroeconomic policy but also comprises the behavioral science of choice and decision-making. The members of the seminar were on this topic strongly of one voice.

6. SPECIFIC COMMENTS AND VIEWS MADE BY SEMINAR MEMBERS

The students who participated in the seminar were all colleagues in China and shared both experiences and a point of view. Differences of opinion were infrequent and when they did occur were on minor matters. To reprise the questions mentioned above, considering whether China will reduce significantly its level of dependence on coal, there was no debate. In their unanimous view China will continue or pure necessity to coal to fire thermal power-plants as the predominant source for electrical power. Likewise there was no debate about the destructive effect of this dependency, not only because of the factor of air pollution (noxious gasses and particulate matter), greenhouse gas emission, and acid-rain production but also acknowledgement that stress on the environment and infrastructure as a result of the necessity to transport the coal great distances to the power plants had lasting economic and social costs. Contrary to more optimistic studies done in the United States the students in the seminar were united in their belief that the per capita consumption of energy in China is unlikely to stabilize. Partly this pessimism derived from skepticism about the ability to anticipate the future rate of economic growth in China and, they believed -- despite one student’s valiant attempt to do so—the actual impossibility to construct a mathematical model to optimize China’s energy needs in the future. There view was not that China’s growth rate would continue unabated, indeed several anticipated a crash; but because the economic conditions in China are extraordinarily volatile due to diverse factors including inward migration, political change that results in poor future planning, rapidly increasing (in energy heavy sectors such as automobiles) unsustainable consumer demand, etc. The students also argued, due to demographic factors primarily, that clean energy sources (hydroelectric, wind, and solar) will not have a major impact on levels of pollution in China within the next 20 years. There are serious technical problems, especially with wind power, but they believed that with focused government incentives technical problems could be successfully overcome. Questions about innovation, in sharp contrast to what one might expect from European or American students, were thought to be somewhat beside the point. There was a consensus that appropriate and excellent technology had been developed in the United States and Germany and the sensible strategy would be to deploy it in China. In general, however, foreign technology is too expensive for China and so the most hopeful prospect would be
if the Chinese government funded research and development to “adapt” the foreign technology to achieve the quickest results.

China’s five year plans were taken seriously by everyone in the class despite the recognition that they tended to project unattainable changes. However some results have been remarkable achievements and the process is what initiates the commitment of resources.

Sadly the students did not think that engineers could exercise more responsibility given the perverse incentives for rapid expansion and the opportunities for short term financial gain. If a system were devised to insure the appropriate participation of engineers on all issues of environment, safety and health the students were sure that management would be reluctant to carry it out. This reluctance would be aided and abetted by the widespread corruption that exists regarding the enforcement of environmental protection and safety regulations.

7. CONCLUSION

We return to the Academy’s “Grand Challenges” and ask what are the actual challenges, perhaps not always grand, regarding energy production and consumption, and protection of the natural environment, facing engineering in the next two decades. The first order responsibilities may seem mundane as they only minimally involve innovation. Much energy is wasted and frequently the natural environment is degraded due to poor stewardship on the part of managers and engineers. The distinction between managers and engineers should not be overstated. If one takes the CDIO definition of engineering seriously one recognizes that implementation and operation are management tasks that engineers must not eschew. Much of what engineers must do is to make sure that existing standards are maintained and regulations are obeyed.

Beyond that, as we have seen, carbon sequestration techniques need to be improved and put universally into place, particularly in coal burning power plants. Here there is room for technical innovation (corresponding to the create and design elements of engineering). In China, in order to make other modes of electrical generation feasible, the development and deployment of an extensive smart grid is necessary. This development will lead to incremental improvements and permit planning for future development to be more flexible, responsive to concerns for the protection of the natural environment and changing societal needs.

However, these recommendations alone will not make a significant difference to the levels of air and water pollution without improved enforcement of China’s environmental laws and regulatory standards. Of course engineers have a primary responsibility to conduct their professional activities in accordance with these laws and standards, but the current situation in China makes it far too easy for violations to be overlooked. It will take more diligent enforcement on the part of the government. But this alone may not be enough. The costs of environmental protection are high and businesses must, in addition to facing regulatory penalties, be given appropriate incentives to invest in the necessary equipment and technical staff to be able to achieve best practices.


2The barrel of oil equivalent (BOE) is a unit of energy based on the approximate energy released by burning one barrel (42 US gallons or 158.9873 litres) of crude oil.

3www.engineeringchallenges.org/cms/challenges.aspx

4www.stats.gov.cn/english/

5Bloomberg News - Feb 27, 2011

6Many of the judgments rendered in this discussion reflect the professional opinions of the members of the seminar. Since the purpose of this paper is to consider the professional responsibilities of engineers, rather than to resolve details of a scientific or technical nature, these opinions in those cases where there was a clear consensus among the members of the seminar, are not questioned or further documented.


EXPLORATION AND PRACTICE OF CHINESE UNIVERSITIES’ INNOVATION EDUCATION

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ABSTRACT

This paper, based on a comparison with foreign countries, focuses on innovative education and points out the main factors hampering the development of Chinese innovative education. Seen from By using the experiences of innovative education models of foreign universities, this paper concludes innovative education to be an inevitable requirement for the development of higher education in Chinese. It also discusses basic measures in open education, a concept of innovative education, innovative assembling of teaching staff, and an innovative of curriculum system and education theory.

Key words: innovative education; university development; exploration and practice

1. INTRODUCTION

Innovation is a concept processes bearing the characteristics of fresh ideas, inventions and clear description. It originated from Latin with three meanings: 1) renewal; 2) invention of new things; 3) change. Innovation was mankind’s unique cognitive power and practical ability. It was also an advanced manifestation of human initiative and an inexhaustible motive force for a progressive social development. During educational reform at the turn of the 21st century, universities globally put the fostering of innovative skills as a main goal. China began its innovative education in 1992. In the past 20 years of reform and development, it had taken a solid step in innovative education. But compared with others, chinese innovative education remained in the exploration and practice.

2. MAIN FACTORS RESTRAINING CHINESE UNIVERSITIES’ INNOVATIVE EDUCATION

2.1. RELATIVE LAG OF INNOVATIVE CONCEPT AND EDUCATIONAL SYSTEM

Chinese educational ideas, systems and structures lagged behind the times; The problem was becoming more and more serious. The late 18th century, some European countries challenged old educational ideas and systems. Rapidly college education changed from: “when we left university, many students had little idea what real learning meant.” Universities developed rapidly directly promoting the development of science, technology and a human society. The golden period of higher education in China began at the end of the 20th century. It developed quickly in number and scale, but politics and economy overshadow pure education. It left a remarkable “mark of time” on Chinese innovative educational system. The system ignored fostering a creative sense. Undue emphasis on the proportion of the graduates admitted to higher level learning made the competition tougher. This not only affected the all-round student development and, limited their personality development. The concept of Chinese innovative education became popular in 1999. “Education should provide knowledge and skills for all aspects of innovation”. Innovation of education was a basis for the
innovation of theory, system and technology. The key to leap-forward development in higher education depended on its own innovation. Facing a knowledge economy, we need to take bigger steps in educational ideas and systems to adapt to the development of modern society.

2.2. GOVERNMENT’S BUDGET INSUFFICIENT FOR EDUCATION

The natural budget was an indispensible to and development of education. But compared with other countries, the amount designated did not meet needs for the annual increase failed to keep up. According to research by scholars, the greater increase in educational investment appeared in 1960-1975. The world average rose from 3.6% to 5.5%, 3.7% to 6.5% in developed countries and 2.3% to 3.5% in developing countries. Compared with others with per capita GDP of $3 000, the proportion of Chinese public educational expenditure of GDP is far below that of South Korea, Malaysia, Thailand, South Africa, Poland, Mexico, Hungary, Czech and Brazil. In general, educational expenditure exceeded 4% in countries with per capita GDP of $3 000. China’s per capita GDP amounted to $3 300 in 2008, but its educational expenditure was only 3.32%, in some countries with lower incomes is 4% in 2004. China remains 4%.

2.3. DESIRE FOR QUICK RETURNS IN REFORM OF HIGHER EDUCATION

The prevailing setback for higher educational reform was a lack of vigour. The primary cause was profit. Universities roughly maximise profits by minimising expenditure and energy. Good skills fostering mechanism was a gradual process, which requiring all social members, especially staff to participate. It was a goal every educator should pursue. Innovative education, to some extent, was nature of human. Just as Maslow said, “It is very possible that innovation is something inherited, which has something common and universal and it can be definitely found in all healthy children.” And Engel once pointed out, “Under the condition that all people work with reasonable division of labour, they not only make mass production to satisfy the abundant consumption of all social members and to make sufficient reserves, but also let everyone have adequate time to experience all valuable things from the culture which history has left--science, art, way of communication and so on. Besides, they should change these from something processed only by the ruling class to the common heritage of the society and further develop them.” That is to say, educational innovation should become a total conscious activity of everyone. In fact, however it is not the case. Seen from the aspect of university development, educational system mechanism was imperfect; lacking vigour and efficiency educational reform remained superficial. It was difficult to meet the student need of innovative development. This was out of step with social demand and the Graduates were not those who were “needed” by employers. The goal for universities was to increase the employment rate and ignore the student need for individual development. Seen from the students, side teaching section for them was often difficult to be well carried out their innovative practice lacked effective check and evaluation. There was no effective incentive or regulation mechanism for innovative education. Besides, because of laziness, there was limited improvement in students’ sense of innovation or innovative ability.
3. INNOVATIVE EDUCATION AN INEVITABLE REQUIREMENT FOR UNIVERSITIES’ DEVELOPMENT

3.1. INNOVATIVE EDUCATION IS THE OBJECTIVE REQUIREMENT FOR CHINA’S CONTEMPORARY EDUCATION DEVELOPMENT

Many facts indicated development of technology and education decided and sustained development of future economy, the growth of wealth, the prosperity of society and people’s welfare. Frazer says looking into the 21st century, science and technology still decided the advancement of society unless a global catastrophe occurs. [8] Taking a panoramic view of practice and research concerning innovative education home and abroad, our notices innovative education had been promoted to a stage of “surely talk, surely change, and surely do”. [9] In developed countries, some mature models of innovative education such as Williams’ creation and emotion model, Guilford’s structure of intellect model, Osborn’s creative thinking, Tyler’s competence model and Davis’ AUTA model, from which require reading on for they bear features of standardisation, exploration, practicality, individuality and persistent learning. [10] Countries globally are making great efforts in innovative education; likewise, China’s education was undergoing further reform. “To accelerate the construction of high level universities, especially, the world-famous high level research universities called on speeding scientific and technological innovation and building a national innovative system.” [11] Thus educational innovation had become a main task in building a country with strong human resources. Educating high quality skills through innovative spirit and ability was placed in a more prominent position. [12] documented both by the 2010 national education working conference and China’s Outline of the National Program for Long and Medium-term Innovation and Development, hence implementing innovative education and constantly promoting quality education has become a main direction of educational reform.

3.2. INNOVATIVE EDUCATION A WAY OF SOLVING MAIN PROBLEMS OF RESTRICTIVE UNIVERSITIES’ DEVELOPMENT

In China, scientific development, a frequently mentioned concept, had become through politics a “hot term” in people’s life. During the scientific development movement, it had been found the most prominent problem restricting universities’ development to be insufficient innovation. The system lacked an incentive motive; inadequate funding restricted development of innovation; the lack of teaching staff had led to insufficient innovation; disciplines were not conducive to student innovation development or cultivation; scientific research power could not be efficiently integrated, research findings nor timely turned into productivity. [13] To solve these and other problems hinged on innovation. Innovative education could improve reforming the old management ideas, system, decision-making and mechanism, resulting in establishing a new efficient mechanism of innovative management corresponding with cultivating innovative skills. Innovative education could stimulate students’ initiative, creating a good innovative education environment. Innovative education can stimulate students study initiative and creativity, and was beneficial to educating high quality innovative talents. Innovative education could make a university seek opportunities, grasp opportunities, and make use of opportunities, thus pushing its university development both in innovative in academic and technologic research.

3.3. INNOVATIVE EDUCATION HELPS PROMOTE’ COMPREHENSIVE STRENGTH

Today, the rapid progress of science and technology and an ever-changing society, all trade make higher
demands on an employee’s innovative ability. For a country facing a constantly changing world, more and more various skills were needed ready for global challenges and its opportunities. Therefore, for education, it was an essential task to educate large numbers of innovative skills geared to development. Neil Rudenstine, former president of Harvard University, pointed out “in the process of heading into a new century, a best education is to help people have innovation, to make people be good at thinking, full of ideals and insight, perfect and successful.” [14] If a student wanted to meet the needs of the society and enjoy a position in a complex and challenging society, book knowledge was not enough. A student, based on specialty study, try to promote innovative ability, possibly an efficient way of realising social value. Innovation made all the difference between success and failure in the development of everything and the cultivation level of innovative skills marked the comprehensive strength of a university.

4. CONSTRUCT IN CHINESE UNIVERSITIES’ INNOVATIVE EDUCATION IN THE NEW ERA

4.1. OPEN EDUCATION

It was important for innovative education in Chinese Colleges and Universities to lead the general trend world education and adjust to the situation the country. The university could then carry forward their advantages and features, and also absorb and learn from advanced world cultures and global achievements. To absorb and learn from outstanding human civilization and achievements, create a brand-new chapter of Chinese education; [15] to strengthen the international exchanges in education and to refer to the outstanding achievements of education development in the world is an inevitable choice for innovative education in our country. [16] For most colleges and universities, each subject to various constraints, open education, either hierarchically or quantitatively, was at a lower level, which is confined to participation in some academic conferences, mutual visits once a year, signed co-operation agreement or memorandum and so on. There was rarely co-operation, exchanges, learning or references in the true sense. In order to promote the development of innovative education in different countries and share in the results of the progress of human civilization, China needed to break the old concept of open education, strengthen international co-operation among colleges and universities and broaden international perspective so that China could move forward.

4.2. INNOVATIVE EDUCATION CONCEPT

The key to innovation lay in skills, while their development relied on education. And it was colleges and universities that carries the burden of skills training. Through educational activities, students were enabled to participate, practice, think, explore and create actively. Students’ potential to innovate was thus inspired their innovative ideas elicited, thereby innovation of social knowledge, technology and institution could be promoted. [17] In this sense, innovation of education concepts in colleges and universities took a leading role in promoting improvement in human culture and civilisation. Therefore, colleges and universities should strive to stand in the forefront of times for innovation. Instead of being regarded simply as organising students to participate in innovative competitions and skills competitions, innovative education should be treated as one of the core elements of quality education and take its rightful position in higher education. Only with advanced concepts, thorough understanding, and scientific orientation, could colleges and universities solve problems in innovative education, both in theory and practice. Innovative education could thus serve the purpose of promoting students’ comprehensive and co-ordinated development, foster students’ innovative spirits and developed them personality traits.
4.3. INNOVATIVE DEVELOPMENT OF TEACHING FACULTY

There would be no first-class innovative skills without a first-class innovative teaching faculty. An innovative teaching faculty was one of the important factors for the development of an innovation-and-research-oriented university. Colleges and universities had adopted all forms of strategies in faculty building with little success. The main causes were: Firstly, it was difficult to introduce high-level skills and disciplined leaders it was even more difficult to dismiss poor teachers, which placed an excessively heavy burden on colleges and universities. Secondly, it was difficult to meet the requirements of teacher trading. In China, there was a series of course training requirements for secondary school teachers, but none for university lecturers. Today, because of a lack of professional training, many young lecturers were at educational low level resulting in a poor quality of teaching. It is known through this survey, the vast majority of young teachers require in-work training to upgrade their qualifications at academic level and quality, but restricted by a variety of factors, this need was difficult to meet at many universities.

Thirdly, there was no sound, efficient mechanism to share high-level human resources. To solve the problems, the following measures might be taken: Actively learn from the experience of advanced countries and establish long-term personnel training and introduction mechanisms pay special attention to team-building and establish an innovation teams, with a discipline leader and competent teachers. Thirdly, create a sound environment for innovative teachers, while fourth, mobilise resources, giving full play to top teaching and researching resources, both inside and from outside universities.

4.4. CONSTRUCTION OF AN INNOVATIVE CURRICULAR SYSTEM

An innovative curricular system was the basis for the development of the innovative skills. Starting several courses was not enough in construction of the system. More important was that the innovative idea should be executed throughout the entire educational process. The new curricular system should be based on developing professional qualities, cultivate students’ comprehensive abilities, focus on innovative spirit and practical abilities, break the traditional disciplinary system, establish ability-oriented educational concepts, spread new knowledge, and construct a system emphasising basic theory and innovative abilities, while enhancing practical techniques and comprehensive qualities. Basic theory should include the common theory and specialised theory. Emphasising basic theory required to improving teaching quality and levels of basic courses so that students, with specialised, broad and profound theory, had more capability for development. Emphasising innovative ability demanded correct positioning in skills training, constructing an integrated practice system of specialised course experiment, curricular planning, internship, social practice and graduation projects to strengthen students’ awareness of innovation and practical abilities, and cultivating an innovative awareness by decreasing theory teaching hours and increasing practical hours. Enhancing practical techniques needed to focus on improving students’ application abilities, reform practical teaching system, increase the proportion of practical work in curricula. What had to be emphasised was enhancing practical techniques did not refer to students’ proficiency in some skills, but their proficiency to apply it. It called not only for a practical curricular system to cover all key contents of a theoretical course system, but construction of an education system to meet demands for innovative skills, enterprising spirit and practical ability. What’s more, other aspects had to be taken into consideration, such as systematic, comprehensive training on practical techniques in classes, extra-curricular self-teaching open experiments, and integration of intramural development training on professional qualities and internship so that practical courses was emphasised to cultivate students’ abilities in raising questions, analysing questions, and resolving questions. Enhancing comprehensive qualities demanded construction of the quality development
system, standardisation of the quality development for overall development of the students’ qualities, \(^{[21]}\) and paying attention to the role of humanity education in shaping students’ healthy personality and the enlightenment of scientific spirits on students’ innovative spirits.

4.5. THEORETICAL RESEARCH ON INNOVATIVE EDUCATION

Theoretical research on innovation was important in developing innovative education. In the early 21st century, many theories were proposed. However, most only expounded on how to set up an innovative education idea, or how to change and break the traditional education concept to establish an education with innovative idea. Therefore, those theories “overemphasised speculation on the innovative education theory, lacked a profound analysis and research on how to establish the innovative education environment and system.” \(^{[22]}\) Innovative education, hence, was an exploration, and the universities, to take a lead, should work at the following aspects:

4.5.1. Discovering serious problems in innovative education.

Such as the rigid objectives, immature modes, overemphasis on specialised knowledge in the curriculum, irrational utilisation of modern teaching techniques, lack of an innovative culture environment and the imperfect guarantee system for an innovative education system.

4.5.2. Enhancing research on innovative education in developed countries.

Innovative education began earlier in developed countries and a comparatively complete system has been formed. Therefore, Chinese specialised research institutes and laboratories should be established to make systematic research on the innovative education system in developed countries.

4.5.3. Exploring the innovative education mode suitable for the individual university, and constructing the innovative education system.

Each university, with its own schooling characteristics and dominant disciplines and specialties, should integrate the innovative idea into curricula, cultivate students’ innovative and discovery abilities, establish a platform for students to demonstrate innovation and creativity, adopt an effective policy to motivate innovation and strengthen the construction of a guarantee system so that a complete innovative system was established.

Innovative education covered many fields. It had rich content, important significance and far-reaching influence. However, the ideas in this paper require further research.

5. CONCLUSIONS

From what has been discussed, it could be concluded innovation, as always, was the drive to push civilization and the development of human society, in which the key element was skills, needless to say, the essential approach to the harvesting of skills was education. Thus, universities and colleges should pay more attention to fostering innovative talents as they reflected how well a university was and was also the lifeblood of a university in today’s severe academic competition. In innovative education, a university should possess not only a group of innovative teachers, but also had a setup of innovative courses going through the
entire education period. Meanwhile, it was significant to study innovative theory which could play a positive role in guiding development of innovative education. Furthermore, in innovative education a university should give full attention to both its strengths and features. Above all, it was important for university to update education ideas, seeking to adopt advanced techniques and learn from achievement of other universities both in China and abroad especially in innovative education. Last but not least, it was necessary to point out innovative education was a systematical project requiring all society participate.

6. REFERENCES


[5] Data from website of “Educational Survey” by Economic Cooperation and Development Organization and Website of UNESCO.


A NEW “5E+3C” EDUCATION PATTERN OF INNOVATIVE AND APPLIED TALENTS

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ABSTRACT

While educating students majoring in gemology and material technique, Geosciences Experimental Teaching Centre at Shijiazhuang University of Economics has installed a series of measures to improve talent training. It has formed an education pattern of innovative and applied entrepreneurship in the context of quality education, while strengthening construction of discipline, curricula, laboratories and professors.

This education pattern was named “5E+3C”. “5E” and referred to five student qualities which were targeted. The first E stands for the “Engine”, meaning a motivation of a student like a motor “Engine” providing inner driving force. Without it, students cannot make spontaneous efforts in learning. The second E represents “Essential”, indicating a necessary basic knowledge and theory students should master. Without them, students cannot get anywhere. The third E refers to “Exercise”, interpreted as operating abilities, namely, basic skills. The fourth E expresses “Exploration”, the spirit of tracing, research and “Exploration”, including a strong sense of curiosity. The last E stresses “Entrepreneurship”, which refers to quality of entrepreneurship, business planning and implementation the enterprise quality. “3C” meaning one should provide students with three kinds of teaching resources and services. The first C is short for “Condition”. Students require intensive learning and correct teaching conditions which meant highly qualified teachers, excellent textbooks, well-equipped laboratories and mature practice bases. The second C is the short for “Chance”. Students needed opportunities to take full advantage of conditions. The third C means “Conduct”. Students needed scientific, rational and efficient guidance.

In the new education pattern of “5E+3C” for training innovative and applied talents, students were the most important stage in the links of the “5E” education, while teaching administrative offices and teachers were the main service suppliers in “3C”. The cultivation of students’ “5E” was the education goal and the provision of “3C” the basis of achieving that goal. If both educators and the educated clearly understood their positions and tasks, positively interacted with one another and were well-coordinated, the training of innovative and applied talents would succeed.

Keywords: innovative and applied talents, education pattern, gemology and material technique, 5E+3C

1. INTRODUCTION

With dedicated effort, Shijiazhuang University of Economics had achieved remarkable results from innovative talent training. Since 1999, it had outstanding achievements in various competitions for
cultivating student innovative spirit and ability. The awards were: Since the first “Cup of Challenge” for National College Students' Innovative Undertaking Contest, our students have accumulatively won two National Silver Awards, 10 National Bronze Awards, and 12 Provincial Special Awards. Since the fifth “Cup of Challenge” for National College Students' Science and Academic Works Contest, students had accumulatively won three National Bronze Awards, four Provincial Special Awards, ten Provincial First Prizes. Since 2002, we’ve won five National First Prizes, fourteen National Second Prizes, twenty-four Provincial First Prizes, and twenty-one Second Prizes in China Undergraduate Mathematical Contest in Modeling. With the effective development of innovative education, students’ overall quality has been greatly enhanced. Moreover, the rate of student employment significantly improved.

Geosciences Experimental Teaching Centre at Shijiazhuang University of Economics strengthened its experimental teaching platform, teacher teams, experimental teaching materials and laboratory teaching resources [1]. Such positive steps were made for the passing on of innovative and applied skills. In 2008, the Geosciences Experimental Teaching Centre was designed as a national laboratory teaching demonstration centre, by China’s Ministry of Finance and Ministry of Education.

In the cultivation of innovative skills, it is strongly believed even with excellent teaching conditions and related education, only a few achieved the goal of innovative skills most students reached only final Qualification. Therefore, to ensure more innovative and applied skills was an urgent problem. Faced with this task the university we put forward the new “5E+3C” education pattern in the context of quality education [2].

General Secretary Hu Jintao pointed out at a National Education Working Conference, “adhering to people-oriented policy and implementing education for all-round development is the strategic theme of education reform and development. It’s also the requirement of fully carrying out the education principles of the Party. The core is to resolve the problems of what kind of person should be educated and how to educate. The focus points are as follows: face all students, promote the students to be overall, improve the students’ social sense of serving country and people, initiative spirit dared to explore, and problem solving practicing skills. ” [3]

A new education pattern of innovative and applied talents from the teaching practice in the context of quality education was formed paying attention to training students in political consciousness, in building character in humanities and scientific exploration, in physical and mental health, in professional knowledge and skills, in communication and co-ordination skills, in competency of organisation management and in pioneering and innovative spirit [4]. The emphasis was on encouraging all students to be all-rounder. The objective was training innovative and applied skills.

2. THE “5E+3C” NEW EDUCATION PATTERN

In the “5E+3C” new education pattern, “5E” refers to five qualities of the students which we target at in our education.

The first “E” stands for “Engine”, the motivation of a student like a motor “Engine” providing inner driving force. The educated required an inner driving force for pushing them forward towards a training objective. Even good study conditions and excellent work cannot achieve ideal effect without inner
motivation. Students required to be imbued with charming personalities, encouraging the educated through a positive way of life, warm them with careful consideration yet guide them with rigorous scholarship. Plus, cultivate internal drives necessary for students to become innovative and applied talents should be cultivated. The internal drives include ideal, virtue, social and family conscience, a desire for success, hobbies, etc. In the process of training inner drives, pointing out the correct direction of development for students was vital. In such cases, the geosciences experimental teaching centre had played a positive role in training innovative skills. The Geosciences Museum and laboratories invited scholars and successful entrepreneurs to lecture and to carry out field practice to train students’ pioneering spirit. This aroused student enthusiasm towards learning and fostered them with a sense of responsibility towards family and their nation, encouraging them to have high ideals and learn successful adults.

For the second E “Essential” which indicated the necessary basic knowledge and theories students should master, attention needed to be paid to the teaching of basic knowledge and theory, whatever the skills training. Teaching of basic knowledge and theory might diminish, but was indispensable. Without this process, student would lack a firm base. The teaching of basic knowledge and theory was completed mainly of theoretical classroom teaching but experimental teaching also played a vital role. Students were asked to preview and review necessary knowledge and theories before they entered experimental courses. Before the experimental step, teachers inspected student reviews of closely-related theory base and previews of the contents of experimental teaching. Employing modern teaching meant, students were asked to do complete theory tests based on a series of experimental teachings before entering open experimental courses in the Geosciences Experimental Center. If they passed they were allowed to the next step. Otherwise, they were asked to to try again. Possessing a solid foundation of basic knowledge and theory offered a firm footing of improvement and development for further study, research and innovation.

The third E “Exercise” was interpreted as operating ability, namely, basic practical skills. Primary practical training was the employment and operation of all types of experimental conditions. Fundamental experiments were “Essential”. Students needed to master experimental methods and should be familiar with the operation of different instruments. The training of complex design was more important. Students needed to learn to face more complicated specific problems, how to choose corresponding experimental projects and design related schemes and select various experiment methods, instruments and equipment. They should learn to carry out experiments by themselves. Therefore, the geosciences experimental center attached great importance to arranging basic experiments and comprehensive design experiment scientifically and reasonably so students were equipped with solid fundamental skills. On this basis, they were able to develop experiments for further research and innovation.

The fourth E “Exploration” meant the spirits of tracing, research and “Exploration”, including a strong sense of curiosity. Without a spirit of “Exploration”, innovation was dormant. In the education of innovative skills, educators needed to pay attention to the cultivation of pursuing spirit. Curiosity, doubt, investigation and trying one’s utmost to solve a problem would lead to new discoveries, inventions and creations. But students required to be equipped with scientific attitudes, advanced methods and innovative ways to make experimental research possible. So various methods such as science projects, enterprising contests, scientific works competitions for students, graduation projects and graduation theses actively and positively directed students to develop innovative experiments. The training of a exploring spirit included the comprehensive cultivation of pursuing interests, courage, thinking and methods. The Geosciences Experimental Center encouraged the students to begin their research and develop a spirit of exploration for innovative experiments.
More and better innovative experiments were the key in the cultivation of innovative talents.

The last E stressed Entrepreneurship, which referred to the quality of entrepreneurship, business planning and implementation, that is, an enterprise quality. Unesco headquarters pointed out emphatically in Framework for priority action for change and development of higher education [5] in 1988 that at the institutional level, developing entrepreneurial skills and initiative should become a major concern of higher education, in order to facilitate employability of graduates who will increasingly be required not only to be job-seekers but to become job-creators. The first formal response of Chinese higher education should be The education development action plan in 21st century [6] in January, 1999. Here enterprise education and encouraging establishing high-tech enterprises was emphasised. It is said geologists have the spirit of arduous effort enterprise in a broader sense. Establishing scientific or technological enterprises or serving in geological departments or relevant industries all belong to enterprise of geosciences skills. Any type of endeavor means to have and develop. Enterprise education in this university includes four levels.

- The first is to cultivate enterprise awareness and enthusiasm, which belongs to a stage of enlightening awareness,
- A second is to cultivate student enterprise in theories and knowledge
- A third is to train students’ enterprise ability, and
- A fourth is train students’ enterprise skills.

The Geosciences experimental Center actively participates in and assists enterprise education initiated and organised by the Students Affairs Department and The League Committee at this university. We top class conditions and opportunities for students’ enterprise activities and are supported by excellent technical and intellectual support.

In the “5E+3C” education pattern “3C” stands for providing students with three kinds of teaching resources and services.

The first C is Condition. Students require good teaching conditions, especially in the experimental field. The training of “5E” requires the support of teaching conditions, especially experimental teaching conditions. Laboratory construction (including laboratory equipment, specimen, model, environmental facilities, management systems, software platform of information technology, etc.) has proven a base for experimental teaching. Excellent experimental materials, courseware, text books, reports, etc. are vital. Enthusiasm, commitment, experiences and top qualifications are fundamental for experimental teaching. To provide students better facilities, laboratory equipment continuous to be improved instruments and equipments also provided the effective management and maintenance. Efforts has been made to improve the quality supported by government and this university. The experimental teaching center actively employs high-level teachers, experts and scholars in many ways to become full-time, part-time or adjunct faculty. All of these provide excellent innovative and applied skills training.

The second C Chance means providing students with opportunities to take full advantage of conditions, especially experimental teaching conditions. Top conditions are not enough to guarantee the effect of innovative and applied skills training. More time is spent on experimental teaching to improve students' internal drives, basic theories, fundamental skills and spirit of “Exploration”. Students are provided with various activities to train their exploring spirit and enterprising qualities, such as science projects, enterprising contests, scientific works competitions, graduation projects and graduation theses plus other forms of entrepreneurial activities.
The third C **Conduct** means providing students with scientific, rational and efficient guidance. With good experimental teaching conditions and good opportunities, training of innovative and applied talents was almost ready. The one piece of the jigsaw was effective guidance. It was the key for successful “**5E**” training. Experimental teaching was just the scientific, rational and efficient guidance for the “**5E**” training. High quality experimental teaching was the scientific, rational and efficient guidance from highly skilled teachers to students. Rational organisation and exact guidance of experimental practice and effective management of relating processes was imperative.

In the “**5E+3C**” students were the subjected to the links of the “**5E**” education. While speaking of “**3C**”, the subjects were the university, academic departments (including our centre), and teachers. “**5E**” was the objective of education; “**3C**” the basis of realisation of the objective. If educators and the educated clearly understood their positions and tasks, positively interacted with and were well-co-ordinated, the training of innovative and applied talents would achieve better results.

### 3. THE EFFECT OF “**5E+3C**” EDUCATION PATTERN

For the past eight years, the new educational pattern of “**5E+3C**” was explored with students majoring in gemology and material technique, satisfactory and effective progress was obtained. From 2007, the graduate employment rate statistics were 100%. Except for entering Peking University, University of Geosciences (Wuhan), University of Geosciences (Beijing), Zhongshan University, Beijing University of Technology, Chinese Academy of Sciences and other units for further study, they play an important role at the National Gemstone Testing Centers, and other testing center in Guangdong, Zhejiang, Fujian, Jiangxi, Yunnan, Sichuan, Tianjin, Hebei, Henan, Heilongjiang, Liaoning, Xinjiang and other provinces. They also played a leading role in CTF, Colorful Yunnan, Cloud Mining, Zhou Dasheng, Ryan and other famous jewellery companies, and in the Great Wall College of University of Geosciences and other educational and training institutions. The graduates received high praise from employers. Postgraduate rates were 23.08% in 2009, 22.81% in 2010 and 21.70% in 2011.

Teachers and students appreciate the new education pattern of “**5E+3C**”. They see clearly objectives and tasks of education and teaching. They realize what was important, what they worked towards, and what remained be done also to interact in improved.

### 4. CONCLUSION

The pattern of “**5E+3C**” was a valuable “Exploration” of education and teaching, “**5E**” (**Engine**, **Essential**, **Exercise**, **Exploration** and **Entrepreneurship**) referred to five student qualities which targeted. “**3C**” (**Condition**, **Chance** and **Conduct**) meant that providing students with three kinds of teaching resources and services.

In future, training model would be constantly refined in content and implementation. In return it would continuously improve the quality of education. Greater efforts and contribution for China's geology and mineral industry and the cultivation of innovative- applied talents in its related industries would be made.
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ON THE PRACTICE TEACHING CONTENT BASED ON PROFESSIONAL FEATURES

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ABSTRACT

Based on analysing the importance of practical teaching in modern higher education, this undervalues to demonstrate at the University level. Practical and academic bases are recommended to be introduced creating a potential employment market, realising the educational modes combining of producing, studying and researching and cultivating the student ability to adjust to the society. At last, the proposed practice base construction modes are part of government policy for, projects to create a win-win situation for industry, universities and students.

Keywords: institutions of higher learning; professional features; practice base; model

1. INTRODUCTION

In China, college students' poor practical ability, teachers' lack of engineering backgrounds and, academic bias restrict development of outstanding engineering skills. Excellent engineer education and training programmes are part of reform project to implement the Outline of China's National Plan for Medium and Long-Term Education Reform and Development (2010-20) and the National Medium- and Long-term Talent Development Plan (2010-2020), It is a major initiative to advance China from an extensive, but largely academic engineering education Nation to a powerful hands-on engineering education country. Through research into creating a professional practice base, this paper discusses the enhancement of students' practical abilities and an increase training in opportunities. Instruction is also recommended for promoting higher education training personnel to meet the social needs and to improve the standards.

2. THE IMPORTANCE OF PRACTICE TEACHING IN HIGHER EDUCATION

2.1 THE IMPORTANT WAY TO PUT THEORY INTO PRACTICE

Compared with classroom teaching, practice of teaching emphasises more on knowledge application and an ability to carry out project fulfilments. Internship was an important integrated teaching procedure to enable students to strengthen professional and perceptual knowledge and enhance innovative ability. Book knowledge, indirect experience, and direct perceptual recognition could be merged through practical teaching. This was especially important for fostering applicative skills. Therefore, teaching arrangement and course setup had be focus on strengthening practical methods and of training, enabling graduates to master fundamental culture and professional technical theory. They also needed strong professional application capabilities, practical skills and a higher overall structured. As was an important part of professional training, more practical approach was vital. Time should be set aside to ensure success. It should use the entire programme. In cultivating the rules of professional technical education should also be followed. From
general to specific, from single to integrated, and students should be enabled to gradually master a professional practical skills each job require plus comprehensive practical ability and quality each profession require.

2.2 IMPETUS OF ENHANCING THE QUALITY AND LEVEL OF GRADUATES' EMPLOYMENT

The employment of graduates from undergraduate colleges was under dual pressure from key universities and higher vocational colleges. High employment pressure often causes college students a greater psychological burden, some even mental disorders, which affected normal study, life long-term growth development becoming a factor to hinder normal society. Many enterprises however had difficulty in recruiting; moreover, finding employees prepared for the long term was difficult. This illustrated the between training and the job market’s personnel needs. To adjust to strengthening of practical teaching, was an urgent task. At undergraduate colleges, job orientation training was mainly aimed to satisfy enterprises' random. Hence, the establishment of an off-campus practical base provided a professional training place for cultivating application-type talents adaptable to the needs of the economy and employers. It would be a platform for enlarging student employment opportunities.

2.3 BUILDING THEORY AND PRACTICAL UNIFIED TEACHING VISION

Most of today’s university and colleges have upgraded from vocational colleges. To meet increased of enrollment scale, younger teachers some masters, doctors and undergraduates have become an integral part of teaching staff. In terms of scientific research and teaching reform, regular universities lag behind key universities. To survive, regular universities need to strengthen practical teaching. In this area younger teachers could strengthen practical skills and enhance personal use of theory. Through connecting with skilled technicians, teacher could recognise and participate in business operations. Practical experience allows teachers to abilities and become specialist teachers.

3. PROBLEMS OF PRACTICAL BASE CONSTRUCTION AT UNIVERSITIES

To cultivate student proficiency, universities have employed various measures to strengthen practical teaching, but problems abound

3.1 LACK OF SCIENTIFIC PLANS AND ACCURATE POSITIONING

Accurate positioning of education determined healthy and sustainable development. Similarly, whether practical base is scientifically planned determined whether if could become useful for training students’ in practical skills. Universities should consider training goals characteristics and the graduates’ employment areas and potential industry entry points. Students would in such internship be able to understand and appreciate the nature of future jobs, as a basis to adapt to all spheres of society.

3.2 LACK OF EXPENSE GUARANTEE

Off-campus practical base construction required considerable financial support to ensure they became an important platform for students to acquire practical skills. But government investment does not always increase proportionally with the expansion of education. Universities spend considerably on
infrastructure to maintain correct basics. Only after evaluation and inspection are the funds sometimes put into practical base construction. The funds are insufficient to most regular universities, resulting in no sustainable guarantee. Practical experience and content cannot be ensured so goals of developing students’ skills are unrealised.

3.3 LACK OF TWO-WAY COMMUNICATION

According to various surveys, most university practical bases can meet only the demand of students understanding superficial production and business processes. Many practical bases (enterprises) consider student internship a burden. Some students lack enthusiasm in the face for it monotonous content. Universities should offer valuable technical services to help enterprises solve technical problems in business management and operation and provide an opportunity for professional technical personnel to take refresher courses at university, to realise the communication between practical bases and enterprises, thus guaranteeing the stabilisation.

4. SPECIAL PRACTICE BASE CONSTRUCTION DETERMINED BY THE GOAL OF INTERNSHIP

4.1 THE NECESSITY OF ESTABLISHING A POTENTIAL JOB MARKET

Different universities have differing training targets and specifications which makes each employment field and region unique to universities. Through building practical base, universities and enterprises can set up closer co-operative relationships and widen employment channels. But universities make potential employment markets or resources on-going. Through comprehensive observation of students in internships, enterprises realize which theoretical knowledge, practical skill, individual tutelage and communication skill qualities employees should possess. Invisibly, universities and graduates have grasped the priority of employment specialisation. Facing fierce competition in the job market, universities should cultivate not only professional talents society needed, but also graduates’ employment opportunities. Professional practical bases would help in all respects.

4.2 THE POSSIBILITY OF INDUSTRY-LEARNING-RESEARCH EDUCATION MODE

Universities, enjoy the advantage of creative management and technical innovation. The development direction of a modern university is to integrate production, teaching and research. Universities co-operate with various enterprises in integrating industry, learning and research, which bring universities and enterprises closer and also promote an enterprises' healthy development. The advantages for universities and enterprises can be connected fully through integration of production, teaching and research. However, the effect of production-learning-research integration advocated for many years is limited, for there a good co-operation platform is missing. An off-campus practical base of professional features provides such an opportunity, where the industry-learning-research education mode plays an important role in teaching reform and enhancing college students’ synthetic abilities. The practical base is a effective route to cultivating students abilities. When this base is well built, the relationship is better understood; further co-operation between universities and enterprises becomes likely. Hence, according to market demand, universities strengthen their professional teaching; the industry- teaching- research makes a further step to promote employment.
4.3 CULTIVATING UNIVERSITY STUDENTS' SOCIAL ADAPATION ABILITIES

In essence, every enterprise pursues profit. It is hoped that every employee will create bring the greatest benefit. But many are unwilling to spend time waiting for employees mature. Therefore, enterprises do not want new graduates as they lack working experience and social skills. Graduates who have been educated in those areas are obviously more welcome. Establishing practical bases is a bridge to make students and enterprises mutually more acceptable.

Internship is a must for graduates in employment. It enhances university students to become more competent. Practical bases are important areas to cultivate students’ practical skills and innovation ideas and also to forge liases to make students connect with society. A practical base lies solid platform for students switching their professional knowledge quickly into a practically operational ability. Establishing professional practical bases was to lead students to carry out activities based on that professional knowledge background and employment as fundamental goal. It made up effectively students’ lack of professional knowledge and enhanced their professional skills and what they could offer industry.

5. APPROACHES TO THE CONSTRUCTION OF PROFESSIONAL PRACTICAL BASES

5.1 THE MODE OF GOVERNMENT’S PUSH

China’s social economical system determines government played a leading role in professional practical base construction. State-owned enterprises or state-controlled enterprises were important to China’s economic development. On one hand government could encourage and support enterprises to establish bases through financial allocation or tax incentives; to encourage lead enterprises and universities to establish bases, promote technology innovation and innovation and to widen channels to exercise student practical skills. Moreover, government could use mainstream media influence to make enterprises understand it was a social responsibility to offer students’ practical opportunities and create employment. Government needed to change public opinion on the importance of college students’ practical work. To motivate enterprises to build professional technology practical bases, government should supervise and monitor the enterprises. Through government incentives many such bases, should, based on modern theory, be built and developed.

5.2 THE MODE OF PROJECT ORIENTATION

The traditional concept that the practical base was only the place for students’ to receive internship chances should be abandoned. A modern concept of establishing professional practical bases should take its place. Projected technological service should be seen as a platform to promote co-operation between universities and enterprises. Under this mode, obligations and rights between enterprises and universities would be determined by projects according respectively to enterprises’ technological requirements and the universities’ technological resources, wherein the students’ internship would be involved. Universities might interact effectively with enterprises through such a mode of co-operation.

5.3 WIN- WIN CO-OPERATION

Using students in a practical exposure is a burden. To ensure companies accepted students’ for the long term and became real practical bases, universities should decide how to help enterprises create benefits.
Universities can make full use of their own resources, and provide services. For example, universities could study business management problems and operations alongside technical personnel; universities could also make use of faculty forces to provide employee technical training or other short-term courses.

Universities could also ensure students took part in some of the enterprises’ business operations. Then, the depth and range of academic expertise will be broadened. Students could learn more about industry information and adjust the learning direction. Students’ practical skills could be strengthened to achieve the skills’ training goals. The mode of win-win cooperation should base itself upon a combination of enterprises and teaching practice services to meet both. It would be mutually rewarding enterprises and universities.

6. CONCLUSION

Mainstream universities should cultivate application-oriented skills, being those enterprises seek. The professional practical base was an indispensable place to cultivate application-orientation skills. Only when professional practical bases are well constructed and fully utilized, might universities cultivate skills required by society.

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INNOVATION AND TECHNOLOGY
DEVELOPMENT OF SMALL, MEDIUM AND MICRO-ENTERPRISES IN SOUTH AFRICA THROUGH BUSINESS INCUBATORS

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ABSTRACT

This paper investigates the role that universities could play in supporting business incubators in South Africa. The study was done at a time that South Africa was experiencing immense challenges in identifying opportunities for creating employment. In the first quarter of 2011, the rate of unemployment rose to 25%. Despite the financial support in the form of business management training, consultancy services, and provision of infrastructure, 75% of new small, medium and micro enterprises (SMMEs) fail prematurely after a short period of existence. The present study first looked at the business incubator initiatives in Brazil, China and India as benchmarks. In these countries business incubators have become the nexus points where the industrial world interfaces with the academia. Business incubators are pivotal in spawning the SMMEs in all sectors of the economy, in both rural and urban settings invariably leading to beneficial outcomes such as job creation, technological innovation, skills development and a broad spectrum of goods and services. Business incubation promotes economic development in two ways; first, in business development associated with direct production and second, in the human development index. Business incubators also help diversify economy by broadening tax base. Business incubation can be initiated at establishments such as governmental organizations, local government communities, universities, research institutions and private consortiums. The present work is a desk study that investigates the intervention of South African universities in support of technology-based incubators. The current role of universities in supporting the business sector is determined with focus on business planning, technological innovation and training on essential business disciplines such as legal matters, accounting and financial management, marketing and information technology. The paper recommends the underlying critical success factors for university-linked business incubation. These include emphasis on the customer-driven business ethos where demand pull overrides product push. The universities being the repository of technological know-how should proactively generate business ideas for many unemployed university leavers rather than merely react to infrequent calls of a few budding entrepreneurs.

Keywords: Business incubators, small and medium enterprises, employment creation, universities, South Africa.

1. INTRODUCTION

Small, medium and micro enterprises (SMMEs) are increasingly seen as playing an important role in the economies of many countries [1]. Governments throughout the world focus on the development of the SMME sector to achieve economic growth, contribute to job creation, alleviate poverty, increase competition, exploit niche markets and diffuse technology. In South Africa, SMMEs contribute 56% of private sector employment and 36% of the gross domestic product [1]. South Africa’s unemployment rate stands at 25% [2]. New SMMEs are seen as a significant component to South Africa’s development thrust. Ironically start-ups struggle due to lack of knowledge and skills. They require support with financing, access to suppliers, advertising, as well as finding premises and competent staff [3]. Since the attainment of independence stakeholders have come up with a number of SMME support initiatives and the South African government introduced the following pieces of legislation:

- the National Small Business act of 1996 that opened the way for the Department of Trade and Industry to address SMME development in South Africa;
- the Skills Development Act (SDA) of 1998 that sought to enhance the skills levels of employees by providing a framework for training to take place within the workplace;
• the skills Development Levy Act (SDLA) of 1999 that provided a means to fund training at workplace; 
and
• the National Qualifications Framework Act (NQF) of 2008 that provided a national framework for 
education and training in South Africa [4].

In addition to these instruments 85% of the government spending on goods and services was directed to 
SMMEs, thereby cushioning them against competition from large retailers [3].

The government also supports SMMEs through Ntsika Enterprise Promotion Agency and Khula Enterprises 
Finance Limited. Ntsika Enterprise Promotion Agency provides non-financial services to SMMEs whilst 
Khula Enterprises Finance Limited provides financial support.

Other role players that augment government effort in supporting SMMEs are NGOs, local business service 
centres (LBSCs), community based organisations (CBOs), foreign donor agencies and tertiary institutions 
[4]. These role players enhance entrepreneurship in SMMEs through business skills training, technical skills 
training and entrepreneurial skills training [4].

With the above instruments and infrastructure in place, a decrease in unemployment rate, a more equitable 
income distribution, increased globalisation, and a stimulated economy was expected [3]. Surprisingly, the 
impact has not been significant. In the first two years of starting SMME failure rate in South Africa is at 75% 
and this is one of the highest in the world.

This work is a desk study that analyses business incubator models in Brazil, China and India. Lessons learnt 
from these countries are then drawn for South Africa to integrate into its SMME support initiatives.

2. RESEARCH OBJECTIVE

In view of the challenges the South African economy is facing in creating and supporting employment, this 
study has the following objectives.
• To investigate the extent to which the concept of business incubation is embraced in South Africa.
• To compare South African business incubation model against models in Brazil China and India.
• To investigate the role of South African universities in setting up and supporting business incubators.
• To identify areas for improvement in the South African business incubation model.

SMMEs are discussed in the context of the definition provided by the National Small Business Amendment 
Act Number 26 of 2003. This act defines SMMEs based on the number of paid employees, turnover and 
asset value. Table 1 gives the act’s definition of SMMEs.
<table>
<thead>
<tr>
<th>Industry</th>
<th>Asset</th>
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<th>Full-time Employees</th>
<th>Turnover</th>
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<td>Retail and Motor Trade and Repair</td>
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<tr>
<td>Wholesale trade, Commercial Agents</td>
<td>R10m</td>
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Transport, Storage and Communications  
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3. LITERATURE REVIEW

Business incubation is a concept that was originally developed in the USA and is regarded as a cost effective way of promoting innovation and creating sustainable entrepreneurial ventures [6]. In its generic sense, the term incubator is often used to describe an organisation that, in one way or another, helps entrepreneurs develop their ideas from inception through commercialisation [6]. Services offered by incubators are both tangible and intangible. Tangible services include physical work-space, shared office facilities such as secretarial services and business equipment. Intangible services are in the form of in-house consultancy, mentorship, marketing, business planning, legal services and accounting [7]. Business incubators support emerging businesses in their early, most vulnerable stages. They promote new firm growth, technology transfer, economic development and diversification [6]. As such the incubators constitute a source of new innovation and growth for an industry, encouraging the emergence of new technologies, entrepreneurship and the creation of new jobs. This focused help to selected early stage companies also increases the chances of survival of SMMEs three to four-fold when compared to those starting outside an incubator [8].
3.1 GENERIC MODELS OF BUSINESS INCUBATORS

According to Chandra, business incubators come in many forms and they fit into the following three types:

- **Technology incubator:** has a university affiliation along with a focus on a specialised technology that coincides with the area of expertise at the university;
- **Traditional/Community-based incubator:** is supported by the state and local development agencies as well as by local chambers of commerce; and
- **Private/Corporate incubator:** initiated by private companies that would like to grow businesses related to their specific technology needs [7].

Despite the differences, all incubators should have tenants within their walls. If an “incubator” has no tenants within its walls, it then loses the defining features of an incubator. It becomes a traditional small business development centre [6].

3.2 SPONSORS OF INCUBATOR FACILITIES

Sponsors of incubator facilities are quite diverse and their objectives often differ.

Private sector corporations and investor groups are primarily interested in property development, transferring and commercialization of technology and investing in opportunities identified in tenant firms.

Public sector sponsors are primarily interested in job creation, poverty alleviation, regional development, equity and economic diversification.

Education sector organisations such as universities and vocational-technical schools have a thrust on empowerment of students through training and establishment of commercial outlets for research outputs.

3.3 REQUIREMENTS FOR SUCCESSFUL INCUBATION

Akcomak identified seven key characteristics of a successful business incubator [9]. It should:

- Have clear objectives;
- Have clear selection, entry and exit criteria for tenants;
- Have qualified managers, preferably with business management experience;
- Monitor and assess tenants to see whether they are on the right track and are meeting targets. The assessment could focus on employment, sales, growth, financial position, or innovativeness;
- Have a set of tangible and intangible services that it provides to tenants;
- Assist tenants to network. This is helpful where there is no likelihood of tenants copying or stealing ideas from each other;
- Have the capacity to sustain its operations. In as much as tenants are expected to be self supporting, incubators are also expected to be self supporting.

4. RESEARCH METHODOLOGY

This is a desk study of publications on SMME support through business incubators. Drawing on the experiences of Brazil, China and India, the paper recommends the critical factors that South Africa can adopt in order to have a successful business incubation programme.

5. COUNTRY CASES

Brazil, China and India were chosen because they belong to the same economic grouping as South Africa, i.e. BRICS. China and Brazil together host more than 1000 incubators and are ranked third and fourth respectively (in terms of the numbers of incubators) following the US and Germany [9].
5.1 INCUBATORS IN BRAZIL

Incubators in Brazil are a product of the Triple Helix Model, i.e. an interaction of the government, the industry and universities. The research institutions and universities are a source of knowledge for the tenants. The government, non-governmental agents, private companies and the federation of industries provide funding.

The first incubator in Brazil was established in 1986 and within 10 years there were 40 incubators [9]. In 2003 the number had increased to 200 incubators. The thrust of incubators was shaped by local needs. Their objectives were to commercialize technology, diversify regional economies, foster entrepreneurship, alleviate poverty and generate employment.

The sectors supported were computer software, services, electronics, biotechnology and chemistry, mechanics, and food processing. Some incubators fostered entrepreneurship in cultural activities such as music, art, sculpture, photography and cinema industry [7]. According to Akcomak most incubators were located in a university or a research institute and more than 80% of the tenants were spin-offs from academia [9]. Universities promoted the idea of incubation until incubators were accepted as a tool for promoting entrepreneurship. Other institutions that supported the incubation industry are the Service for Support to Micro and Small Business (SEBRAE) and the Brazilian Association of Business Incubators and Science Parks (ANPROTEC). ANPROTEC was founded in 1987 and is among the strongest incubator/park associations the world over. Moreover there is the National Incubation Support Program (PNI) that organizes forums where incubators share information, experience and expertise.

The combined effort of the above stakeholders has led to the continual growth of incubators in Brazil. In 2009 the number had increased to 400 incubators [9].

5.2 INCUBATORS IN CHINA

The first incubator in China was established in the late 1980s. In the first ten years, China had 100 incubators and the number increased to 500 in 2007. The number of people employed then stood at 600,000 [7]. Incubators in China are bigger than in other countries and they on average house 60 to 70 enterprises [9].

Chinese incubators tend to be more monolithic and technology-focused. The government heavily subsidizes incubator construction as well as incubator operations and is involved in operational decisions of the incubator. Government involvement negatively impacts the incubators’ market orientation and entrepreneurial proclivity. They do not make risky investment in their client firms [11]. The country has two categories of incubators, i.e. the state owned enterprise (SOE) incubators and the returned Chinese student incubator [7].

A SOE incubator is housed in and supported by the parent SOE. It creates new technologies for and absorbs redundant workers from the parent company [7].

Returned Chinese student incubators were set up to attract Chinese scholars and students in diaspora. The focus of these incubators is to grow and sustain high-tech businesses.

Incubators in China focus more on providing tangible support, i.e. office space, office equipment, laboratory space and equipment and conference rooms.

5.3 INCUBATORS IN INDIA

The business incubator movement in India took off in the late 1980s as a complementary policy tool aiming at promoting entrepreneurship and stimulating new venture creation. The three pilot business incubators were financed by the United Nations through the UN Fund for Science and Technology [9]. In 2009 there were 78 incubators in India [12]. Today, full-fledged incubators have been established at the Indian Institutes of Technology in New Delhi, Mumbai and Chennai. At Hyderabad, the government of India’s Materials
Research Centre has initiated the Advanced Materials Technology Business Incubator (AMTBI) on its campus. AMTBI assists entrepreneurs commercialise materials technology research into advanced products for local and international markets [8].

In addition, India has more than 17 Science and technology parks that are located at Universities. They are sponsored by the Government through the Department of Science and Technology. They also make a contribution in building the capacity of SMMEs. Above all India has a very large pool of young and well qualified technical manpower. The qualified manpower presents an ideal case for knowledge based industry.

The industry sectors supported by the incubators in India are Bio-technology, pharmaceuticals, health, information technology, electronics and communication, textiles, chemical, design, agriculture, rural technology, composite materials development and welding.

6. RESEARCH FINDINGS

Business incubators are also a feature of the South African business environment. Presently there are 29 business incubators initiated by SEDA and they support entrepreneurs in sectors as diverse as small scale mining, furniture, jewelry, construction, bio-fuel processing, information and communication technology, base metal processing, stainless steel processing and floriculture.

The government through the Small Enterprise Development Agency (SEDA) provides the infrastructure and financial support required by the incubators. Table 2 gives details of the SEDA sponsored incubators.

South African universities that participate in supporting Business incubators are:
1. Tshwane University of Technology works with Softstart and SEDA Automotive Development Centre (SATEC). In SATEC Tshwane University of Technology works jointly with CSIR enterprise development centre, and the Automotive Industry Development Centre in supporting small businesses in the automotive sector.
2. Nelson Mandela Metropolitan University works with CHEMIN, a SEDA incubator in the chemical industry.
3. Nelson Mandela Metropolitan University, University of Stellenbosch and the University of British Columbia jointly support Furntech develop skills in the furniture industry.
4. Central University of Technology collaborates with SEDA Agricultural and Mining Tooling Incubator (SAMTI) in Free State. The incubator helps tenants with design of tools; licensing, management of intellectual property, general management training; and entrepreneurial skills development.

<table>
<thead>
<tr>
<th>Business Incubator</th>
<th>Sector</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemin</td>
<td>Chemistry Industry</td>
<td>Port Elizabeth</td>
</tr>
<tr>
<td>Downstream Aluminium Centre of Tech</td>
<td>Aluminium fabrication and casting</td>
<td>Richards Bay</td>
</tr>
<tr>
<td>SEDA Nelson Mandela Bay Incubator</td>
<td>Information and communication Tech</td>
<td>Port Elizabeth</td>
</tr>
<tr>
<td>Egoli Biotechnology Incubator</td>
<td>Bio and Life Sciences</td>
<td>Modderfontein</td>
</tr>
<tr>
<td>Furntech- Cape Town (Head Office)</td>
<td>Furniture Industry</td>
<td>Cape Town</td>
</tr>
<tr>
<td>Furntech-George Cape</td>
<td>Furniture Industry</td>
<td>George-Eastern</td>
</tr>
<tr>
<td>Furntech-White River</td>
<td>Furniture Industry</td>
<td>White River</td>
</tr>
<tr>
<td>Furntech-Umzimkhulu</td>
<td>Furniture Industry</td>
<td>Umzimkhulu (KZN)</td>
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<tr>
<td>Furntech-Durban</td>
<td>Furniture Industry</td>
<td>Durban</td>
</tr>
</tbody>
</table>
Table 3: Combined Impact of SEDA Initiated Incubators. [14]

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</thead>
<tbody>
<tr>
<td>SMMEs Established</td>
<td>1010</td>
<td>224</td>
<td>126</td>
<td>98</td>
<td>52</td>
<td>82</td>
<td>428</td>
</tr>
<tr>
<td>SMMEs Supported</td>
<td>1900</td>
<td>456</td>
<td>128</td>
<td>42</td>
<td>103</td>
<td>159</td>
<td>1012</td>
</tr>
<tr>
<td>Clients Supported</td>
<td>3931</td>
<td>789</td>
<td>608</td>
<td>42</td>
<td>197</td>
<td>280</td>
<td>2015</td>
</tr>
<tr>
<td>PDI Supported</td>
<td>81%</td>
<td>87%</td>
<td>82%</td>
<td>94%</td>
<td>60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women Supported</td>
<td>36%</td>
<td>37%</td>
<td>41%</td>
<td>33%</td>
<td>325</td>
<td></td>
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</tr>
<tr>
<td>Direct Jobs Created</td>
<td>4462</td>
<td>1318</td>
<td>1026</td>
<td>40</td>
<td>266</td>
<td>1812</td>
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<tr>
<td>Direct plus Indirect Jobs Created</td>
<td>21322</td>
<td>10628</td>
<td>6115</td>
<td>124</td>
<td>824</td>
<td>711</td>
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<tr>
<td>Turnover of SMMEs (R million)</td>
<td>R416</td>
<td>R129</td>
<td>R105</td>
<td>R21</td>
<td>R51</td>
<td>R110</td>
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</table>

In Brazil incubators are a product of the Triple Helix Model, i.e. the universities, industry and government work closely together in building and supporting incubators. Universities and research institutions act as sources of knowledge for the incubated companies, whilst the government and private companies provide funding. This joint effort has seen a rapid growth of incubators. Currently Brazil has the fourth highest number of incubators in the world, after USA, Germany and China.
6.1 PARTICIPATION OF SOUTH AFRICAN UNIVERSITIES

This study identified three universities that assist SEDA initiated incubators, and these are:

- University of Stellenbosch – in partnership with Furntech and the University of British Columbia it developed a furniture design training programme. The first programme was run in August 2010.
- University of Pretoria Business Incubator is a satellite incubator of softstart business technology incubator. It supports and promotes pre-startup phase entrepreneurs who wish to start information and communication technologies related ventures.
- Nelson Mandela Metropolitan University in George – enhances technical skills development programme in Furntech.

The majority of the universities have Technology Stations on campus. These stations were established through collaborations with the Technology Innovation agency.

In addition to the Technology Stations, Technology Innovation Agency jointly set up institutes for advanced tooling with three local universities. The mandate of these institutes is given in Table 5.

7. CONCLUSIONS

From the study done on the incubator industries in China, India, Brazil and South Africa the following conclusions were arrived at:

1. The business incubator industry gives meaningful benefits to the country when the following players are involved:
   - Government support that facilitates venture creation and business infrastructure;
   - Universities that provide innovation support;
   - Private sector partnership for mentoring and marketing
   - Professional networking, national and global;
   The triple helix model explains why Brazil attained the world number three position in the incubator industry.

2. There is no one standard incubator model that countries can adopt. What dictates a model that a country adopts are the economic, developmental and social needs of a country. Brazil adopted the triple helix model where the government, industry and universities work closely in giving support to the incubators. In China and South Africa the government encompasses the incubator. In India, the incubator model is a product of the close partnership between the government, universities and research institutions. The models adopted by the four countries explain why these countries have different achievements in the incubator industry. Brazil seems to have succeeded more than South Africa and India because of its all encompassing model.

3. Business incubators are indeed a means of creating employment. China in a 20 year period managed to generate 600 000 jobs from 500 incubators. South Africa created 4462 jobs between 2004 and 2010. Similarly, incubators in Brazil supported 1200 enterprises between 1986 to 2003. People employed then were 5000. These figures justify why business incubators are seen as a potential avenue for employment creation.

4. Literature on countries researched on, did not exhaust all the performance measures associated with business incubators. There is a lot of room to explore measures associated with enterprises and employment created, growth in the company assets, sales turnover and exports, corporate and personal taxes generated, survival rates of ventures incubated, the technologies commercialized and revenues earned by patents and licensing, and the number of graduating firms and their outputs. This analysis could start with an individual incubator, then develop to cover provincial and national level.

5. Though challenging, other outcomes that could be studied are social benefits such as raised level of public consciousness for small enterprise development, enhanced image of the community as pro-entrepreneurship, skills enhancement, attitudinal changes and increased self-esteem.
8. RECOMMENDATIONS – THE WAY FORWARD

With the increasing challenge of unemployment, South Africa needs to embark on programmes that create and sustain jobs. A strategy to improve employment creation in South Africa is summed up by the following recommendations:

1. According to Akcomak most incubators in Brazil were located in universities and research institutes and more than 80% of the tenants were spin-offs from academia [9]. South African universities need to be equally active in promoting entrepreneurship among local SMMEs.

2. In Brazil, the thrust of incubators is shaped by local needs. Depending on need, the incubators focus on poverty alleviation, job creation, or technology transfer. Other incubators have a thrust on entrepreneurship in cultural activities such as music, art, sculpture, photography and cinema industry [7]. In South Africa, SEDA tends to over invest in one sector, for example, it set up seven incubators in furniture industry and four in construction industry. Not much has been done in the clothing and textile industry. This is one sector that desperately needs an intervention. Many jobs have been lost due to competition from China and India.

3. In Brazil, incubators are a product of the Triple Helix Model, i.e. a joint effort of the central government, academic institutions and industry. This has given rise to more than 400 incubators in a period of 25 years. Comparable results could be achieved in South Africa if the three parties were to jointly work on building business incubators.

4. In Brazil incubators have forums where they share experiences and expertise. Such networking forums are very handy to SMMEs. They give SMMEs a platform to learn from each other.

5. From the late 1980s to 2007, China managed to set up more than 500 incubators. Chinese technocrats returning from diaspora played a significant role in building up of these incubators. South African technocrats living and working abroad could also be enticed to make similar contributions.

9. REFERENCE


INNOVATIVE FAST TIME SIMULATION TECHNOLOGY - A NEW COMPETITIVE ELEMENT IN MARITIME EDUCATION

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ABSTRACT

A fast time simulation tool box with complex dynamic models and to display a ship track immediately for an intended or actual rudder or engine manoeuvre was developed to simulate a ships motion. This Simulation Augmented Manoeuvring Design and Monitoring (Sammon) tool box allow for

- A new design for a manoeuvring plan as enhancement of the traditional point planning and,
- Unmatched monitoring of ship handling processes to follow any underlying manoeuvring plan.

During a manoeuvring process any plan may be constantly displayed allowing for a ship’s motion and indicating a predicted future track. Based on input from a ship computer’s data.

The paper investigated the feasibility and user acceptance of the new concept. Navigation display layout was introduced and selected results of simulation studies are discussed which cover testing the influence on manoeuvring performance dependent on different types of functions. This Dynamic Simulation Tool was intended be used on board active vessels, but also as an effective tool for training mariners in ship handling simulators. A trainee could immediately see the result of rudder, engine or thruster commands. Examples were given for results from test trails in a ship handling simulator at the Maritime Simulation Centre Warnemuende at Wismar University, Dept. of Maritime Studies Warnemuende (http://www.sf.hs-wismar.de/mscw.html?&L=1).

The project was an excellent example in demonstrating how universities might use technology to become more competitive in this field. The results of the on-going research were used to found a new start-up company. It is shown, therefore, in this paper the implications of entrepreneurship and innovation in business and engineering education.

1. INTRODUCTION

Manoeuvring ships is a human-centred process. The vital elements in this process are humans’ decisions plus the technical equipment to support these tasks (see Figure 1). However, most of the work is manual, as even today little automotive support is available for complex manoeuvres. Normally ship officers steer based only on a mental model of ship motion characteristics. This mental model was developed during specific training in ship handling simulators and most importantly during practice at sea.

Ship Handling Simulation has a proved highly effective for a Master Mariner’s qualification. But it is based on real time simulation, i.e. 1s calculation time by computer represents 1s manoeuvring time as in the real world. This means in spite of the all advantages of real voyage simulations, collecting manoeuvring experience remains a time-consuming process. Up to now there has been no electronic tool to design one effective manoeuvring. Even in briefing procedures for ship handling training in potential manoeuvres had to be explained, then drafted or described through sketches and further short explanation.

For increasing training effectiveness and importantly the safety and efficiency in manoeuvring ships, the Fast Time Simulation method will be used in future – even on standard computers it simulates in 1sec of computing time for manoeuvres lasting up to about 20min, using innovative simulation methods. This allows for substantial support during both training and live manoeuvring processes at sea.
In Figure 2 comparison was given for essential elements of live manoeuvring processes at sea, also training with/on the ship handling simulators. Additionally, in the right-hand column some Fast Time Simulation (FTS) tools are indicated plus their roles to support each element of the manoeuvring process are indicated by Fast Time Simulation (FTS) tools: These were initiated in research activities at the Maritime Simulation Centre Warnemunde of at the Dept. of Maritime Studies of Hochschule Wismar and developed further by the start-up company Innovative Ship Simulation and Maritime Systems (ISSIMS GmbH).

A brief overview was given on the modules for the FTS tools and its potential application:

- **Sammon** is the brand name for an innovative system for “Simulation Augmented Manoeuvring – Design, Monitoring & Control.” It consisted of four software modules for manoeuvring design & planning, monitoring, multiple dynamic prediction & control and simulation & trial.
  - It is applicable in maritime education and training to support lectures on ship handling to simplify demonstration and explanation of manoeuvring technology details. More specifically it helps prepare manoeuvring training in a SHS environment i.e. for developing manoeuvring plans in briefing sessions, to support manoeuvring during an exercise run, to help in debriefing sessions for analysis in replays and discussions of quick demonstration of alternative manoeuvres;
  - for the application on-board to assist manoeuvring of ships e.g. to prepare manoeuvring plans for challenging harbour approaches with complex manoeuvres up to final berthing/unberthing of ships, to assist steering by multiple prediction during any manoeuvring process and even to lend support for analysing results and for onboard training with a Simulation & Trial Module.

- **Simopt** is a simulation optimiser software module based on FTS for optimising standard manoeuvres and modifying ship mathematics model parameters, both for simulator ships, FTS Simulation Training Systems and for onboard application of the Sammon System. The quality of the math model for the simulation and the parameters in the equations are vital to the effectiveness of the simulation. Fast effective modelling/tuning processes are required both for the general operation of ship handling simulators SHS where clients from several shipping companies need to be trained in their specific ship types and for Sammon dynamic predictor and manoeuvre planning modules. The advantage of the module is to be seen in: It much faster than real time and the steering of vessels is organised by prepared
files from a library for manoeuvre-control settings/Commands for standard procedures and individual manoeuvres.

- Simdat is a software module for analysing simulation results both from simulations in SHS or Simopt and from real ship trials: the data for manoeuvring characteristics can be automatically retrieved and graphic tools are available for displaying comparing and assessing results.

The Simopt and Simdat modules were described in earlier papers ([3],[4]) and also the modules for Multiple Dynamic Prediction &Control [5].

In this paper focus is on the planning process as part of the route planning, specifically for the most complex manoeuvring planning in ports or for the harbour approach.

**Figure 2:** Elements of manoeuvring process for ships & in training and support by fast time simulation tools for simulation/augmentation

<table>
<thead>
<tr>
<th>Real World / Ship</th>
<th>Ship Handling Simulator Training</th>
<th>Fast Time Simulation Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real ship</td>
<td>Math model of the ship for simulation</td>
<td>SIMOPT/ SIMDAT tool for developing &amp; tuning of parameters of math models</td>
</tr>
<tr>
<td>Mission / Planning</td>
<td>Scenario / Briefing</td>
<td>MANOEUVRING DESIGN &amp; PLANNING tool to generate and edit a manoeuvring plan</td>
</tr>
<tr>
<td>Manoeuvring Operation</td>
<td>Execution of exercise</td>
<td>MULTIPLE DYNAMIC PREDICTION tool to monitor and control the vessel</td>
</tr>
<tr>
<td>Recording (VDR, ECDIS)</td>
<td>Recording by simulator</td>
<td>SIMDAT tool to display and assess recordings</td>
</tr>
<tr>
<td>Evaluation of success</td>
<td>Debriefing</td>
<td>MANOEUVRING TRIAL tool for verification of results by simulation &amp; prediction</td>
</tr>
</tbody>
</table>
2. APPROACH FOR A FAST TIME SIMULATION TOOL PLUS FULL DYNAMIC MODEL FOR MANOEUVRING/ROUTE PLANNING

2.1 SHIP DYNAMIC MODEL FOR MANOEUVRING SIMULATION

The equation of motion used as a math model for a ships’ dynamic is:

\[
\begin{align*}
X &= m\left(\ddot{u} - v\dot{r} - x_G r^2\right) \\
Y &= m\left(\ddot{v} + u\dot{r} + x_G \dot{r}^2\right) \\
N &= I_Z \ddot{r} + mx_G (\ddot{v} + ru) \\
Q &= I_{ME} \ddot{\psi}_{ME}
\end{align*}
\]

(1)

The answers (=) provide the effects of inertia where u and v represent the speed components in longitudinal and transverse direction x, y, r area ship’s rate of turn. The vessel’s mass is m and x_G the distance centre of gravity is from the origin of the co-ordinate system, I_z is the moment of inertia around the z-axis.

The ship’s hull forces X and Y, as well as any yawing. N around the z-axis are on the left-hand side. Their dimensionless coefficients are normally represented by polynomials based on dimensionless parameters for instance in the equation for transverse force Y and yaw moment N given as the sum of terms with linear components N_u, N_v, Y_r and Y_v and additional non-linear terms depending on speed components u, v and rate of turn r, revolution n. Other forces, as for instance rudder and wind forces, are expressed in “look up” tables. There are other models, e.g. for the engine or thruster operation: for the sample in the fourth equation in (1) Q represents the sum of the torque components of engine, propellers and others; on the right is the inertia moment of the rotation parts around the propeller axis.

Additional differential equations represent calculation in heading and position. The solution of this set of differential equations was calculated at least every second; some internal calculations with higher frequency.

This equation of motion (1) can be written:

\[
x'(t) = f(x, u_c, t)
\]

(2)

Where:
- State spaces with track co-ordinates ζ,η, heading ψ:
  \[x = [u, v, r, \xi, \eta, \psi, \delta, n_{ME}, n_{TH}, \ldots]\]
- Controls with commanded values Cmd for main engine ME and thrusters TH:
  \[u_c = [\delta_{Cmd}, n_{ME-Cmd}, n_{TH-Cmd}, \ldots]\]
- with initial conditions at: \(t = t_0\) : \(x(t_0) = x_0, \quad u(t_0) = u_{c0} : \)
  \[x_0 = [u_0, v_0, r_0, \xi_0, \eta_0, \psi_0, \delta_0, n_{ME0}, n_{TH0}, \ldots] \quad u_{c0} = [\delta_{Cmd0}, n_{ME-Cmd0}, n_{TH-Cmd0}, \ldots]\]

This equation of motion (2) can be solved by numerical integration for the prediction time period \(t_0\) to \(t_1\) in the form of the general solution:

\[
x(t) = x(t_0) + \int_{t_0}^{t_1} x'(t) \, dt
\]

i.e. for the full set of states and controls:

\[
x(t) = x_0 + \int_{t_0}^{t_1} f(x, u_c, t) \, dt
\]

(3)

For a simplified simulation for the so called “curved headline” for static prediction, a solution was used by integrating track and heading, assuming only constant speed u_0, v_0 and rate of turn r_0, resulting always in a circular motion with constant speed and used for a simplified prediction with reduced accuracy or to indicate the current motion status valid only for a small time span:

\[
x(t) = x_0 + \int_{t_0}^{t_1} f(u_0, v_0, r_0) \, dt
\]

(4)
2.2 TECHNOLOGICAL SETUP FOR MANOEUVRING SIMULATION WITHIN ROUTE PLANNING

The technological sand the elements to use this math model for manoeuvring design within a route planning process is shown in Figure 3. The planning data was collected by the interfaces of the planning data collector. By means of the ship simulation parameters from the ship data base module the fast time simulation module executed simulation of the manoeuvring segment and presented results in the presentation & displaying module. if the results are acceptable the segment will be stored in the manoeuvre data base. all the organization for this process will be done by the data base manager module.

![Diagram of manoeuvring simulation setup]

**Planning Data Collector** - Interfaces for selecting:

1. Ships condition data interface:
   - Loading parameters, (Draft, Lateral Areas); Maximum Control settings limit (rudder angle & turning rate, engine power …)

2. Ship Steering parameter Control interface:
   - Commanded Rudder angle, Engine speed rate, Bow / Stern thruster settings…

3. Initial States / Ship Motion & Environmental parameter interface:
   - Heading, speed, positions, ROT, Wind, current, water depth …

**Ship Data base Module**: Ships Simulation parameters (Parameters of simulation math model for the planned ship conditions)

**Fast Time Simulation Module**: Simulation of ships track, speed & heading for selected manoeuvring controls for planning algorithms & training

**Data base manager Module**: Manoeuvre Planning Mode
- Editing, handling /shifting and display of related manoeuvre segments on the planned track;
- Recording of simulated manoeuvre sequences as track data and control parameter settings at Manoeuvring Points

**Manoeuvre Data base Module for Manoeuvre Plan**: Storing manoeuvre plan elements for prediction during conning process /execution of manoeuvres

**Presentation & Displaying Module**: Display of manoeuvring information / simulated track in ECDIS -, Radar- environment:

Static Manoeuvre Plan / Ships Track Data

Figure 3: Elements of manoeuvre planning process based on fast time simulation tools for designing manoeuvre plans
3. FAST TIME SIMULATION FOR DESIGNING MANOEUVRES FOR ROUTE PLANNING

3.1 PRINCIPLE OF FAST TIME SIMULATION OF MANOEUVRES IN ECDIS AND SAMPLE DATA

The fast time simulation method was used to discover efficient manoeuvres in design of plans within a ship's route planning process. The use of this tool can be explained by sample scenarios:

The sample ship is the RO-PAX Ferry Mecklenburg-Vorpommern with Length = 200m, Beam = 28.95m, draft = 6.2m, displacement = 22,720 tons and speed = 22 kn. She has two pitch propellers, with two rudders located behind them plus one bow thruster.

The test area was Rostock Sea Port. The RO-PAX ferry is seen entering the fairway from the north, to be steered through the fairway, and to be turned, followed by an astern motion into the ferry basin (as in Figure 4 right), alternatively to the berth at the west pier (as in in the sample, Figure 9).

Some basic functions and interface displays are shown:

For demonstration purposes of a complex manoeuvre procedure the ship is initially positioned in the fairway (black contour) ready to enter the turning area as an objective for the first manoeuvring segment. For the planning procedure the ship’s motion can be controlled by the settings in the control panel window on the right side. Any manoeuvre can be generated and is immediately displayed in the ENC in less than 1 sec. In this case the rudders are set 10° to a far board (STB) to achieve a small turning rate ROT = 4.5°/min to port. The length of the simulated track corresponds to the settings in the prediction window (left top corner): the range value the duration of the simulated manoeuvre, indicating the track length of that manoeuvring segment; the interval value controls the number of displayed ship contours on that predicted manoeuvre track. The selected end position of the manoeuvring segment is indicated by the ship’s shape in red in the ENC.

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This planning process demands the full involvement by the navigating officer: The most suitable manoeuvres can be found by trial and error but it is possible for the officer to bring in his full knowledge to bear and to take advantage of experience and skills – it is possible to ‘check’ and to verify immediately an officer’s results and to then ensure they will work. This is important not only for safety and efficiency, but for experience for future similar manoeuvres.

Figure 5: Display for manoeuvring design by fast time simulation for immediate presentation of manoeuvring results: Sample for entering the turning area with slight turning to STB from initial conditions in a fairway at manoeuvring point MP 1

3.2 SAMPLE OF DESIGNING A FULL MANOEUVRING SEQUENCE AS PART OF ROUTE PLANNING

Planning procedure for a complete manoeuvring plan follows the principles as described for a single segment in Figure 5:

- Figure 6 presents the situation after accepting the previously planned manoeuvre – now the next segment is to be planned from MP 2 to MP 3: the ship is to enter the turning area and to slow, both engines are set to STOP (EOT 0).
- In Figure 7 the complex turning manoeuvre is seen: the ship is using in parallel its engines, rudders and the bowthruster to turn as rapidly as possible.
- In Figure 9 the result for the full manoeuvring plan is to be seen with the entire set of manoeuvring points (MP) for complete approach and berthing manoeuvre.

The different controls settings and the track of the planned manoeuvre sequences are stored in a manoeuvre planning file to be displayed in the ENC. For the execution of the manoeuvre this plan can be activated later to be superimposed in ECDIS, with the ships’ actual position of and most importantly with the prediction of manoeuvring capabilities (see Chapter 4) for effective steering under actual manoeuvring and environmental conditions.
Figure 6: Planning of the next segment from MP 2 to MP 3 – speed reduction

Figure 7: Planning next segment from MP 3 to MP 4 – complex turning and stopping with engines, rudders and thruster
Figure 8: Planning of the next segment from MP 4 to MP 5 – end of turning and going astern

Figure 9: Complete manoeuvring plan for the route segment for passing the turning area and approaching the berth in astern motion
4. OVERLAID PREDICTION FOR ON-LINE MANOEUVRING DECISION SUPPORT USING MANOEUVRING PLANS AND THE MULTIPLE MANOEUVRING PREDICTION MODULE

4.1 PRESENTATION OF DYNAMIC PREDICTIONS IN ECDIS ENVIRONMENT

For a compact presentation of information for the captain, pilot and navigating officer respectively, a new layout of a conning display was designed and implemented into the equipment installed on an integrated navigation system. To test the technical feasibility and user acceptance, the new conning display with the integrated multiple manoeuvring prediction module was implemented in the INS equipment of the large full mission simulator bridge of the ship handling simulator of MSCW. The sample ship was again the RO-PAX Ferry “Mecklenburg-Vorpommern”, the test area Rostock Sea Port; the RO-PAX ferry is leaving the berth to be steered through the fairway and then to leave port.

The layout of a dedicated prediction display integrated into an ECDIS is shown in Figure 10. It contains Conning information together with the prediction and the planned manoeuvring track. The centre window shows the ENC in head up mode together with motion parameter for longitudinal speed and transverse speed, and a circle segment with the rate of turn indicated. The ship’s position is displayed in the centre of the ENC as a ship contour, where also track prediction may be indicated as a curved track or as a chain of contours for selected prediction time. The prediction parameters as range or interval of presentation can be set in the control window on the right side.

![Figure 10: Layout concept for manoeuvring prediction integrated into ECDIS (left) and enlarged comparison of static and dynamic predictions (right) together with planned manoeuvring track (red broken line)](image)

The dynamic path prediction with the sophisticated simulation model is shown as a chain of ships contours based on a full math model (ship contours every 60sec for 5min, turning to STB). This dynamic prediction reflects already the effect of the setting of rudder and propeller control parameters shown in the left bottom window: In this sample the two rudders of the ferry used are set to 12° starboard and the engine order telegraph for the two controllable pitch propellers set to 50% representing 130 rpm of the propeller. The actual pitch status is 19. This interface allows for a presentation of dynamic predictions of steering and stopping characteristics as an immediate response according to the current steering handle or engine order telegraph position. It can be perfectly compared with the planned manoeuvring track as a reference line or curve, shown as red broken line in the ENC window.

The predicted track for the simplified static path prediction based on of current constant motion parameters (implemented as add-on in some ECDIS solutions) are shown as a magenta curve: According to the actual/present small rate of turn to port the predicted track is presented as a circle segment to the left side.
4.2 TEST SET UP AND SAMPLE SCENARIO FOR USING THE MANOEUVRING PLAN WITH ON-LINE PREDICTION

Figures indicate the effect of the dynamic predictor and the advantage of displaying the planned manoeuvring track as a reference for future manoeuvring decisions. In Figure 11 the manoeuvring plan is to be seen as a concept for leaving the berth and port, prepared by the method indicated in 4.1.

Figure 11: Complete manoeuvring plan for the route segment for leaving the berth /port

Figure 10 indicates the start of the scenario from the berth. At MP 1 a suitable rudder angle is adjusted to steer the ship along the planned track through the fairway (red broken line) using dynamic predicted contours. The magenta line of the static motion prediction follows slowly according to the change of the current rate of turn. Figure 12 shows the course change to the turning area and then into the next fairway segment reversing the turning by counter rudder to steer the ship into the next straight fairway segment. Investigation for improving manoeuvres in Rostock ferry operations were made to analyse the performance specifically in the turning area. Analysing the VDR recordings from ferry approaches it was found there was room for improvement. Applying the predictor new strategies were found to save minutes in this area, most important in tight time schedules ([7]). Alternative manoeuvring strategies were developed in the ship handling simulator by combining non-interrupted turning and backing to berth. It was found it offered a potential of saving up to 25% of total manoeuvring time on the selected route segment.
Figure 12: Manoeuvring Sequences in ECDIS using prediction methods and planned manoeuvring track for steering the ship on to turning area (left) and reverse turning to steer into the straight fairway segment (right).

Figure 13: Simulation interface for the manoeuvring simulation & trial module providing real time simulation and predictions together with planned manoeuvring track for steering by means of the panel interface on the right side.
5. MANOEUVRING SIMULATION & TRIAL MODULE

This module combines a full simulation module for a ship manoeuvring process with all the modules shown to test to try out manoeuvring plans and strategies, used:

- As training tool in maritime education
  - both in briefing/debriefing sessions for ship handling simulator training,
  - in lectures on ship manoeuvring in classes and,
- as a training tool on board ships.

Figure 13 shows the interface of this module: To control the virtual ship during a simulation process the manoeuvring panel on the right side allows steering of the ship in real time along the planned route supported by the multiple predictor.

6. CONCLUSION AND SUMMARY

Route planning and efficient ship manoeuvres were essential to the safety and efficiency of maritime transport. Innovative technologies, enhanced algorithms and procedures had great potential not only for advanced support for the bridge party when manoeuvring a ship, but also to improve ship handling training as well.

Selected aspects of past and on-going investigations regarding on-board manoeuvring assistance and into the integration of new maritime technologies on board ships were presented in this paper. As a main outcome the concept of a comprehensive Sammon tool box for simulation augmented design, monitoring and control of manoeuvres was introduced and discussed for use on board and in ship-handling training with full mission simulators. Core element of the universal tool box was the implementation of innovative "Fast-Time-Simulation" technology which allowed for dynamic prediction of ship movement, taking into account actual steering commands, for immediate display of an expected path. The system was tested using the excellent resources for research and development of the Maritime Simulation Centre Warnemuende. During trials several manoeuvring situations were managed. There was an increased performance when using the FTS tool.

The presented new applications had great potential to contribute to safe ship handling in challenging sea areas and harbour basins and critical environmental conditions and would improve on-board maritime operational risk management in several ways ([2]). Collision avoidance ([1]). Ship-handling training using full-mission simulators improved by enhanced support for briefing, monitoring and analysis of performance data for de-briefing purposes.

This development was an excellent example to demonstrate how universities might develop and use technology to become more competitive in co-operation with start-up companies to benefit from entrepreneurship and innovation on business and engineering education.

7. ACKNOWLEDGEMENTS

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8. REFERENCES


INTERNET, WEB APPLICATIONS AND SOCIAL MEDIA CHALLENGES FOR ENGINEERING EDUCATION AND ENTREPRENEURSHIP

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ABSTRACT

The instant knowledge can be explained by surfing articles on the web. By using its applications on fixed or mobile or wireless devices, one can access the data at any place or time. It is possible to be present, at a distance, in healthcare, education collaboration and entrepreneurship discussions, also for control of processes, robots etc.

Social media can connect engineers sharing common interests assist finding fast resolutions of problems and expand borders of knowledge in form of collective intelligence. With this information at stake it could be expected many discoveries might freely emanate students yet in the educational process.

Mobile learning (M-learning) enabled collaboration between engineers, researchers and students, providing easy communication and exchange of knowledge. M-Learning, combined with social media, provided excellent connection with those sharing common interests. The mobile environment could use several channels to provide services: SMS, voice, USSD, and mobile Web.

In this paper, several services published through varying communication channels are presented. M-learning is connected with all other mobile services and its integration planned. Within the evaluation of these services, results for quality of experience (QoE) testing are reported with several suggestions on development of new types of services.

1. INTRODUCTION

The social media is related to the education of people and for advertising. However, social networks connecting the public with common goals such as engineering education also help in the sharing knowledge and experiences. As news travels fast so innovations develop even faster and global communication are informed of developments. The media participating in this development process includes television, Internet with textual articles, imagery, videos and social groups sharing links to content on various subjects. When engineers introduce tools, many innovations emerge from such collaboration.

This paper presents several services being published through different channels. The examples show possible combinations of usage of desktop and mobile environments to implement services. Statistics will indicate users’ affinity with different technologies and channels.

Innovative communication services derived ideas for utilisation of mobile devices. They use data exchange and differing connectivity procedures of mobile devices, taking into account the availability of the user and for some applications, the geographic location of the user. Many standards and services have been established, paving a path for fresh applications to be invented. Mobile services provide users easy access and manipulation, thus saving effort and time. Telecommunication operators develop new services to provide even more diverse types of services and applications, utilising infrastructure resources.

Within the last three years, the number of mobile application has increased from almost nothing to significant numbers. In March 2011 iPhone had > 350 000 applications in its App store, Android OS counted 250 000 applications and Windows Mobile OS 10 000 applications. Blackberry has ~3000 applications [20]. RIM has announced a player to support use of Android applications on their Blackberry tablet platform. [21].
Web browsers for mobile phones (smart phones) still have problems while using Web applications demand interaction, but Web applications save users from installing new versions of the applications, finding and downloading the correct version of an application for the phone model and operating system it uses, then eliminating installation of potentially dangerous software. The sales of applications are a good reason for their development. Applications allow usage of specified phone functionalities such as location retrieved from inbuilt GPS. Input and output systems differ and might demand specific approach during development. Installing games locally might save users from data transfer costs.

Many entrepreneurs use development in the mobile environment to create businesses. New firms such as Tweetter, Facebook, Google and others, are the businesses themselves, providing a platform for advertising and promoting and represent means of communication. But also, Internet and its communication links are certainly support for any business and, therefore, communication platforms provide a means of communication for them. One already feels the benefit of this development in everyday life, but many ideas to be implemented.

Development and sales of mobile applications for iPhone OS, Android, Blackberry are boosted by young people and entrepreneur companies [22]. Sometimes, it is not complexity, but smart ideas that generate revenue.

Telecom operators offer services for communication, advertising of businesses and various implementations for various groups, such as business companies, family group, and homes.

It is a trend for mobile operators to develop various services for subscribers. A number services are predefined upon activation by a subscriber line and choice tariff model. Certain services may activated or deactivated by direct subscriber interaction. By proving several different channels for manipulation of services, companies became closer to subscribers. Different channels can be used to provide ubiquitous access to a specified service; other way to combine different channels was to combine them into a new, more complex service.

In this paper, a statistical and quality of experience QoE testing are applied to several services which can be activated by users through several different channels. From the statistics and QoE testing, several conclusions on users’ choices and preferences drawn. The Introduction section points out several examples of services provided by mobile operators through various channels also, channels for manipulation of mobile services are briefly explained.

Section 2.1 Architecture of Telecommunication System is explained with cases of services when a user communicates using both mobile and desktop environments simultaneously with Internet and GSM network communication.

In Section 2.2 several examples of services being published through multiple channels are explained. A third section covers the evaluation of the affinity of users with different service channels, together with statistic data and QoE testing for a set period.

In conclusion, (the fourth section), future combination of Internet and GSM channels into new more complex and integrated services are suggested.

The goal is to create connected collaboration environment for users in academia and industry.

Some services, presented in this work, are to be integrated; some innovations are already established. Users are encouraged to take an active part in development and improvement of the integrated system. After standardisation, the system would be offered to both academia and industry.

2.1. SERVICES PROVIDED BY MOBILE OPERATORS THROUGH VARIOUS CHANNELS

Services with combined interfaces enable secure and direct access to and for a user. Many types of businesses prefer efficient and direct communication with clients. Notifications are sent via e-mail, SMS or by a direct telephone call. Some examples are:

1. Notifications to the user through SMS notifications from banks about transactions)
2. Mobile advertising to a selected group of users through SMS, MMS, mobile applications that support advertisements.
3. Secure logging-in on Web sites, sending codes on SMS or calling automatic voice service which provide information to identify a user thorough Internet
4. Additional security messages regarding online payments from the businesses
5. Mobile applications on which a user logs-in as a customer to visit a business (coffee bar) which business owners use as evidence of popularity

2.2. CHANNELS THAT CAN BE USED TO MANIPULATE A MOBILE SERVICE

1. Human operator – calling on a specified service number for customer care and after subscriber identification an operator is able to activate or deactivate services. An operator uses internal applications to activate or deactivate the service.

2. IVR - Integrated Voice Response [18] – telephone technology enabling a computer to detect voice or dial tones on clicking of telephone keypad buttons and used a normal telephone call. IVR systems can answer via a previously recorded message or use a dynamically generated audio for further instructions to a user. IVR systems can be used to control almost any function where interface can be chunked into a series of simple choices. A well constructed IVR system can be scaled to execute a great number of calls.

3. USSD - Unstructured Supplementary Service Data - this technology is intended for GSM networks. [20] This ability is inbuilt in GSM standards to support transfer of information through signal channels of a GSM network. USSD provides session-based communication and enables usage of various applications. This communication technology is used to send text between mobile phones and application programmes or networks. USSD is similar to SMS but in USSD, transactions are executed in one operation. With SMS the message can be sent to a mobile and stored for days if a phone is deactivated.

4. SMS – Short Messaging System – A user can activate or deactivate a service through a predefined service message. Service messages can be delivered with delays to provide non-logged-in users with information. Execution of the service depended on the interaction of the user, so generally this type of the provisioning of the services was executed slowly. Additionally, a user needed to use specially predefined type of message which read via another medium.

5. Web interface – certain services can be published through Web application and offer manipulation of services. Requests arrive in an operator’s system which then provisions requests and send a response to the Web. Examples: Activation of e-Bill, buy packages on the Internet, to send credit from post-paid to a prepaid subscriber, set e-mail, MMS, SMS, WAP; parameters or change numbers with privileged pricing. First services to be published retrieve data for subscriber. E.g. Retrieve all calls with prices and times, retrieve of invoices, or sales vouchers.

2. ARCHITECTURE OF TELECOMMUNICATION SYSTEM

Architecture of information and network resources of a mobile operator are shown in Figure 1. Interaction of users with the public Web interface of an operator is made by simultaneous desktop environment and mobile GSM communication. The Web application is hosted on operator’s Web server separated from the remainder of the internal network [33]. Web servers forward requests to Web services which run on application servers. The Web services represent a communication interface with business integration platforms. The processes that listen to the queues contain the business logic of the request and execute calls to databases for querying and DML functions and procedures. The processes may make calls to internal web services (provisioning of a service on network elements) as well as to external Web services from other businesses and partners. Also, database procedures can make calls to internal and external Web services.

The user of a Web site may activate a service over the Web then will receive confirmation of executed activation on Web and SMS with notification of changes.

In case of activation of a mobile service on the MSISDN [38], the request from Web servers are forwarded to internal application servers which communicate with databases and network elements, if service requires provisioning on network elements.

In case of e-commerce, after the choice of payment on the Web site, the server makes redirection online transactions, which are hosted by separated business and certified for execution of payment transaction with banks. Communication is made through secure Internet connections. The e-commerce return replies to an operator’s Web server. If the Web payment is successful, a user receives an SMS, e-mail notification and information on the Web site.
In Figure 1, can be seen two channels used by subscribers, Internet and GSM in implementing a service.

![Diagram](image)

**Figure 1:** Architecture of the resources of a mobile operator and communication of users using Internet and GSM networks

### 3. EXAMPLES OF SERVICES PUBLISHED THROUGH MULTIPLE CHANNELS

#### 3.1. ELECTRONIC BILL

The electronic bill represents replacement of a paper invoice with notification a generated electronic invoice. Subscribers receive SMS and e-mail for the generated bill. This service is unrelated to a specific way of payment, but subscribers use online methods.

Channels through which users can activate Electronic Bill are:

1. **Operator** - activation of a service can be executed in a shop or by contacting a call centre, after identification of a subscriber.
2. **Web portal** - for activation of this service through the Web portal (Figure 2), a user must provide an e-mail address. For confirmation of successful activation, a user receives SMS, e-mail and the web site, Manipulation of the service in the business (or middle) tier is completed by Web service.
3. **Integrated Voice Response (IVR)** - upon activation of the service, electronic bill through IVR, subscriber calls a specific number receive an option and makes choices by clicking numbers on a dial pad, for a successfully activated service, subscriber receive an SMS.
4. **SMS** - the third channel for activation of the electronic bill service is via an SMS message with predefined content, such as “START E-BILL”. Reversely, for deactivation of the service, the message would be “STOP E-BILL”.

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3.2. E-PAYMENT THROUGH AN OPERATOR’S WEB PORTAL

E-payment is realised with checkboxes and by using subscribers’ e-mails stored in an operator’s database. After selection of an invoice a user is redirected to an external system for online payment with the amount to be paid and the user's e-mail. On the online payment system, user enters payment card data. After successfully executed a transaction, the Web site for online payment displays a message and link to return to an operator’s portal. On the operator’s portal, the status of the invoices is changed from “Unpaid” to “Processing” then “paid”. Subscriber receives SMS and e-mail for notification of any successful transaction.

3.3. VOUCHER RECHARGE

Recharging vouchers for a prepaid number can be achieved by a post-paid subscriber through a special service that transfers a value to the prepaid user and will executes invoicing. The post-paid user receives an SMS for executed recharging of credit and also receives an SMS with information of recharging, plus a post-paid MSISDN that initiated recharge.

A prepaid user can recharge any account via online payment. Notification of a successful online payment is visible on the website; the user will receive SMS and e-mail notification. Figure 3 displays online payment of a voucher. The interface for entry of payment data (card number, and owner) adjusts design to an operator’s brand. A user in a way that the user saves time by buying a voucher from a “shop” and the service is available 24/7.

The Web portal can be accessed via mobile devices from newer generations. Some mobile browsers still experience troubles with complex Web controls. But more reliable usage is now provided by desktop environment, what is cheap and easily accessed.
4. EVALUATION OF THE AFFINITY OF USERS WITH SERVICE CHANNELS

To make services more user-friendly, telecommunication operators provide several channels for activation/deactivation. Statistics will be given for several services users can manipulate with services published through several channels:

- **My Circle**: A subscriber may choose four numbers with privileged tariff,
- **Bill**: Service from which a user receives SMS and e-mail notification for generated invoice and
- **voucher recharge**: Recharging prepaid account a post-paid subscriber

<table>
<thead>
<tr>
<th>Service</th>
<th>My Circle (%)</th>
<th>Electronic bill A(%)</th>
<th>D(%)</th>
<th>Voucher Recharge (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>19.4</td>
<td>~0.33</td>
<td>2.8</td>
<td>N/A</td>
</tr>
<tr>
<td>IVR</td>
<td>79.4</td>
<td>3.4</td>
<td>13.8</td>
<td>94.5</td>
</tr>
<tr>
<td>USSD</td>
<td>1.14</td>
<td>N/A</td>
<td>N/A</td>
<td>~1.81</td>
</tr>
<tr>
<td>SMS</td>
<td>~8e-4</td>
<td>3.5</td>
<td>5.0</td>
<td>N/A</td>
</tr>
<tr>
<td>WEB SITE</td>
<td>0.06</td>
<td>92.7</td>
<td>78.4</td>
<td>3.73</td>
</tr>
</tbody>
</table>

* A = Activation of the service; D, Deactivation of the service

In Table 1 a statistics and quality of experience (QoS) testing for use of the three services is presented. The values are given in percentages of total usage of each service over all channels. For the service Electronic bill two columns are shown. “A” and “D” stand for activation and deactivation of the service, respectively. After examination of the data the following conclusions were reached:

1. Because of differing periods of the starting of the service over various channels, there are differences in channel usage. The My Circle service is mostly exploited through the IVR channel. It would be expected users manipulate this service through a Web application, but they are accustomed the IVR channel.
2. USSD channel is visual and, as such, more convenient for usage of activation of services. But because of the presentation of the channel, has a smaller number of activations. This channel offers many opportunities for creation of various services, as a visual tool, in the menus, all offers can be presented at once; IVR is rather of serial nature.
3. An electronic bill is published on the same day through all channels, but because of a possibility to highlight it on the Web portal, this channel marks convincingly highest usage rate. IVR, SMS, USSD are used when users acquainted with the service and actively require to know service status.
4. Voucher recharges from post-paid to prepaid subscribers is mostly used through the IVR channel. Here case, the timing and order of the publication of the channel are crucial. Also, although Web offers comfortable usage of services, simplicity of service manipulation and factors regarding any necessity of the service at any time and place, have made mobile option more usable.

It was concluded the main factors in choosing a channel by are:

1. Complexity or simplicity of service;
2. Necessity for access to the service at any time and place;
3. Order of the publishing of the service on different channels;
4. Advertising and promotion of a channel;

Chart 1 indicates the growth of the cumulative success rate of bill activation towards the number of the visits to the Web portal. The success rate is calculated as number activations service versus the number of logins to the portal. The success rate, marked in red, decreases over time is the number of the visits of users to have activated the service increases. These subscribers visit the portal, at least twice a month; the number of registrations of new users is constant. The blue line, which depicts cumulative success rate, indicates parabolic growth. Cumulative success is calculated as sum of success rates over time. The index ~5.47 which is the value of the cumulative success at the end of the eighth week, represents the total number of activations versus the number of the logins to the portal in the first week. This shows a constant for positive increase of users to choose the services.
Chart 2 realises the number of visits (logins) within the first eight weeks from the moment of the publication of the bill service. After two months existence of the service, the number of visits of postpaid users has increased three times. Triple multiplication of the visits and the usage of the portal has triggered and accelerated the upgrade of the middle-tier web services from one application server to two servers, in order to provide good quality of service for the changed situation.

The Mobile Virtual (MVT) has developed for consultations using mobile devices, pocket PCs, mobile phones, etc. The MVT was inspired by necessity for ubiquitous access to information using the convenience of a mobile handheld device. When compared with other types of distance learning methods, m-learning should be used in a manner to provide fast and exact answers to questions. According to this series, consultations in a group created implicit collaboration among students, which increased quality of obtained engineering and/or business knowledge.

This MVT consultation system is implemented using client-server architecture providing a lower communication load on client devices. This kind of “thin client architecture” was chosen as mobile devices limited memory and processor power. The server part was implemented as a desktop PC application, as serving a client demanded a system offering high performance and data throughput. The entire communication and synchronisation among clients was executed server application. The architecture of the MVT as a multi-agent system is presented in the Figure 4.

Figure 4 represents the design architecture of the consultation system. Client applications reside on pocket. They have three main parts: Active user agent (AUA), VoIP client, and the set of the client features for
drawing and messaging. AUA manages a user’s interaction within the application regarding interface layout, visibility and dimensions of certain controls. This agent counts the number of hits to each control application (message window, MVT, etc); VoIP client serves the voice transfer. The client application represents all the features that a student or professor (instructor) might require in their mutual communication: chat, draw, voice, upload and download of files. Both types of clients (student and professor) share the same general architecture. The communication is realised through wireless area networks connected to the Internet. The server runs through a desktop computer and contains the: Passive user agent (PUA), Media Agent (MA), XML data storage, VoIP Server and UDP server application. For the purpose of memory saving and avoiding overload to the processing power of the clients’ handheld device, PUA and Media Agent reside on the server side. The messages with which agents communicate are XML based, as are, the data types describing user profiles stored in the database.

The server application communicates with the database. Specialised functions that take care of the user interface of each participant are the PUA and MA. More details about the basic virtual table can be found in [17].

5. CONCLUSIONS

Several services in live production have been observed only in order to gain relevant data on usage of available. The relevance of these services provides sufficient certainty to make conclusions about the affinities of the users with different channels. These conclusions provide guidance on development new services which would preferred by consumers. Internet and GSM protocols can be used simultaneously and provide adequate accessibility to user based on relevance of information for which user should be contacted. M-learning is associated with all other mobile services and its integration is planned for future research.

Affinity and quality of experience (QoE) of the channels with activation of services, the conclusion is that if users had began to use the service through a certain channel, it was likely that they would continue to use the same channel, as they had learned the routine. Also, the sita of the user was important (is he or she in front of a computer, or on the movement). In moments of necessity, when the user was not at home or in the office, channels through his/her mobile telephone were used. Web provided rich interface, where the service was explained. USSD channel was also visual, while IVR was auditive. To use an SMS channel, a user must know the correct keywords or structure of the message. Web interface offered promotion of a service, because of a rich interface and abundance of accessible services. A user could be easily acquainted with new services, and immediately activateb them; . combination of multiple channels could be noticed when implementing more complex services.

With publication of several channels for one service, users had varied ways to access a service. Users had more control of a subscription status and gained trust in automated services. More over engagement of human operators for repetitive tasks decreased and users did not have to wait.

Future work and trends that to be expected and which engineers and entrepreneurs will certainly use are:

1. New types of services with greater integration of mobile and desktop environment to use the best of both worlds: desktop with commodity and cheap Internet access, and mobile with personalised secure nature, accessible from any place;
2. It is suggest to continue the process of integration of services into more complex systems available from various platforms (mobile, tablet and desktop) be continued;
3. Communication among systems from different organisations and businesses to connect relevant people to vital services and communities.
4. With growing offers of PC tablets on the market, development for this environment should be increased and tablets be affordable to everyone. They might even be replacement for desktop PCs in cases of personal use, when Internet and word processing are only required.

6. REFERENCES


INTERNATIONAL VIRTUAL TEAM WORK AS A MEANS OF INFORMING THE INTEGRATED NATURE OF BUSINESS.

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1 Glasgow Caledonian University, Glasgow, UK:
2 Marquette University, Milwaukee, USA:
3 Metropolia University, Helsinki, Finland

ABSTRACT

Virtual teamworking is expected to increase within the global community. Their success and effectiveness is influenced by four interrelated dimensions [1]: *virtual presence, social responsiveness, shared goals, and identity*. We report on the differential manifestation of these four elements in communication and success of interdisciplinary teams of engineering students working with business students.

Business students from either Finland or USA collaborated with engineering students from UK (a mixture of electrical, mechanical and product design) and were tasked with creating a feasibility study for a new product. The purpose of the project was that individual team members would gain experience within their own field, and develop a working knowledge of transferable skills.

During 2008/9, one part of the UK cohort worked with Finland where business students studied Entrepreneurship. The remainder worked with USA where the business students were studying project management. In both cases, video conferencing was used to facilitate the virtual team meetings; issues regarding the quality of conferences will be discussed.

Virtual teams were able to develop a strong and positive *virtual presence* where teams from all three locations recognized the value of videoconferencing in facilitating the communication process. Videoconferencing also enabled *social responsiveness* among teams.

Differences emerged with regard to *shared goals* and *identity*. USA team members largely perceived their goal as project managing whereas their engineering partners largely as developing the feasibility case. This lack of alignment among goals of the UK engineers and USA business students possibly created incongruence between their perceived identities on the project. In contrast, UK engineers and Finland business students shared the common goal of producing a feasibility case but there was an unresolved difference in perspectives related to disciplines. However, the similarity of their fundamental objective preserved a degree of identity that persisted even in the event of extremely poor communication.

Differences also emerged with regard to visiting Asian and African students within UK teams when contrasted with home students. They consistently demonstrated lower engagement with both videoconferencing and the feasibility case. Being from collectivist nations, these individuals may be more greatly influenced by group membership, have fewer skills in entering and leaving new groups, and be less prepared for more open and precise communication [2] than individuals from the UK. Further, they may be less willing to respond to ambiguous messages that often arose in the context of these projects. Our findings suggest numerous implications for teaching and engagement of virtual teams.

1. INTRODUCTION

Global transformation and specialization of workforce needs have tasked educators with introducing innovative, client-facing enhancements to their curricula [3, 4, 5]. Although most schools already emphasize relevant curricular skills, demands posed by globally distributed organisations obligate educators to look beyond traditional classroom offerings. A substantial body of research on virtual teams and projects [6] has shed light on virtual team management. However, conduct of collaborative offshore teaching initiatives to support virtual team learning has only recently begun to pick up pace. Consequently, from a pedagogical
perspective, much is yet to be learned regarding effective design of collaborative virtual team learning opportunities.

This paper describes experiences stemming from a multidisciplinary teaching initiative between engineering students at Glasgow Caledonian University, UK (GCU) and business students at both Marquette University in the US, and Metropolia University, Finland. The initiative was designed to provide students with experience in their own field, in international teamwork, and to develop working knowledge of transferable skills.

2. TEACHING AIMS AND ASSESSMENT

GCU teams of about eight third-year students comprised a mix of disciplines from three degree programmes, namely International Product Design, Mechanical, and Electrical engineering. They worked with teams of between two and four students from one of two partnering universities:

a) Marquette University, (US) where business students studied Project Management, learning to control projects within a business scenario, in this case new product development.

b) Metropolia University, (FI) where students studied Entrepreneurship by creating ideas for new product and forming a business case for it.

The teams collaborated via videoconference (VC) to complete a feasibility study for a new product. Interactions between GCU and US/FI students were intended to promote a reciprocal transfer of understanding of the needs and desires of engineers and businessmen. Videoconference facilities, Skype and Adobe Connect allowed “face-to-face” discussion and shared workspace (VLE - Blackboard) allowed students to share information and interact in a number of ways, see Figure 1.

GCU hosted a number of students from other countries (largely Asia and Africa) and visiting students made up approximately half the GCU members of each team, giving a strong cultural mix. This was deliberately organised to improve the international working skills of UK-based team members and to integrate international students into the student body. GCU team make-up for the two sets of students is shown in Table 1.

GCU had four key objectives:

1) Learn about new product development,

2) Acquire skills necessary for working in a multi-functional team,

3) Recognize that other disciplines may approach their target in different ways,

4) Understand cultural differences that influence approaches to invention and to work.

They received eight hour-long lectures, weekly 30 minute tutor moderated team meeting, and a weekly VC session lasting about 25 minutes with their virtual partners. During each of the twelve weeks study, the balance of six timetabled hours was considered directed study.
US students had three primary objectives:
1) To learn concepts of Project Management in an applied manner,
2) To learn skills related to working with multi-disciplinary offshore teams,
3) To understand processes and technologies for enabling successful management of offshore projects.

US students received 15 weeks instruction and classroom team interaction on their course. Local teams had weekly meetings, were required to prepare a weekly agenda for VC sessions with their GCU partners, and to submit minutes of meetings within 24 hours of VC sessions.

FI students’ primary aim was to study entrepreneurship. They were asked to collaborate with GCU teams to devise a new product and to supply a related business plan. There was flexibility in the manner in which they approached the project but teams were constrained to meet with GCU once a week, according to a previously agreed timetable.

GCU students carried out two tasks to allow assessment of student interaction and learning:
1) A business case presentation delivered jointly with their virtual collaborators to a panel of lecturers during the final week of their 12 week module.
2) A self-reflective essay that encouraged students to consider what they had learned of the process, what they had learned about themselves and how they would amend their performance in future engineering-business team-working interactions. Comprising reflective answers to 27 questions, the self-reflective essay assessed three fundamental aspects of collaborative virtual work: teamwork, business, and technology.

US and FI had their own specialized assessments that are not considered in this study, e.g. US students, in addition to the business case, developed detailed projects plans and documentation for project execution. From here on, findings and discussions will be based on the GCU assessments described above. Largely reflecting the perceptions of GCU faculty and students, it is important to recognize that trust is a two way process and each of the three parties experienced issues of this nature during the course of the semester.

### Table 1: Distribution of Glasgow based students.

<table>
<thead>
<tr>
<th>Partner Country</th>
<th>Status</th>
<th>GCU Home</th>
<th>GCU Visitor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>GCU Home</td>
<td>20 (51.3%)</td>
<td>18 (52.9%)</td>
<td>38 (52.1%)</td>
</tr>
<tr>
<td>USA</td>
<td>GCU Home</td>
<td>19 (48.7%)</td>
<td>16 (47.1%)</td>
<td>35 (47.9%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>39 (100%)</td>
<td>34 (100%)</td>
<td>73 (100%)</td>
</tr>
</tbody>
</table>

3. **THE RESULTS**

The distribution of students according to their collaborating country is illustrated in Table 1. As noted, each GCU teams had approximately equal numbers of visitors and home members.

Figures 2, 3 and 4 show raw student marks on an arbitrary scale. The marks are listed in ascending order of rank. Marks for GCU home students who cooperated with Finland (FIH) and those who cooperated with the USA (USH) are very similar. Generally, however, marks for visiting students were lower than for home students and, in the case of visiting students cooperating with a team from the USA (USV), marks were considerably lower for both business and technology questions.
A statistical analysis\(^1\), performed using analysis of variance (ANOVA), demonstrated that there was no difference between mean team marks for FIH and USH for the Team score (Figure 2). The same is true for the visitors. However, the underlying population for home students is statistically higher than for visitors.

For both Business and Technology (Figures 3 and 4), there were no differences between mean marks for FIH and USH students. However, there were significant interaction element in the ANOVA analysis showing that the effect of the collaborating country has a marked influence on visitor marks. Specifically, for both these score categories, visiting students interacting with the US (USV) demonstrated significantly lower scores than visiting students working with Finland (FIV).

### 3.1 OBSERVATIONS ON THE PROCESS

Four aspects of the virtual team collaboration interaction, and learning processes between GCU and its US and FI partners are considered in greater depth here.

#### 3.1.1 Team size

GCU originally intended to form teams of four students, in accordance with previous experience and the recommendation of others, e.g. Gibbs [7] states:

“the larger the group, the more difficulty students will have cooperating and coordinating their efforts, the easier it is to hide and the harder it can be to distinguish the contributions of individuals. Groups larger than six can lead to many problems and few benefits other than saving marking time.”

However, a late influx of visiting students approximately doubled the cohort. Consequently, the module ran with many more per group than anticipated. Increasing the number of groups was not feasible; this form of collaboration necessitates that groups have to be pre-negotiated with the partners, leaving little room for flexibility. Furthermore, team meetings are constrained to overlapping class times across the international time differences.

#### 3.1.2 Team building.

However good a team is, one semester of twelve teaching weeks leaves little time to develop a product and this may impact on team cohesion. From the point of view of an engineer, the following stages are essential in product development:

1) Customer characterisation

\(^1\) We are indebted to Mr William McLaren of GCU for this analysis.
2) Create product ideas
3) Select a single product idea
4) Develop the idea
5) Resolve issues
6) Prepare and deliver product idea as a presentation

Assuming 2 weeks for each stage, all 12 weeks are accounted for and students may focus on task rather than team-building. Consequently, tutors provided guidance on team-building and teamwork during tutorial discussions. Although the teaching team expected that most participants would have experienced working in teams during study prior to this module, this may not have been the case, especially for visiting students.

3.1.3 Videoconferencing sessions

Although students from all universities deposited information on a shared platform (Blackboard), there were differences in the VC facilities used.

**GCU-US**: Students conferenced from dedicated rooms at both locations, using Polycom VC equipment, and interacted using GCU’s Tandberg suite for audio and video. Teams used a second computer to share documents using Netmeeting. All sessions were timetabled, most were monitored by a staff member.

**GCU-FI**: As professional VC equipment was unavailable, students used Adobe Connect for audio, video and document sharing. The system did not require use of a dedicated room and teams were tasked with setting up their own Adobe site, hence, sessions were less closely monitored. Initial confusion over team numbering led to missed connections and a degree of aggravation. GCU tutors observed this looser control seemed to lead to poorer communication between the two countries. To overcome this, some groups elected to use Skype.

It is worth considering some student comments in regard to their video experience because they do not necessarily follow the staff perspective. Students from both groups criticise and identify challenges of dealing with VC, with international collaboration and with technical difficulties which could be partly responsible for differences in students’ responses in the self-assessment.

One student wrote regarding relationships with FI: *I feel the relationship between the two centres never really got started. We had our first VC meeting on the adobe connect software and it worked ok as the teams in Helsinki were using a common group page to host the VC meetings. After this point the VC meetings for our team just didn't get off the ground and I feel this disrupted any possible relationship that could have formed. This part of the project I found very disappointing and after most of the failed VC meetings I went away feeling frustrated and unwilling to do any work relating to the project. Later I realised that something needed to be done so that VC meetings could happen and we moved onto using Skype software for the VC meetings. This proved more successful than the adobe software and our team was able to have VC meetings for the last 4 weeks of the project. I was pleased that our team managed to get the VC meetings back up and running and we could at least interact with our Helsinki team members. Looking back upon this I realise that this should have been done much sooner and better communications with the Helsinki teams members should have been established from the outset.*

Another wrote: *The international relationship was rocky to say the least. This was mostly due to technical issues, poor attendance on their behalf and the fact that our Finnish counterparts seemed to only work on the day we video conference. I found this frustrating that this part of the team were not pulling their weight by doing the allocated tasks and communicating poorly. The local team tried to remedy this by contact though email, mobile phone and Skype, but there was still less than desirable levels of participation. I suppose you can only lead the horse to water, you can't make it drink.*

Comment from a student interacting with US: *The relationship with our American colleagues wasn't as good as the relationship maintained within our side of the group (Glasgow Caledonian Members) and I believe this was due to only meeting our American colleagues once a week for a brief 20 minute period through the video conference software. I felt the relationship wasn't as good as we didn't see our American colleagues daily where as we saw our side of the group members daily in classes etc.*

Another wrote: *It became evident that “X” had become the team coordinator for team USA. We agreed that anything that required to be dealt with the week before our meeting would be relayed to the local teams via me and Mellissa. On reflection more video conference time or skyping would have helped...*
both groups and the team over all. A more relaxed relationship could have been formed; also team members who weren't really contributing may have opened up in a more relaxed situation. Personally I have no problem with public speaking and meeting new people, however there are some people who have issues with this. We may have had a stronger bond and produced better overall results had we all been functioning on 100%.

3.1.4 Efficacy of reflective questionnaire as an analytical tool.

The questionnaire was designed to assess how well students understood the subject matter. By requesting a reflective answer, students were expected to provide a thoughtful analysis of issues rather than a textbook answer. Questions such as “Describe the relationships between the two centres” are open-ended and could lead to numerous answers. To narrow the scope of responses, the question might have been posed as “describe what was bad and what was good in the relationships between the two centres”. For assessment, the more open question provides greater scope for demonstrating comprehension. Similarly, other questions should be examined in order to determine the efficacy of the questionnaire used.

3.2 DISCUSSION OF RESULTS

3.2.1 Business and engineering cooperation

GCU has been operating collaborative projects of this nature since before 1998 [8] but only occasionally has there been concurrent projects between different sites and with multi-disciplinary teams. Indeed, it is unusual within the educational fraternity to mix business and engineering students separated geographically. Most studies of cooperative teamwork concentrate on joint ventures of either teams of engineers or business students. Little has been written on dissimilar teams. Indeed, our own work has been reported largely through conference papers. Over the years, issues that have arisen pertain largely to teamwork rather than videoconferencing per se., and Schmidt et al [9, 10] developed a model of virtual team collaboration and, it is believed, were the first to quantify the issues. They demonstrated that a virtual environment is only weakly associated with team problems. Rather it is the human and social attributes associated with teamwork, such as performance, identity, and (intrinsic) motivation that contribute significantly. GCU-US and GCU-FI interactions in session 2009/2010 (reported here) have raised additional significant issues that warrant consideration. For instance, underlying issues associated with cooperation between dissimilar parties had not surfaced before which may be associated with the large influx of visitors in each team.

Inexperience must also be taken into account as none of the teams in the three locations had previous exposure to virtual teamwork. Nevertheless, it took only a few sessions for to develop a relaxed approach to the medium. This positive virtual presence seemed to arise because teams from all three locations recognized the value of VC in facilitating the communication process. There was also a degree of social responsiveness engendered by the need to work with a remote team. However, such responsiveness was fragile, relying as it does on mutual trust. Previous work [11, 12] has shown that actual responsiveness is essential to foster trust, lack of which leads to fragmentation.

There were also differences with regard to shared goals and identity. US teams initially perceived their goal as project managing and that of the engineers as developing the feasibility case. This lack of alignment of goals possibly created congruence between their perceived identities on the project. As roles and goals became clearer, business information was exchanged but final feasibility cases lacked authority. In contrast, UK engineers and Finnish business students seem to have shared the common goal of producing a feasibility case which, it might be speculated, could help develop a more coherent identity. However, there appeared to be a difference in perception of the flexibility around the task requirements. The Finnish teams believed that the module offered greater freedom to invent than actually available and were disappointed to find some restrictions (namely to invent an electro-mechanical toy for a disabled child). Disillusionment and reduced motivation on their part may have clouded the communication process and may well have encouraged localization such that GCU teams decided to “go it alone” and collect market information themselves.

As evidence, one GCU-FI student wrote: There was also a bit of conflict between the centres as due to so many weeks with no communication, team members in Glasgow made decisions that advanced the project which team
members in Helsinki were unhappy with. Fortunately these issues were ironed out with the Helsinki team members agreeing that the project had to move forward. The main point I think I learned from this relationship is that proper communications must be set up with international partners and the need for each party to keep the other regularly informed of what is happening at their end.

In contrast, a GCU-US student wrote: The American university despite having two meetings cancelled due to national holidays managed to achieve all their tasks on time. Since the meetings were held online through net meeting the meetings between the two universities were more in a formal way. This however did not make the meetings a hassle for us being students but rather helped complete the work on time since the requirements for the project was simultaneous work between the two universities. Also we constantly communicated through the blackboard online software when net meeting was not an option.

Comparing achievements of GCUs home (H) and visiting (V) students, Table 2 shows a “student t” analysis of the results. It can be seen that the mean for V is always lower than for H. For visitors working with Finland, the value of “p” for both business and technology indicates that this difference may not be significant, however, for both business and technical categories, the visitors performed better with Finland than with the USA. Several issues warrant further attention:

1. Why are visitor marks always lower than those of home students?
2. Why are visitor marks so much lower for those cooperating with the US?
3. Why do ‘team’ marks appear different than the other two categories?

### 3.2.2 Visitor mark lower.

A possible explanation for lower visitor marks lies in the different educational and cultural experiences of the visitors [13]. The nature of teaching in Asia and Africa seems to be didactic with emphasis on individual learning rather than team experiences [2]. Additionally, as most of the visitors had just arrived in the UK, they had to contend with different teaching styles, culture, language, and a specifically different (Scottish) accent. Consequently, most visiting students may have been ill-prepared for immediate immersion in a team project. Observation of the conference sessions illustrated this point where the centrally positioned characters proved to be home students with visitors sitting peripherally. Communication was dominated by home students, even after several weeks.

Confirmation of this is provided through one visiting student’s comments:

*When the project began and teams were assigned, I was defiantly apprehensive about the project, worrying about what skills I could bring to the table, how my skills compare to those of different disciplines and how I*

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Key:

- HV: home compared to visitor within one centre
- HH: home compared to home between two centres
- VV: visitor compared to visitor between two centres.

mean x: (1)(2) F; (1)(2)U; (1)(2)FU

Table 2: Student distribution results for the data in figures 2-4
would factor in this module on top of an already mounting workload.

The local team based in Glasgow took a while to bond and to be able to relax in each other’s company. I feel this was due to each of the members own apprehensions about the course - like mine mentioned above - which were then coupled with cultural differences and language barriers, but as the project progressed the team soon formed a bond which was lucky as it made the project a whole lot easier if you can enjoy working with your team mates.

Within GCU, and particularly in the School of Engineering and Computing, there is a strong tradition of student support. Although this is particularly true for visiting students, the outcomes of this work would seem to indicate that more attention needs to be given to facilitating greater engagement in activities and learning initiatives not native to them.

### 3.2.3 Visitor mark lower with the USA

This is a particularly perplexing result but might be associated with team dynamics and two points are worthy of consideration. Firstly, GCU students in GCU-FI teams seem to have developed stronger coherence in light of communication problems and it may be that there was a greater imperative at GCU to cover all aspects of product development for which all local players needed to be equally engaged. Observation by staff and comments within reflective essays indicated that the Finnish element did not consider it necessary to supply intermediate (partial) information prior to a completed business plan at the end of the semester. Thus the perception on the part of GCU students was that everyone in the GCU component needed to play their part in collecting information. In contrast, USA teams seem to have been more forthcoming with partial information, reducing the need for GCU to collect business data. This may have resulted in lower drive for collective input, and hence engagement, in the GCU side: in other words, having 8 in the GCU component of the GCU-US team resulted in several members freewheeling under the perceived lighter workload.

The second consideration is that linguistic and social differences might also explain lower visitor marks. It is common in Europe to discover that continental team players find communicating in English easier if they are talking with another continental than with a British national, perhaps due to idiomatic usage in UK nationals. Therefore, it may be that the visitors found the Finnish students (comprising largely of Finns and Dutch whose English would be more correctly constructed) easier to understand than the USA students (whose English language would also be nuanced). Equally, the UK nationals might have found it simpler to engage with American English.
speakers, with whom there was a stronger cultural similarity. If true, it might be that visiting students find themselves overwhelmed with additional cultural and communication dimension from US teams and withdraw rather than interact. Those who had the opportunity to work with the Finnish members are more familiar with the European language style and communication nuances, e.g. from Finnish members, and are more comfortable and able to follow discussions taking place. For visiting students, the language challenge, with UK, US and Finnish members, combined with the challenge of new technology and a shortage of time for team-building across international boundaries, may have restricted full engagement.

3.2.4 Team mark different

An inspection of three boxplots for the three activities (Figure 5) shows the difference in team behavior of visitors for both business and technology. Even though team means are the same (Table 2), medians are quite different. The median, shown by the bar in the boxplot, indicates that, contrary to other observations, the Finnish cooperation fared poorly as compared with the US. As already observed, there seemed to be a more positive cooperation within GCU–US teams than within GCU-FI and since the virtual team model of Schmidt (2008) suggests that trust, motivation, identity, and performance are inter-related, it seems possible that the greater cooperation shown with the US partners provided visitors with a better insight into teamwork than the more difficult arrangements with Finland.

4  CONCLUSIONS

In this innovative three-way learning initiative, a number of interesting interaction effects having serious implications for preparing engineering and business students for global careers are uncovered. Students, both business and engineering, demonstrated considerable learning of transferable skills and some learning of technical issues within collaborating virtual teams. This programme initiative has demonstrated that multi-disciplinary teaching can be integrated in undergraduate curricula, to respond to changing skill needs and global work patterns.

However, the findings also highlight that learning objectives for such multinational initiatives need to be adjusted. First, academic and teaching faculty should clearly identify what skills are truly transferable in short learning engagements in virtual settings. Further, as teams become more culturally diverse, time devoted to team building, for instance through virtual socialization, may enable improved engagement of the larger student body. The challenge for educators then is to design a flexible, sustainable course offering that can provide rich enhancements to existing curricula.

5   REFERENCES


GOVERNING THE INTERNET TECHNOLOGY ADOPTION PROCESS FOR THE SMALL AND MEDIUM HOSPITALITY ENTERPRISE (SMHE)

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ABSTRACT

The SME sector makes a significant contribution to the economies of developing countries. Small and Medium Hospitality Enterprises (SMHEs) within the tourism industry are identified as a key component of this sector. Over the years the services offered by hospitality enterprises have remained relatively unchanged. Technology adoption is changing the manner in which business is conducted and SMHEs are no exception. Although technology has not yet been developed that will change the manner in which the core services are offered, technology does exist which can help SMHEs manage their businesses more effectively and efficiently. The Internet has created a global marketplace for SMHEs and has thus become an indispensable tool for not only marketing or communicating with consumers, but it also provides a platform for consumers to transact online. However, despite the advances in technology and in particular with Internet technologies, SMHEs are not effectively using these new technologies. The SMHE consumer now has easier access to technology which gives them access to information. For SMHE to compete they need to continuously identify ways to attract and transact with technologically aware consumers. This study sought to identify IT Governance principles which can be adopted by SMHEs as well as Information Systems (IS) success factors that will act as success indicators for SMHEs who implement technological solutions. The findings of this study led to the development of a model which acts as a guide when making the decision to adopt technology in order to improve SMHE competitiveness. This model is based on the examination of existing theories and models such as; the Delone and McLean IS success model [1], and the ITGI’s [2] IT Governance focus areas model. A review of related literature provided the theoretical foundation of this study and influenced the development of a research instrument. The research methodology included mixed methods which incorporated data from the literature survey, questionnaires and observations completed by SMHE owners. The findings of this study confirm the existence of a positive link between the use of Internet technologies by SMHEs and their competitive advantage.

1. INTRODUCTION

Internet technologies have redefined how business is conducted in many industries, and the hospitality sector of the tourism industry is no exception. Information technologies and web based advertising have changed how products are delivered to end consumers within this sector [3]. Technology has radically changed the efficiency and effectiveness of business organisations, the way that business is conducted, as well as how consumers interact with the business [4].

With new developments in the use of the Internet, that have seen more users retrieving information and transacting online, Small and Medium Hospitality Enterprise (SMHE) owner/managers can no longer ignore the Internet as a business tool. Internet technologies have the potential to help SMHEs enhance service quality, reduce costs, improve productivity, gain competitive advantage, and increase profitability. In the right conditions with the right partners the deployment of Internet technologies can help re-enforce the competitive position of small businesses [5, 6]. Three possible uses for the Internet in business can be identified, namely: promotion of business services, provision of information, and processing of business transactions [7]. However, the use of Internet technologies and globalisation has brought new challenges as well as new competitive opportunities for SMHEs [8, 9].

The deployment of any technological solution must be linked to the overall strategic objectives of the business. If a businesses’ strategy is aligned to client expectations and Internet technologies, this should
result in added value to the business [5]. The attainment of this alignment is crucial to the success of a business [10].

This paper examines the factors affecting the adoption of Internet technologies by SMHEs, and also focuses on the alignment of Internet technologies and business strategy.

2. RESEARCH PROBLEM AND OBJECTIVES

The problem identified is that SMHEs do not derive the full benefit from using the Internet as a business tool. Despite the increased promotion of the Internet, hospitality enterprises do not utilise the Web as an effective business tool [7, 10, 11].

This study attempts to establish that a positive link exists between the use of Internet technologies by SMHEs and their competitive advantage. Recommendations culminated in the development of a model that acts as a guide for SMHEs when aligning Internet technologies with business strategy in order to gain this competitive advantage.

3. THEORETICAL BACKGROUND

This section identifies factors that influence Internet adoption by SMHEs. The discussions include the relevance of the Internet to SMHEs, factors that affect Internet adoption by SMHEs, the alignment of IT strategy to business strategy, and finally IT Governance in the context of the SMHE.

3.1 THE INTERNET AND THE SMALL AND MEDIUM HOSPITALITY ENTERPRISE

The Internet is changing the tourism industry structure by altering barriers to entry, minimising switching costs, revolutionising distribution channels, and facilitating price transparency, while enhancing efficiency [4, 12]. SMHEs that want to compete in the current tourism market must embrace Internet technologies, specifically websites as a tool for conducting business. The Internet has opened doors for SMHEs not only in local but also in international markets. Internet is well suited for small businesses as it allows them to keep their doors open 24 hours a day to customers all over the world at reasonably low costs [13]. The following section looks at the internal and external factors that can influence the decision to use Internet for business.

3.2 FACTORS INFLUENCING INTERNET ADOPTION BY SMALL AND MEDIUM HOSPITALITY ENTERPRISES

The Internet plays a sizeable role in influencing the purchasing decisions of hospitality sector consumers. Consequently, due to its impact on traveller’s behaviour the Internet is perceived to be one of the most influential technologies [4], SMHE owners/managers are pressurised to adopt Internet technologies for business because consumers of hospitality products rely on the Internet prior to making the decision to buy, while processing the purchase transaction, as well as for post sale support. The next section introduces the Technological, Organisational, and Environmental model and its application to analysing Internet technology adoption in SMHEs.

3.2.1 Technological, Organisational, and Environmental Model

While consumers may play an important role in influencing SMHE owners/managers to consider Internet technologies as an option, Tornatzky and Fleischer’s [14] Technological, Organisational and Environmental (TOE) model highlights three aspects, which influence the process of adopting, implementing, and using technology: Technological, Organisational, and Environmental context. Other factors influencing the adoption of technology by SMHEs will also be discussed and categorised according to the (TOE model) framework.
This section continues and provides a detailed explanation of the model (Figure 1), starting with the Technological context.

**Technological Context**
In the above model Technology considerations include availability and characteristics. Perceived Usefulness [15, 16] and Perceived Ease of Use are technology related factors that SMHEs should also consider. The importance of using Internet technologies lies not only in the availability of a computing device or the Internet line, but rather in people’s ability to use them [17]. The characteristics [14] or features of the Internet technologies will influence the decision making process. The selected Internet technologies must aid the SMHEs’ to meet their business objectives.

**Organisational Context**
The organisational context refers to descriptive measures related to the organisation such as organisational scope, size and managerial beliefs [18]. Four factors linked to the organisational context of the model can be highlighted: organisational readiness, strategic decision aids, managerial productivity, and organisational support [16]. Whilst Scupola [19] focuses on top management support, CEO characteristics, employees’ IS knowledge and attitude, and resource constraints such as financial and human resources of the firm.

**Environmental Context**
“Environment context includes both the direct and indirect roles of competitors, industry associations, and the governments” Riyadh, Akter and Islam [20]. In the environmental context four factors are identified: industry, market scope, competitive pressure and external IS support [21, 15]. However, one additional factor namely, market scope can be included [21].

In summary, it is therefore evident that the TOE model [14] provides a well structured framework against which the Internet technology adoption enablers or inhibitors can be grouped by SMHEs. The TOE model can also help SMHEs gain a better understanding of the environment they operate in. The next section reviews the relevance of the aligning Internet technologies to SMHE business objectives.

### 3.3 ALIGNING INTERNET TECHNOLOGIES TO BUSINESS OBJECTIVES

SMHEs also exhibit the common characteristics of small and medium enterprises (SMEs) found across other business sectors because they are classified as small enterprises. SMHEs exhibit some positive business practices such as continuity, good employee relationships, familiarity with customers and prompt decision making; conversely, they often lack expertise in strategic management [22]. The importance of planning must be emphasised as it provides a sense of direction and clarifies management thinking [23]. However, time for planning in SMHEs is not always prioritised. Business strategic planning is not practised in SMHEs due to poor skills, limited resources, and manager/owner’s short term focus [10]. Developing a business strategy is important as it allows the owner/manager an opportunity to create a coordinated plan that ensures the efficient allocation of resources, provides direction for business operations, creates a shared
understanding of challenges and goals and provides a clearly defined means of identifying and evaluating resources [10].

Ward and Peppard [24] introduce a distinction between IS strategy and IT strategy. IS strategy focuses on the following business aspects: What information is required to ensure that business strategic objectives are met; or which information yielding processes within the business can be enhanced by using technology. On the other hand, IT strategy is concerned about identifying and planning for the acquisition and implementation of technological tools and the infrastructure needed to deliver on the outcomes stipulated in the IS strategy. In agreement with the distinction between IS/IT strategy made by Ward and Peppard [24], this study used the common collective term ‘IT’ to refer to IS and IT. Business/IT alignment is the process of developing and sustaining a symbiotic relationship between business and IT in order to gain a competitive advantage [25]. This alignment is also a fundamental pillar of the IT Governance model discussed below.

3.4 IT GOVERNANCE AND THE SMALL AND MEDIUM HOSPITALITY ENTERPRISE

The increased use of technology has created a critical dependency on IT, which necessitates that businesses pay specific attention to IT Governance [25]. IT Governance is defined as “the strategic, tactical, and operational model organisations put in place to govern their business activities and e-commerce initiatives” Molla [26].

ITGI [2] provides a definition although differing from other authors in its simplicity, is quite relevant for application to the SMHE context: IT Governance is the processes which ensure effective and efficient use of IT in enabling the organisation to achieve its goals.

Different authors have derived different models to try and put IT Governance in context. The IT Governance model this research project will analyse is from the Information Technology Governance Institute [2]. The ITGI model identifies five IT Governance domains:

![Figure 2: Five domains of IT Governance (ITGI, 2007)](image)

SMHEs characteristically have poor planning and strategic management skills. This section introduced five domains (strategic alignment, value delivery, risk management, resource management, and performance measurement) that can guide SMHEs in their planning. The next section focuses on the research methodology used in this study.

4. RESEARCH METHODOLOGY

Both qualitative and quantitative data collection methods were used for this study. The applicable data collection strategy used in this study is called triangulation when two or more methods of collecting data are used [32]. This study used both methodological and data triangulation as both quantitative, qualitative and literature methods and data collection instruments were applied to validate the results. Where the methods overlap application of triangulation is found.

The quantitative approach involved the use of closed questions in the questionnaire, and likert scale type questions. The questionnaire acted as a foundational source of quantitative information; in addition
qualitative data collection methods were also used. The qualitative approaches include semi-structured interviews and observation of respondents’ websites.

Overall this study was executed in six phases (see Figure 3 below). In the first phase theories and opinions from authors in the identified research area, were detailed and discussed. From the review of current literature, the existence of the identified problem is validated, fundamental principles which contribute towards the development of a proposed hypotheses or model are discussed, and benchmarks for Internet technologies that may contribute towards the improved performance or success of SMHEs are discovered. The literature review was structured in three parts: part 1 looked at the possible ICT adoption challenges faced by SMHE owner/managers; part 2 identified relevant Internet technologies that can be used by SMHEs; and part 3 reviewed models that can be applied to help solve the identified problem. Once the review of related literature was completed, phase 2 identified SMHEs in the Buffalo City Municipality. Once identified, the possible participants voluntarily participated in the study.

Phase 3 focused on the development and deployment of data collection tools that were used to answer the research question and to address the purpose of this study. This study used a multiple case study approach to collecting data. Several means can be applied for this purpose including: interviews, surveys, document analysis, observation, focus groups, and questionnaires [33]. For the purposes of this study four of these were used namely: questionnaires, observation, document analysis, and semi-structured interviews.

The final three phases take the study closer to the answers of the identified questions and the proposed model in the following manner: the fourth phase involved interpreting and evaluating the information and documented findings; the fifth phase, a model was designed to help the SMHE make informed ICT adoption decisions; the final phase (6) evaluates the relevance of the model developed in phase 5 against a panel of industry experts.

The phases highlighted in this research design are summarised in the figure below:

![Figure 3: Research methodology summary](image)

The next section discusses the findings and recommendations of this study.

5. FINDINGS AND RECOMMENDATIONS

Empirical findings

Section 1: Technological Context

In the Technological context three factors were mentioned namely; Availability, Perceived ease of use, and Perceived usefulness. The perceptions of the owner/managers based on their experiences using technology and how much value will be added to the business if technology is used, plays a vital role in the adoption of ICTs. Lack of availability or accessibility also has the potential to negatively influence the decision to invest in ICTs.

Availability:

In this section it was discovered that SMHE are currently supporting their trade activities primarily via; fax to email, email, Internet banking, and to a lesser extent online bookings, online payments, online database registration and search engine listing. The findings from the survey showed that respondents used the
Internet extensively for the Internet based services (e.g. fax to email, email) but the newer Internet technologies (e.g. Social Networking) were not used. On the other hand, the interviews revealed that although an SMHE’s owner/manager experienced some technology related challenges, these challenges did not impact on their ICT investment decision(s).

**Perceived Ease of Use:**
Though some respondents find learning to use the Internet and actually using the Internet difficult, they represent less than 20%. The overall impression is that from the respondents’ feedback nearly 50% find it easy to perform tasks on the Internet and at least 55% think that overall, the Internet is easy to use. If the decision to invest in IT was based purely on whether the owner/managers found it easy to use the Internet, only 55% of the respondents would invest in Internet technologies.

**Perceived Usefulness:**
An overwhelming trend indicates that a greater number of respondents are of the opinion that ICT generally has a positive impact on business tasks, activities, efficiency, and quality of work. The perceived usefulness of a product (Internet technologies) has a direct bearing on whether it will add value to the business. If the owner/manager is convinced that the product will add value (to any agreeable scale) to the business, then the purchase or investment in the product improves considerably. Overall 50% of the respondents think that ICT is a useful business tool.

**Section 2: Organisational Context**
In the organisational context the influencing factors, which can sometimes be overlooked include firm scope, size, and managerial beliefs. The most influential factor in the case of SMHEs is managerial beliefs. However, giving equal importance to the other factors within the organisational context such as organisational readiness, employees’ IS knowledge could also prove beneficial to SMHEs in the long term. In the case of organisational readiness, careful consideration must be given to the type of resources already existing within the organisation, as well as, additional resources required. Employees’ IS knowledge can help to create a supportive environment or alternatively a frustrating workplace environment if employees have limited IS knowledge and no training is made available.

Figure 4 below shows a general consensus on the importance of issues such as *planning, strategy, active involvement in business,* and *having a clear business direction.* With 93% of the SMHE owner/managers agreeing or strongly agreeing to the statement that *ICT is a part of the business strategy,* the lower adoption rate of Internet technologies is uncharacteristic. If the owner/managers understand the contribution ICTs can make to their businesses, the slow pace at which SMHEs are adopting Internet technologies must be attributable to other factors.

![Figure 4: Organisational context influencing factors (1)](image)

The feedback (Figure 5) from the respondents strongly (only 10% disagreees) indicates that the SMHE owner or managers agree in principle that prior to implementing an ICT solution both negative and positive consequences as well as how potential benefits will be measured, must be considered. They also agree that it
is important to ensure that ICT tools are used for their intended purposes, with only 3% finding this slightly important.

![Figure 5: Organisational context influencing factors (2)](image)

Section 3: Environmental Context

External factors to some extent have an influence on the decisions made by the SMHE owner/managers. This section addressed some of the common considerations identified by the authors of the literature reviewed. Owner’s own experience is determined to be the most influential factor, with 95% of the respondents finding the owner’s experience as important/very important when making ICT investment decisions. At least 78% of the respondents also found recommendations made by ICT companies as important/very important. Eighty three percent classified Laws and Government as important/very important, and what their competitors were doing as important/very important to 76% of the respondents. Customer needs are important/very important in the case of 90% of the SMHEs. Eighty eight percent of the responses showed that it was important to consider the staff’s ICT capabilities, as well as affordability prior to investing in ICT.

This study found that although some SMHEs have business websites, there is very little diversity as far as Internet technologies are concerned on these websites. This could be attributable to two factors indentified in this study, the low level of formal Information and Communication Technology (ICT) skills of owner/managers and SMHE owner/managers’ dependency on the guidance of ICT vendors/intermediaries. It is recommended that SMHE owner/managers identify sources of current ICT information (e.g. tourism industry publications, tourism industry regulators) to ensure that they are aware of relevant technological developments. The ICT information will help decrease the level of dependency on intermediaries. Additionally SMHE owner/managers have to invest in personal ICT up skilling for themselves and their employees. To reduce the risk of ICT failure, once the technologies are implemented the staff must be trained to ensure they are comfortable with using the technology.

The findings of this study also revealed that although SMHE owner/managers in principle acknowledge the importance of planning, in practice they do not implement this in their own businesses. It is also recommended that SMHE owner/managers incorporate planning as part of other business activities. Proper planning will help to clearly define the objectives of the business and thus make executing tasks to ensure objectives are met, easier. Prior to selecting Internet technologies SMHE owner/managers need to clearly identify how the technologies will assist towards meeting the objectives of the business (IT strategy).

It is further recommended that SMHEs ensure that Internet technology investment initiatives are aligned with business objectives. The analysis of data led to the development of the e-commerce success model for SMHEs [34]. Discussed in the next section, this model provides a guide for how SMHEs can achieve this alignment.
5.1 E-COMMERCE SUCCESS MODEL FOR SMALL AND MEDIUM HOSPITALITY ENTERPRISES

The e-commerce success model for SMHEs (Figure 6) can be used by SMHEs to derive value from using Internet technologies. The e-commerce success model for SMHEs systematically displays how the components (Information quality, Systems quality, Service quality, Intention to use, Use, and User satisfaction) identified in Delone and McLean’s IS success model [1], can interact with the components (Performance measurement, Resource management, Risk management, Value delivery, and Strategic alignment) highlighted in the ITGI’s Five focus areas of IT Governance model [2] to achieve alignment between the SMHE’s Internet technology adoption process and business objectives. The additional component (Influence of the owner manager) unique to the SMHE context is represented in the model as having a direct influence on the businesses’ strategic alignment. The influence of the owner/manager is crucial to the successful implementation of Internet technologies in SMHEs. The owner/manager’s influence is shaped by the following factors: Perceived ease of use, Perceived usefulness, Formal ICT training, Level of involvement, and Clear business vision. The model implies that if the customer services offered are enhanced by technology, and the SMHE owner/managers have a clear strategy for the business ensuring that any investment in technology is aligned to business objectives, a competitive advantage can be enjoyed by the SMHE.

6. CONCLUSIONS

Internet technologies have altered how SMHEs operate their businesses and communicate with consumers. However, the low rate of Internet technology adoption by SMHEs can have a negative impact on business efficiency and effectiveness. The e-commerce success model for SMHEs (Figure 6) acts as a guide for SMHE owner/managers when aligning Internet technologies to business objectives. The model suggests that with any technological tool or gadget the owner/manager must first identify what the business objectives are, and secondly answer this question: “Will this technology tool help the business meet the identified business objectives”? In addition, the model proposes that in order to ensure that ICT value is optimised owner/managers have to recognise the influence they exert over the strategic alignment of the business. Value will be enjoyed from technology if IT strategy is aligned with business strategy. The owner/managers of SMHEs are the custodians of business strategy. The model depicts two main drivers of strategic alignment in an IT Governance context namely, influence of technology (based on results from using technology) and the influence of the owner/manager (based on owner experiences and knowledge). Internet technologies have become an accepted and some may argue,
essential component of business. Careful consideration of all components of the model prior to investing in Internet technologies will create a competing advantage for SMHEs.

7. REFERENCE LIST


THE GAP BETWEEN UNIVERSITIES AND BUSINESS - CAUSES AND EFFECTS - ENVIRONMENTAL ENGINEERING EDUCATION IN ROMANIA

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ABSTRACT

The paper reflects problems faced by those involved in Environmental Engineering education at "Lucian Blaga" University of Sibiu (LBUS), Romania and improvements required and instituted to improve curricula and student entrepreneurial skills.

Environmental Engineering is a relatively new field of study for Romania and the Sibiu region. In this century of speed it is vital to constantly update information, to learn and teach up to date trends in technology and practical approaches. The main objective was to educate modern specialists in this field and also to try to make them conversant with European problems involving environmental engineering and its place according to European Union legislation and standards. This study evaluates industrial engineering and environmental protection curricula of a four-year bachelor degree.

Traditional teaching with its lack of practical knowledge and tenuous links with industry creates major issues for graduates such as unemployment and few practical skills required to develop business acumen. Moreover, the ongoing changes in legislation, not only on environment issues, but also to fall in line with EU legislation in education, have led to chaos in both the Romanian education system and compromised graduates' futures.

To make a difference and resolve Romanian environmental problems it is necessary to go further than simply completing courses at university. It is necessary to alter the mentality required for both students and teachers.

The objectives of this paper are: To identify cause and effect of the gap between universities and industry, to build bridges between universities and socio-economic environments and to apply efficient methods to develop entrepreneurial skills for students involved to apply to environmental engineering and sustainable development.

The manner in which problems were identified, using cause-effect analyses, tools and solutions are presented in this paper. Successes and what remains to be gaps hard to be cross are investigated are focused upon. The most suitable way to assist the environmental engineering field to develop is to strengthen links with foreign universities especially those with better experience in the main fields. A glance at teachers and student mobility discloses remarkable results. On one hand, companies are more interested to become involved in education process to attract skilled graduates. Such strategy comprises the three essential components: Scientific, academic and teaching methods.

New avenues to face entrepreneurial challenges have been identified to optimally prepare students to meet the challenges faced by sustainable development and environmental issues.

1. INTRODUCTION

The university education of engineers and technicians faces a dilemma. On one hand there is a strong demand from society to enforce interdisciplinary and systems thinking to master intricate interaction between technology and society and between technology and the physical and biological environment, locally and globally. On the other hand, there is a similar need and demand for specialists able to penetrate complicated physical, societal problems and sub-systems inherent in the global integration of all facets of society and
technology, and the environment. The greatest challenge faced by educational institutions worldwide is to master and meet needs in a rational, structured, and stable manner. Sometimes, educational systems begin to swing from one extreme to another in outlook and approach; however education, usually conservative, is slow to change. This often, therefore, fails to keep pace agree with the faster changes made by society, thus education lags. The consequences of that for society may be catastrophic [1].

2. ENVIRONMENTAL ENGINEERING EDUCATION

Education is an essential tool for achieving sustainability. Society now recognises that today’s economic development trends as unsustainable, public awareness, education, and training are key to moving society towards sustainability [2].

Today, environmental issues affect almost all commercial and industrial sectors. They are a central concern for the public, governments, even international relations. There are several universities in Romania offering various programmes related to environmental science and engineering, but alas the syllabuses of most remain traditional.

Romanian research is, however gradually making progress in the waste field. There the role is to support and streamline local and central authorities programmes and have them put into action waste management systems similar to Europe’s best. A central authority level, there are two national research institutes subordinated to the Ministry of the Environment (The National Institute of Research and Development for Environment Protection – ICIM Bucharest and The National Institute of Research and Development for Industrial Ecology – ECOIND) these include laboratories and special sections for research in the field of waste management technology.

The role of these research institutes is to scientifically evaluate and put into practice, based on national statistics and national reference data bases, governmental and local adopted strategies, as well as to monitor implementation of the agreements signed within the treaty when joining the European.

Waste management is a difficult and complex problem in Romania and is far from meeting the environment rules of the European Union. The worsening problem of waste, especially domestic waste is, generated by a significant increase in quantity, its mixed nature and by the inappropriate way different stages of waste processing are handled, probably because of the lack of a structured waste products market in Romania.

This aims to create a new generation of environmental entrepreneurs possessing skills to face them to launch fresh ventures, products, and technologies to address environmental and natural resource problems, to develop management, consultancy, engineering and technology professionals who would like to a refocus their careers within environmental entrepreneurship.

3. UNIVERSITY AND BUSINESS COLLABORATION - OUTCOMES AND IMPACTS

The collaboration is [3]: “A mutually beneficial and well-defined relationship entered into by two or more entities to achieve results they are more likely to achieve together than alone.” Successful collaboration includes several key elements. Collaboration should [3]:

- Be mutually beneficial - successful collaboration usually includes a “win-win” situation;
- be a well-defined relationship - successful collaboration usually includes congruent expectations of all participants in terms of roles, guiding values and end-in-mind;
- include multiple entities - a successful collaboration recognises the value of different perspectives and the importance of allowing for those differences; and,
- achieve results together un likely to be achieved alone - collaboration is work in and of itself. For it to be worthwhile, collaboration needs to result in greater benefits than costs, the whole is greater than the sum of the parts.

University researchers have collaborated with industrial scientists on marketable projects. News coverage at the turn of the 21st century might lead one to believe this is a new phenomenon. Traditionally, industry sought partnerships with universities as a means to identify and train future employees. As global economies
shifted, companies wanted access to an institute of learning which created the cutting edge, knowledge and
technology, something central to university research. But such knowledge creation and technological
development required considerable capital investment, historically provided by government [4].

Interdependent research relationships between universities and companies enables both to sustain growth in
their own areas. When studying the manner the environmental engineering field at LBUS began and
developed during the last four years, it was possible to identify curricula weaknesses, along with the need to
stress practical activity instead of theory, threatening to suffocate the entire curricula. This was identified as
the result of inadequate laboratory equipment or lack of both equipment and funds. The solution was to open
a strong dialogue with the business community by applying for joint projects. Such an example is
collaboration with the Regional Agency for Environmental Protection, Sibiu and that provided more positive
results than anticipated.

Examining information presented in Figure 1 it appears some problems and effects are without solution but
many have been solved. Crowded curricula, for example, have been improved and adapted to LBUS partner
universities hosting guest lectures, student exchanges and course content updated. Nevertheless, credit points
system remaining correlated with other universities –both Romanian and European Union systems so
students are unable to continue studies abroad or find themselves adequate employment.

Another identified issue pinpoints poor laboratory equipment. Co-operation with companies allows some
practical activity inside industry, but the number of students and the time spend at companies is minute. A
project for practical study joined by LBUS this year appears to solve that gap, providing funds for such
activities.

Legislative education and environmental protection, in a state of flux is negatively affecting the entire
system. Developing Masters courses, diploma and projects on environmental engineering will provide
exciting research results and a possibility for future graduates’ integration. While companies rely on
university researchers for product innovation, faculty gains prestige through increased external research
funds [5]. Just as industry requires innovative ideas to ensure profits, so researchers need additional research
funds to sustain the added value of the faculty.
4. CONCLUSIONS

There are many benefits that derive from university-industry relationships providing benefits for society, universities and companies.

Social benefits: Society benefits from university-industry research relationships through innovative products and technologies; industry-sponsored university research often develops into practical applications to benefit society. Universities are encouraged to demonstrate the impact of their research; university links to business companies allows for creation of research consortia.

University benefits: Interaction with industry are clear. Attention must be paid to the benefits that accumulate to a university. Some universities seek industrial partnerships because of the potential financial rewards of patents and licenses emanating from the commercialisation of academic research. This provides a means by which universities can narrow the government funding gap. Patents generated through industry-sponsored research are sometimes, shared between companies and universities. The aim is for the university to use patent revenues to support non-market orientated activities, such as the teaching mission of institutions, highly specialised research and test facilities.

Company benefits: University-industry collaboration can stimulate companies' internal research and development programmes. University researchers assist industrial scientists identify current research that might be useful for the design and development of innovative processes and potential products. This first look at cutting-edge research gives companies a competitive edge as it decreases time required to move a potential product from the laboratory to the market, strengthening international economic competition [6], [7]. Excellent researchers teams are constantly refreshed with new talent, networks and knowledge of international cutting edge research, ideas and innovation of all kinds – freed from industry mindset.

5. REFERENCES


RE-CURRICULATING: CAN AN ENGINEERING LECTURER CONTRIBUTE TO MEET 21ST CENTURY AFRICA’S CHALLENGES?

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ABSTRACT:

Sub-Sahara Africa faces great challenges in harnessing its resources for the benefit of its people in an increasingly competitive world. Other problems notwithstanding, lack of understanding of engineering - and failure to deploy modern technology - are arguably the root cause of these challenges. Africa’s engineering education institutions are therefore obliged to be epicentres of transformation of supply chains - and consequently - of ways of people’s lives. The institutions however, have their own well documented problems. I review these and point out others. It is argued that solutions to some can come from within the academics and institutions with or without government help. Problems on curriculum, textbooks, society expectations, student motivation - among others are addressed. To enhance student’s future competitiveness and sensitivity to the continent’s socioeconomic challenges, dynamic flexibility in curriculum formulation and implementation is proposed. I illustrate this with a student participatory example in an Applied Thermodynamics course taught over the past three years. Students were taken through two projects: first on normal Thermodynamics theory using a Problem based learning model and later on different entrepreneurial applications of the subject matter employing Project Based Learning techniques. By analysing the student responses in one particular semester, it is shown that the approach can indeed help hasten learning of engineering, and be used as one of the means to help transform Africa’s supply chains, and hence her people’s lives. I end with sets of recommendations to various university based stakeholders: the students – who need to be adaptive to rapid changes in curricula; their lecturers – who must adopt flexibility, seek industrial exposure, exploit the technological vacuum and write suitable books; the universities – who need to re-examine their policies in line with relative values of teaching, research and society service at this point in time.

Key words: Engineering curriculum; Engineering education; Thermodynamics course; Africa’s challenges; Problem Based Learning; Project Based Learning.

1. INTRODUCTION

It is a well-established fact that socio-economic development and transformation of a country largely depends on the means of production and level of Technology deployment in that country [1-3]. Whereas people in developed countries take use of machinery in their supply chains for granted, the majority of those in developing countries largely depend on muscle power and/or vagaries of nature. This in turn, affects the socio-cultural outlook of the latter. In sub-Sahara Africa - where over 800 Million or more than half of the world’s poor live [4], - it is common to find even educated people intimidated by use of machinery - let alone the application of the natural sciences to engineering design to solve many of their problems. In interaction with engineering students, academics and professionals in West, East and Southern African countries over the last 30 years for example, it has been noticed that the majority still regard innovation and creativity in Engineering and Technology as a preserve of the developed world. To illustrate: In a 1989 management conference at one of the companies the author worked, a suggestion to research and develop a local organic based fertiliser for the company’s major crop was flatly rejected on grounds that: “All research has been – and still will be - done in Europe”. Then, from 2006 to 2010, of the 1338 multi-cultural/nationality students taught at Diploma, BTech and BEng levels, in the Southern Africa region, 977 of them – or 73% - thought engineering was primarily a western profession. Further, 2009-2010 discussions with some colleagues on need for special engineering textbooks tailored to needs and experiences of African economies and students have yielded responses like: “Will those books match the traditional western ones?”, “Is the Technology level in Africa high enough to give good content in the books?”, etcetera.
Urges for transformation of African economies from rural-peasant to developed-modern have been the concerns of various governments since political independence of individual countries e.g.[2-3, 5-8]. Whereas it is commonly believed that the people of a country are its greatest resource [9-10], it can be argued that in a competitive world, this is true only if a critical fraction of those people is skilled enough to transform the supply chains. Empirical evidence – as presented by Lawless [11] and cited by Case [12] suggests that fractions of people in engineering professions correlate closely with this transformation. For example, while the ratio is well below 0.1% for developing countries, it is one to two orders of magnitude higher in developed countries. Thus, while Case reported percentage figures of 0.26, 0.32, 0.33 and 0.82 for US, UK, Japan and Norway respectively, Kanyarusoke [13] reported a 2006 figure of 0.04 for South Africa - the undisputed technological leader on the continent. As of end 2010, approximate registered figures for three of the relatively ‘more developed’ East African nations were: Kenya - 0.017; Tanzania – 0.006; Uganda – 0.005.

Bokova [14] advises that 2.5 Million new engineers and technicians are currently required in sub-Sahara Africa if millennium development goals (MDGs) on clean water and sanitation are to be achieved by 2015! Yet to address the entire supply chains problems on the continent, there are even more crucial skill needs in areas of energy, infrastructure, resources management and education! Clearly, the task for Africa’s engineering education institutions is both urgent and ominous. And the institutions face serious problems in meeting this demand. While many problems originate outside the institutions, others are from within. In this paper, we focus on one area – curriculum. Even there, we concentrate on efforts a lecturer within an institution can make to help accelerate curriculum redevelopment and implementation processes.

2. CURRICULUM

There are many definitions and outlooks on curriculum. All incorporate a mention of content of the course a learner gets in an institution. The website http://www.wisegeek.com/topics/curriculum.htm [15] defines it as “an integrated course of academic studies”. Kelly [16] stresses inclusion of “the overall rationale of the educational programme” within the definition. Smith [17] developed Kelly’s earlier definition into four outlooks: the content or syllabus; the process of transmitting the content; the focus on actions to enable the learner make prudent decisions; and the Learner outcomes achievements. For the case reported in this paper, the working definition used was: “a plan of ordered experiences students will have over a period of time so as to achieve predefined outcomes” [18]. Here, we will concentrate on the desired outcomes and the experiences of students when with the lecturer.

The broad outcomes of an education programme are normally defined by the national government through statutory bodies. To illustrate, in Uganda – East Africa, this responsibility falls on the National Council of Higher Education while the Council for Higher Education (CHE) through its Higher Education Quality Committee is the corresponding body in South Africa. The outcomes are then interpreted at institutional level and used to define aligned goals coherent with the institution’s mission. All these efforts are however of little effect without the lecturer’s professional input at departmental level. It is here that the influence of engineering professional bodies – like Engineering Council of South Africa (ECSA) or the Uganda Institution of Professional Engineers (UIPE) or similar national body – is realised - through the lecturer’s mandate to implement the curriculum. It is therefore only logical that the proactive lecturer will not just implement: s/he will also seek to influence formulation and evaluation of the curriculum. However, to do so effectively requires a clear understanding of society’s and industry’s expectations of the graduates’ abilities. Unfortunately, this is an area where many engineering academics are not all entirely agreed!

Griesel and Parker [19] reported a prevalent lack of common understanding between South Africa’s academics on one hand and the engineering practitioners in industry on the other. Kanyarusoke [20] reported and argued against opinions by some academics on roles of university dons in enabling graduates to quickly settle in industrial careers. Excuses like: knowledge versus experience creation; basics versus details imparts; and worst of all, role of genetics on essential behavioural attributes were exposed for the fallacies and obscurantism they portrayed.

In a study on how University of Cape Town (UCT) chemical engineering graduates felt about their undergraduate training, Case et al. [21] reported gaps in: management, interdisciplinary and practical skills.
Specifically on the latter two, a number of respondents were greatly concerned that while what they studied at UCT prepared them very well for analytical work and lifelong learning, most of it was at variance with the day to day routine of having to work with mechanical and electrical engineers and of managing big machinery. In a 1995 to 2001 author’s experience at a leading Foods and Chemicals company (from a supervisory standpoint) and subsequent consultation work in East and Central Africa, some of this was noticed among Chemistry and Food Science fresh graduates from the regions’ universities. However - though still not up to industry expectation - engineering graduates from University of Nairobi seemed better prepared in practical aspects. Those from Makerere appeared to have had better preparation in business appreciation and entrepreneurship. It would therefore appear that engineering faculties across the continent have several things to learn from each other as they re-curriculate.

3. CURRICULUM CHALLENGES FOR ENGINEERING EDUCATORS IN AFRICA

Falade [22] described engineering education as dealing with training engineers for purposes of initiating, facilitating and implementing technical development of a nation. Kanyarusoke [18] defined it as “The Teaching and Learning of Applications of the Physical Sciences to the service of Man”. Whatever definition is used, engineering education on the continent faces challenges – many of which are well documented. Falade [22] listed nine major challenges facing Engineering Education in Africa. Central among these was the issue of curriculum. It was reported to be based on foreign models and completely inappropriate for Africa. Earlier, Aderoba [23] had shown Nigeria’s engineering curricula not only to be wrong for Africa, but also out-dated - in countries from where they were adopted - US and UK. To make a precarious situation worse, Falade pointed out the poor implementation in part due to: lack of relevant text books; sufficiently trained academics and experienced support staff; inadequate funding and obsolete facilities. To illustrate, he reported the average equipment age in selected universities’ workshops and laboratories to be 15.8 years at the time.

Owolabi and Rafiu [24] added the over-ambitious desires of government(s) to grow economies beyond what was realistically possible. For example, they calculated that Nigeria’s target - of being among the G20 by 2020 - could only be achieved if its economy grew by at least 13% annually between 2009 and 2020! As if to vindicate their pessimism, the GDP growth rate in 2009 was 5.6% [4]. Oryem-Origa and Hannington [25] emphasized the lack of science/engineering facilities not only at tertiary level but also at high school and lower levels. Fraser [26] on the other hand, added the interesting issues of low numbers of women in engineering and insufficient Quality Assurance.

All these reported problems are exogenic to universities. Their solutions seem to be expected only from governments. There are underlying requests to governments: “Provide enough funds to engineering faculties/schools; Pay engineering academics and their support staff well; Rid countries of insecurity, corruption and social-political upheavals ------.”

Obviously, African governments must make more serious efforts to address these concerns. But can the academics contribute to solving some of these problems? Or are there other challenges not mentioned – which the African engineering fraternity in general can help face - with or without government support? The author’s response is a Yes for both questions. For example, curriculum is largely their responsibility; Problems of suitable text books can almost entirely be solved by academics in collaboration with practicing engineers. On the other hand, there are challenges of diversity within the lecture rooms – especially in Southern African universities – which can be exploited by academics to enrich teaching practices and improve Learning e.g. see [18]. Failure either to recognise or to cater for different learning styles among students in a class room so as to increase interest and learning are squarely in the lecturer’s ‘court’. It often happens that the ‘highest flyers’ academically are employed to teach engineering – but this does not necessarily mean these are the best prepared to do the job! Hence the general observation by Felder and Silverman [27]:

“A class in which students are always passive is a class in which neither the active experimenter nor the reflective observer can learn effectively. Unfortunately, most engineering classes fall into this category.”

The general insecurity and state of underdevelopment in many countries provide numerous opportunities to both academics and practicing engineers. Then, are issues of: bureaucracy, inertia and general red tape in
university administrations. Official changes in curricula always take longer to approve than technology and industry outside campuses take. Two examples suffice here: First in Engineering Drawing. Whereas industry has long moved from manual drawing offices through computer aided 2D drafting, 3D CAD to 3D CAD/CAM – and wants graduates with these skills, a survey of African universities engineering curricula on the net revealed a miniscule proportion of time spent on the latter – even in slightly richer countries like South Africa and Botswana! In Energy, again, many curricula do not seem to respond fast enough to the need to sensitise all engineering students (irrespective of discipline) on the crises and opportunities in this area. ‘Renewables’ - in many cases are reserved for post graduate - or undergraduate electives at best.

4. FACING THE CHALLENGES

World over, in trying to better prepare students for industry, researchers have suggested some solutions to these challenges – as they are not necessarily unique to Africa. In the US for example, a model of Industry Fellows has been suggested and tried [28]. This involves practitioners in industry who, along with a full time academic, co-offer a course in the class room. Although there are few such people with both necessary teaching skills and spare time in industry, he concluded that this can be a better option than other alternatives. Other methods used even locally include [18, 29]: student internships, industrial visits by students during term time, use of guest speakers from industry and use of case studies.

Case et al. [21] recommended integration of technical and non-technical skill building in the curriculum. Aderoba [23] was even more forthright when he said: “Skill is best imparted when theoretical foundations are being laid”. He proceeded to succinctly list what a freshly graduating mechanical engineer should be able to do. Among these were: basic design of transmission systems; basic manufacturing of parts; diagnosis and repair of faults in common household and industrial equipment; appreciation of business and of people management, etc.

Woollacott [30] on the other hand reported a “Conceive, Design, Implement, Operate” (CDIO) approach to curriculum review in South African universities. In this approach, emphasis in the classroom would also be put on developing engineering competencies instead of concentrating on the traditional engineering science, mathematical modelling and analysis only. It is not clear however, after four years, how many South African universities have adopted the approach if at all.

Whatever approach is used in addressing the shortcomings of today’s engineering curricula, the issue of available time to cover the ever expanding areas of knowledge in an era when a big fraction of young, bright, fast learners is being attracted to other areas like Human Medicine and Commerce/Management will continue to trouble the curriculum redesigner. In Mechanical Engineering forexample: how do we ensure our graduates grasp the basic engineering science principles and then learn the meaning of money, appreciate human relations, safety and ecological balance issues; then be able to design, select, coach others to operate and maintain equipment within a four to five year period? This - at a time when many countries on our continent have done away with the Advanced level pre university education. For the proactive lecturer, I wish to suggest and demonstrate a flexible approach that shorts the bureaucracy without upsetting internal political dynamics and integrity of the university.

4.1 DYNAMIC CURRICULUM REDEVELOPMENT

The case being reported is that of *Applied Thermodynamics 3*, an exit level course at Diploma level – and a pre requisite to other applied Thermo-Fluids courses at BTech level. The course follows Introductory Thermodynamics. It covers applications: namely - power and process plants, engines, compressors, refrigeration systems, heat transfer, etc. The course content – like many others in engineering – follows established texts. Classic textbooks cover both courses in a rather academic way. The essential practical details – especially as required by a technician and technologist are omitted. This is one of the reasons students gladly sell off the books and give/lose their notes after ‘passing’ the courses. Even for Engineers, the material is not adequate to design most of today’s profitable systems. So, essential elements – as judged from an industrial perspective - needed to be introduced in *Applied Thermodynamics 3*. But these were so many that it was impossible to accommodate all and still retain the credit level of the course. Therefore, it was decided to keep the basic structure but emphasise specific new aspects in the class room each semester.
Outside the classroom, the students were to be given two competitive and assessable group projects that would help build other areas. In this way, the following elements are incorporated in the course without having to go through the whole process of formal curriculum:

- Equipment selection (e.g. compressor purchase);
- Plant installation (e.g. steam line layout);
- Plant operation (e.g. air conditioning units operation);
- Assets care (e.g. MV engine dis assembly/reassembly and general maintenance);
- Engineering entrepreneurship (see second project below) etc.

The key point here is that formal teaching of these is tied to the parent ‘traditional’ topic and not all have to be covered in a semester. Over a period of time however, there will exist a pool of graduates in the field which will have been exposed to almost all the essential skills to make supply chains cost effective. This is what I have called dynamic curriculum redevelopment.

As is to be expected from the foregoing, each semester has its own unique additions to the ‘traditional’ material. Here, I give a 2009 second semester case – some of whose students have now come back for BTech. In class we added centrifugal compressor selection, uprating, installation and maintenance. On internal combustion reciprocating engines, we added diesel fuel systems (including small scale biodiesel manufacture) – pumping, heating during cold starts, maintenance and repairs, etc. The first project work consisted of case studies on pressure systems and industrial safety across the globe (Whale explosion in Taiwan; Chemical reactor explosion in Uganda and a boiler explosion in USA). Apart from motivating deep learning of engineering science and safety principles, it was designed to achieve the following:

- Introduce students to teamworking across different cultural and gender divides
- Motivate continuous learning by forcing students to get vital data from diverse sources
- Introduce a spirit of team competition – vital in today’s business environment
- Train students in written and verbal communication
- Introduce them to the art of judging colleagues – vital in their future roles as supervisors

The second group project was primarily about setting up a small engineering business related to one of the thermodynamics devices studied in class. This time round, students were allowed to pair up first. Then, the lecturer randomly formed groups of 3 pairs to constitute business units of 6 individuals each. This partly answered some student concerns from the first project feedback and introduced some realism (in business, people tend to partner with those they know well) while maintaining the desired diversity. Before embarking on business planning, the groups did some practical work on reverse engineering a device. They inspected and took key measurements of essential dimensions of the device and its parts. They reassembled it and proceeded to compute operating thermodynamic parameters. The devices were: A petrol engine (2 different makes), a reciprocating compressor and an ice making machine. It is at this stage that they were required to form business units. The units were free to decide on whatever activity they wanted to venture into about the device: e.g. servicing of its parts, simple trading, testing, manufacturing, etc. All that mattered was that they chose a potentially profitable course of action about the device. They prepared a business plan which they presented to the class at the end.

### 4.2 STUDENT FEEDBACK AND DISCUSSION

As is typical of CPUT classes, this group was a multicultural, multi national mix of students from different economic backgrounds. There were 84 students of whom, 6 were female. Twenty one of them were employed – and so studied as part timers - though they were grouped with the main day class. The instructions in the assignment brief were that the chatting facility in e-learning was to be used as much as possible. The structuring of the individual reports were such that students felt assured they could give own opinions without fear of any penalty. As a result, after the first project, while 60 (about 71%) had found working with “complete strangers” an extremely rewarding experience, a few had misgivings about being grouped with those they called “non performers” or “lazy characters”.

The responses after the second project were striking in their lack of negative expressions. A number of students reported to have developed potentially permanent friendships across international borders and cultures. In terms of teaching and learning improvement, here in Figure 1, I reproduce two responses: with names deleted for confidentiality reasons:
The benefits of the approach are too obvious to belabour to explain here. However, there are issues one needs to bear in mind when embarking on it. First, is the lecturer’s exposure to industrial practice: this helps put existing text book work in proper perspective. Secondly, a search for exciting and relevant case studies is a must. With internet, this looks easy but the challenge is to configure that work and put it just within the scope of the student’s ability at this stage. Third is the issue of a fair balance of student’s time with other courses. These projects tend to be so exciting and so involving to students that a risk exists for other courses to receive unfair attention – with result of underperformance in those courses. Fourth can be the issue of multi campus – multi lecturer coordination. The challenges here must never be underestimated because we all have different backgrounds and motivations to work. It helps if a ‘more than’ formal working relation exists between the lecturers. Fifth, for the second project, is the issue of a sufficient number of old/disused devices. Because of student numbers, there will always be a need for more devices – and for close coordination of groups’ turns at the units. A 2011 first semester modification was - sending the students to outside workshops for part 1 of the second project. One company was so pleased with this action that it donated a screw compressor and a reciprocating compressor cylinder head to us. This means there is goodwill out there - which can be used to enrich teaching.
5. RECOMMENDATIONS

First to fellow lecturers:
• In addition to noting and acting on the above five challenges, seek to exploit the vacuum created by lack of suitable texts in your area. Look beyond your national borders for potential markets. The whole of sub-Saharan Africa is yearning for books that will address its rather unique engineering challenges both in lecture rooms and in industry.
• Opportunities abound in the chaos created by insecurity, corruption, backwardness and an extremely low technology base on the continent. Sub-Saharan Africa is virgin territory for innovators and inventors. Seek to exploit your privileged academic and professional training and access to young, bright sons and daughters of the continent to solve some of these problems profitably.

To university administrators:
• Rethink the whole process of curriculum redevelopment with a view of hastening it in light of rapid changes outside university gates. As of now, some changes initiated long ago may be being overtaken by events!
• Introduce and enforce a sense of urgency especially within support departments far removed from the student’s learning experience.
• Re-examine your lecturer recruitment and promotion criteria. What does your recruit bring to the lecture room? If it is ‘reciting’ or even paraphrasing text books, then who can’t? If it is number of publications, then of what impact or relevance to sub-Saharan Africa’s challenges are they?

To students:
• Ours is a dynamic profession. Even in the same subject, what was relevant last semester may no longer be as important this semester. Learn to adapt to these changes and work hard to finish your course before some of what you studied in earlier years becomes stale knowledge!

6. CONCLUSION

In this paper, it was pointed out that Africa’s problems stem from a low technology base. Therefore engineering academic institutions are effectively ‘on the spot’. The institutions have both exogenic and endogenic problems. Previous researchers tended to emphasise the former (is it because they were academics themselves?). Here, I have added a few of the latter. Inertia on part of academics to write suitable books – even if it were to be on a cooperative transcontinental venture basis; lack of innovativeness in using opportunities availed by the underdevelopment; bureaucracy and red tape at the campuses; relative insensitivity as to urgency for action in non-academic departments; and perhaps a disoriented, conservative lecturer recruitment/promotion system are some of the endogenic issues within these campuses.

Amidst the bureaucracy of curriculum review - to try to cope with changes in industry - I showed how a motivated lecturer can help hasten the process. Variable small changes within the latitude of her/his authority can – in the medium run ensure availability of a pool of essential skills in the labour market. Not that the age-old practice of pupilage in industry and requirements by professional organisations like ECSA on members to pursue continuous learning will stop. Rather, the realisation that industry tends to train people only in areas specific to its core operations means two things: one – we should not expect it to compensate for shortcomings in previous formal training; and two - it tends to limit skill mobility. It is therefore necessary to introduce these skills and competencies at university level. In this way, we would contribute more positively in helping the continent transform its supply chains.

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STRATEGIES FOR COMPETITIVE UNIVERSITIES
CONCEPTION OF NEW INTERDISCIPLINARY COURSES – MASTER OF BUSINESS ADMINISTRATION “HEALTH CARE MANAGEMENT”

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ABSTRACT

Three considerable issues mark the demographic change in Germany: The overall decline in population, a diminishing birth rate and an aging population challenge politics and business alike. Current areas of activity include the adaption of working conditions to the aging staff, company health management, and the offers for preventive and health-supportive measures. This is related to a change in the society’s health awareness.

Here from, the claim to provide the population with sophisticated medical services appropriate to medical-technical progress is constituted. These are considerable reasons for the development of the health sector into a growing market of the future. Already today, efforts are necessary to fill the vacancies in public health service with well-educated medical and nursing staff and management.

The financing problem of medical and nursing services challenges this issue. For medical institutions this means to guarantee medical service with regard to economic conditions. Not only have the staff of the relevant professions to gain a fundamental medical and nursing education, but they also ought to be taught specific and practice-oriented business knowledge.

The University of Applied Sciences Jena has substantial competencies for health issues in its engineering, business and social departments. In 2010 the interdisciplinary centre of competence “Health” was founded to concentrate these competencies. Among others it deals with the challenges of an increasing rate of economy in the health sector. In addition to practical research, the centre of competence focuses on new teaching issues. One new offer is the establishment of the Master of Business Administration (MBA) “Health Care Management”, which aims to integrate education and health even more closely. It provides a factor of success to meet the mentioned needs. The target group of the MBA includes managers of public health care in medical, nursing, social, and business fields.

The MBA is offered as a part-time course to prevent an interruption of the professional career. A high expertise and the practical knowledge in the respective area are assured by collaborating with other universities and a university hospital. The curriculum is highly interdisciplinary and teaches issues of business and health economy as a holistic process.

The course of study focuses on “General Knowledge of Business Administration” (Human Resources Management, Corporate Management, Taxes and Contracts, Soft Skills, Organization Management), “General Knowledge of Health Economics” (Health Economics, Law, Ethics, Evidence-Based Medicine and Social Law, Health Care Evaluation), and “Special Knowledge of Health Economics” (Health Care Management, Hospital Management, Medical Techniques and Information Systems). Optional modules in the latter major enable the students to specialize according to their interest, job or managerial necessities. Students apply their theoretical knowledge obtained in the course to concrete practical issues in their master theses.

With the establishment of the new course the University of Applied Sciences Jena meets the current and future needs of medical institutions, especially hospitals, for economic knowledge. It can, thus, enhance its profile as an interdisciplinary university offering courses in the field of health, seen from a business, engineering or social perspective.
Keywords: Health Care Management, Master of Business Administration (MBA), education, course offering, interdisciplinary

1. INTRODUCTION

German hospitals are confronted with various challenges. The health sector evolves into a growth market of the future which is notably a consequence of the demographic trend, which is characterized by the following features.

The birth rate keeps decreasing in the next years in addition to the decline of the population at large. From this it follows that the population pyramid has to be adjusted, which means in concrete that the community members are constantly growing older [1].

This is connected to a change in the health awareness on the one hand and a modification of the requirements towards the goods and services of the healthcare system on the other hand. The medical-technical progress facilitates a more and more modern and complex health service supply of the population. But the finance of these services, that are accessible and guaranteed to everybody, proves to be particularly problematic. Due to the general legal conditions and to the introduction of the case-based lump sum (DRG) in particular, the hospitals are forced to work cost-effective. The fundable human and physical resources are and will be limited, which stays in contrast to the extension of the service offer [2].

Therefore it is essential to communicate not only management issues but also special and practice-oriented operational knowledge to the physicians and custodial executives. This is a fundamental precondition for the compliance with the economical basic conditions of each hospital. One of the most important duties of the medical executives (e.g. chief physicians) is the medical and organizational administration of the clinic (e.g. surgery, internal medicine). They are responsible for their subordinate employees and the budget for personnel and non-personnel costs to provide their medical services. They have to be made ready to create plans, to understand managerial key data and make decisions regarding their services, to head and evolve their workforce and to follow legal restrictions. The hospital management therefore confers economical responsibility to the medical senior managers [3].

Within the medical formation there is no or less space for the teaching of microeconomic knowledge. So far the region lacks of possibilities for further education in the sector of business administration for successful employees and executives of hospitals and other health care institutions. The planned Master degree course „Master of Business Administration Health Care Management“ (which will be henceforth named degree course or MBA) shall close this gap. And with this, the teaching and studying offer of the University of Applied Sciences Jena in the field of advanced training for specialized personnel and managers of social and health care facilities, who aspire to hold a leading position, will be ensured. Therefore the MBA is a necessary offer of the department of Business Administration of the University of Applied Sciences Jena. Specialized staff and executives in all medical and health care sectors increasingly inquire advanced training in managerial and health-economical domains.

The concept of the master degree course is the result of an analysis of already existing academic programs [e.g. 4, 5] as well as extended interviews with young executives on the one hand, chief operating officers and head physicians of local hospitals on the other hand.

2. GENERAL CONDITIONS

2.1 THE UNIVERSITY OF APPLIED SCIENCES (UAS) JENA

The University of Applied Sciences Jena is made up of three columns: engineering, business administration and social sciences. At the moment they offer 37 appealing Bachelor and Master Courses in eight different departments. The advantages of the UAS Jena are the practice-oriented, research-intensive and scientifically well-grounded formation, the highly motivated teaching staff and the closely and interdisciplinary working departments. On behalf of a widespread training there are a lot of cooperation programs with not only
European university but with graduate schools worldwide, e.g. in Africa. Successful collaborations in the economy are established, too: international renowned enterprises like Carl Zeiss, Jenoptik, Siemens, Bosch and some other industry-oriented research institutions in Jena stand for modern technology, contemporary management and scientific innovation. The cross-linking with regional as well as supra-regional economy and science and the high significance of research and development represent the specialty of the young, flexible University of Applied Sciences Jena. Since the fall semester 2010/2011 there are 4,901 students from nearly 60 different countries studying at the UAS Jena [6].

2.2 THE DEPARTMENT OF BUSINESS ADMINISTRATION

The study of business administration at the University of Applied Sciences Jena is characterized by proven and focused contents of teaching that have to be recalled after short time in adequate exams. Business administration students work in latest rooms and PC-pools. They have access to an enormous number of internal and external databases plus an extraordinary library. At this department teach and research 18 professors who are supported by a huge number of technical and scientific officers. The degree course “Master of Business Administration Health Care Management” is resident in the business administration department [7].

2.3 FACTS AND FIGURES OF JENA

Jena is the most important industrial location in Thuringia [8]. Among other things the Friedrich-Schiller-University and the university hospital are located here. The latter is the biggest employer of the whole region with over 4,800 employees. At the 26 clinics more than 51,000 hospital treatments and over 364,000 ambulant consultations are realized.

2,300 students study at the Friedrich-Schiller-University medical sciences or dentistry. At 25 institutions there are scientists from over 25 countries doing research on the further development of the medicine. So far there is a lack of education opportunities in the business administration sector for successful employees and executives of hospitals and other social and medical institutions in this region. That is why the department of business administration wants to establish the master degree course “Master of Business Administration Health Care Management”. With this the teaching offer of the UAS Jena regarding the training opportunities for future specialized and executive staff in health care and other social institutions is secured.

The multidisciplinary competence range of the health unity of the UAS Jena bundles the skills of the different departments and supports the master degree course “Master of Business Administration Health Care Management”. With this course a even more tight merge of education and health care can be realized. Through the cooperation with other universities and one university hospital a high professional expertise and practical knowledge on each department are guaranteed. The MBA-course therefore is an essential offer of the business administration department of the University of Applied Sciences Jena.

Special and executive staffs of the medical and custodial domain show a growing demand for further educational training in the managerial and health economical field. This is the conclusion of long interviews with both young managers and CEOs respectively head physicians of the hospitals. Finally the present requests show the significant interest in this degree course.

3. THE DEGREE COURSE

3.1 GENERAL FACTS

At the moment the degree course “Master of Business Administration Health Care Management” is in the accreditation procedure. The MBA will presumably be introduced in the fall semester 2012 and the matriculation will take place once every year. MBA will be offered as a four-semester distance study program so that an interruption in the professional activity is not necessary. The department business administration of the UAS Jena will award the academic grade of “Master of Business Administration” to the graduates.
Because it is a chargeable advanced training offer, the department is not limited by governmental restrictions, which has great influence on the number of the university places. Nevertheless there was set a maximum of 25 students per year.

The MBA course is a course for further education and so it is consequently extra-occupational, scientifically well-founded and with practical relevance. Because it needs to be extra-occupational, the course is a distance study program which includes phases of attendance, which vary in their length. Altogether in the four semesters there will be 184 hours of attendance needed. During those hours the students and their professors discuss and clarify issues and questions of their self-learning phases in face-to-face dialogues. This has as a goal to steady the knowledge acquired at home through project work and exercises on practical facilities. The phases of attendance will take place at the University of Applied Sciences in Jena.

In addition to the phases of attendance there are special teaching aids like certificates of apprenticeship and E-learning tools to communicate the contents to the students. The online-platform is technically supported by the IT Service Centre of the UAS Jena as well as one of the laboratory engineers of the department of business administration. “Moodle” has to be imagined like a virtual building with any learning and working rooms. Each accommodation can be furnished individually with the tools required for the special group or purpose using it. The rooms have an external website with communication and log-in function. For the cooperative creation and maintenance of knowledge and learning is a documental management system including a “knowledge-map” and comfortable tools for authors available. The uploaded teaching aids are adjusted and updated individually by each lecturer, so that the students can work with the newest material.

3.2 STRUCTURE

The degree course scheme of the MBA contains nine compulsory and three elective modules (see Figure 1). The compulsory modules guarantee a generalist education goal, but still there is the possibility to focus on several topics. Expressed in percent the curriculum is made up of 87% compulsory and 13% elective modules. The course schedule is designed to communicate the economical functions as one wholistic process and to show the references between the theory and the practice in the field of health care economy. Through this the thinking and acting in harmony with the business sense in the health care management can be taught.

![Figure 1: Structure of “Health Care Management” (MBA)](image-url)
The module handbook is a recommendation for the students to know in which order the modules should be chosen. The first semester contains the three modules called “Human Resources Management”, “Corporate Management” and “Health Economics”. Through these modules the basis of managerial skills is laid and basic knowledge in the range of health economics will be refreshed and deepened.

The following courses are elements of the module “Human Resources Management”:
- Labour Legislation for Executives
- Human Resource Development
- Operational Health Care Management.

The course “Labour Legislation for Executives” mainly includes the so called individual labour law. Besides a general introduction it incorporates matters of creation and content of employments, problems of impairment of obligation in the labour condition and obstacles appearing while the termination of a working contract. Additionally the basics of the work protection law and the basic concept of the collective labour law will be content of this course.

The focus of the lecture “Human Resource Development” lies on the process model of the human resource development. Starting with the goals and receivers of this development the students will learn about methods of the calculation of the human resource development demand. This will lead to an overview on the measurements taken in this field. The special responsibility of the executives in the area of human resources development has hereby a significant value.

The example of the employee assessment and getting to know elected negotiation methods enable the students to use their newly learned skills in the practice.

The course regarding the “Operational Health Care Management” draws a picture of strategies that are focussed on sustainability and a holistic approach of the human resource and organisational development. Central value is the investment in the health of the employees. Various concepts are communicated which have the aim to create a workplace in conformity with health standards and to capacitate the employees to act in a constitutional way. The students are enabled to implement and evaluate the instruments of the operational health care management in a process- and structure-related manner.

The lectures of the module “Corporate Management” are “Controlling”, “Corporate Governance” and “Capital Budgeting”. Both “Introduction to Health Economics” and “Health Care Policy” are lectures in the module “Health Economics”.

In the second semester the micro-economical and health economical knowledge will be extended. In the module “Taxes and Contracts” the students learn about “Fiscal Law for Senior Managers” and “Mediation and Contract Negotiations”. Special statutory provisions of medicine will be taught in the module “Law”. This is about the communication of knowledge regarding “Medical Professional Regulations”, “Medical Penal Law” and “Medical Liability Law”. The module “Ethics, EBM and Social Law” picks up important parts of the practical work of physicians that will be discussed and worked with in the group. In this module the lecture “Ethics in Medicine” contains the foundations of ethics in patient treatment and their implementation in new health care systems such as “Managed Care” and “Integrated Supply”. The most important codes and their execution and supervision are introduced here. The participator gets an overview on the ethical standards that executives deal with in the health care system. With the module “Soft Skills” the students can improve their key qualifications.

The third semester includes two compulsory modules, which are “Health Care Evaluation” and “Organization Management”. The first one contains the lectures “Economical Evaluation” as well as “Health Care Systems in International Contrast”. “Health Care Economic Evaluation” picks up the design of it and the cost-benefit concept in the health care system. Some basic principles of the health care evaluation will be drafted by presenting comparative and non-comparative studies. In the following the lecture spends time on the demonstration and rating of the quality of life as well as their integration in health care economic evaluation. In the course “Health Care Systems in International Contrast” the national and international
prevention politics are compared, the actual health care political range of problems displayed and possible action alternatives are depicted.

Finally various health systems are compared by re-concentrating on the already contrasted systems and the foundations (e.g. demography, finance, indicators) of those system comparisons will be analysed. The outcomes of this as well as the placement in the context of health care politics bring this lecture down to a round figure.

Furthermore the third semester includes three elective modules “Health Care Management”, “Hospital Management” and “Medical Techniques and Information Systems”. So the students have the opportunity to specialize themselves in terms of their personal interests, occupational area and the managerial specific necessities.

The module “Hospital Management” for example contains the courses “Hospital finance”, “Corporate Planning and Operative Controlling” as well as “Management and Controlling Systems”. Only two of the three elective modules have to be completed successfully.

In the fourth semester the students have time to write their master-thesis.

All courses are a combination of lectures, exercises, term papers, presentations as well as study at home with the help of preparatory papers. Control questions are there to let the students recap the already learned issues. Exercises with solutions serve the acquirement of transfer knowledge. To study a semester abroad is not mandatory but the students can decide on their one, whether they want to study in a foreign country or even to participate in a practical work abroad.

3.3 TARGET GROUP

The Master degree course “Master of Business Administration Health Care Management” addresses to specialized personnel as well as executives in social and health care institutions. It also targets persons especially from the medical area who aspire to occupy a leading position in those institutions and who already have participated in an academic initial training (e.g. Bachelor or Master degree, university or a degree of a university of applied sciences or a technical college).

Still there is the assumption that the applicants already made some experience in the area of management (e.g. project management) and controlling in their previous professional life. The ideal candidate would have a huge knowledge about either the medical, social or administrative district and occupy a subordinate management position.

3.4 IMPARTED SKILLS AND PROFICIENCIES

In this degree course the students acquire the knowledge in a systematical way that is important to fit in a high management position in health care institutions. Therefore gaps in the knowledge have to be closed; the existent skills must be deepened and the comprehensive thinking and acting needs to be practiced.

The students should acquire the competence to analyse, evaluate complex company specific situations and find adequate solutions. Moreover the scholars have to learn how to realize and communicate developed solutions and behaviour guidelines. Besides a professional economic formation in theory and practice the students shall be enabled to comprehend complex correlations and react properly. Basic skills that students have to dominate are plan, monitor, reflect, coordinate, organize, control and administrate. The theoretical and practical qualifications are taught in a deepening way so that the students learn about integrated, holistic and interrelated view on functions, processes and decisions in markets and enterprises. The perspective will always be that one of an executive with overall responsibility. Multifunctional, international and interdisciplinary approaches are implemented in the modular master plan. The disposition to deal with actual issues in the field politics and society in a critical manner is strengthened while the study. Learning and comprehension knowledge change in an adequate proportion. Because of this the economic, scientific and social qualifications on a Master level are given. One qualification goal is to teach the students how to use
their soft skills while working with scientific, analytic and operational methods in the “real life”, e.g. techniques for the evaluation of enterprises, decision models and the portfolio method. In the same way the students will acquire a deep understanding for modelling and development of theories as well as their implementation to solve real problems.

Another important aim is to help the students develop their professional social skills, above all personal key qualifications. These soft skills are for example presentation techniques and the ability to communicate in written and spoken, the presentation of arguments and solutions, the domination of mediation and conflict resolution techniques, the economical way of thinking, leadership skills, authority, acting after a decision made beforehand as well as team spirit which includes the ability to form and lead teams. In addition the course should encourage the students to weigh up critically different theories, models, orientations, behaviours and points of view.

Also the students will be supported to be open-minded towards foreign and multicultural attitudes and their integration into their own thinking and acting as well as the frankness for processes of changing and innovations.

The social skills are completed by the communication of ethic and social aspects of the discipline and the occupational field. This is mainly guaranteed through the course “Ethics and Medicine” and the discussion of case studies.

The degree course instructs the students to be self-dependent while working on scientific matters and boosts them to be interested in theoretical problems and empiricism.

Because of this the Master degree course includes besides a number of academic papers also a written scientific final paper, the Master thesis. In addition to a basic ability to work in an academic manner the alumni should acquire capabilities to think analytically, to understand complex interrelations, to synthesize different components of knowledge, to include greater connections, to detect problems and appropriate solutions and to transfer acquired knowledge to other ways of looking at a problem.

4. CONCLUSION

With the establishment of the degree course “Health Care Management” the University of Applied Sciences Jena meets the actual and future requests of the hospitals and other medical centers regarding the teaching of economical knowledge. This course is characterized by its interdisciplinary departments and is perfected by the expertise of colleagues of other universities and practical institutions, such as hospitals. Therefore it is ensured that the theoretical managerial basics are supplemented by practice-oriented special qualifications.

As a conclusion one can say that with the introduction of this degree course the UAS Jena will strengthen her profile as a multidisciplinary supplier of education in the field of health care.

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INNOVATIVE TEACHING USING INTEGRATED TASKS FOR AN ENGINEERING COURSE

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ABSTRACT

Engineers never used to worry about how and who would replace them in their positions, which was the responsibility of teachers and university lecturers. However, good university lecturers are engineers and today they worry about teaching and lecturing methods. This paper describes the use of innovative teaching methods in an engineering discipline by members of that profession. It is set at two University of Technologies (UoTs) that employ integrated tasks training (ITT) and evaluation through alternative portfolio of evidence (project reports) for final assessment of the subject Engineering Surveying.

The ITT coin various subjects from the various engineering courses, to prepare the students for the reality of the work place while teaching them the basic skills of life. Due to the advancement in technology the student, learns how to adapt to potential future new work related challenges and problems. The integrated project encourages and teaches the students to develop problem solving skills, intra- and interpersonal skills and research aptitude, and empower them to become competent to adapt to technological changes. At an education institution, ITT is designed to resolve problems emanating from financial constraints, reduced teaching times, and increased student numbers. The increased student numbers are responses to political forces demanding justification of programmes and institutional leaders threatening closures of faculty and departments to encourage increased student intakes and benefit from economies of scales. In addition, rapid changes in technology mean institutions cannot teach all the theory in allocated timeslots, and reductions in staff numbers and resources bring in higher staff student ratios, which without innovation may compromise on quality.

The paper discredits the idea of extending course hours or programme years to cover all content, recommending instead that teaching concentrate on the basics while developing students to adapt, adopt, and extend personal knowledge, competencies, and skills without reducing the overall outcome quality. In the end, the engineering programs remain compliant with professional bodies’ standards such as Engineering Council of South Africa (ECSA) and the South African Counsel for Professional Land and Technical Surveyors (PLATO) while conforming to the new National Qualification Framework (NQF) and Higher Education Qualification Framework (HEQF).

1. INTRODUCTION

Engineering and scientific courses, such as Surveying and Geomatics, have traditionally been taught through distinct theory lectures or tutorial and practical fieldwork sessions. However, this teaching approach was most distant from the manner humans naturally learn (inductive) and the manner the graduate is expected to apply the gained knowledge in real life (problem based). In other words, the higher educational institution were and some still are not concerned with the impact their teaching would ultimately have on the level or standard of learning that ultimately results. Most modern theorists, among them cognitive, who replaced the behaviourism theory as the dominant learning paradigm in the 1960s, are now disputing this type of educational approach. This group of researchers believe in these changing paradigms, in particular, those that recognise developments in real life learning and systems design. In this proposal, a concept referred to as Integrated Task Training (ITT) is introduced to students so that higher education learning is inductive rather than deductive.
Integrated Task Training (ITT) consist of scheduled project work where one or multiple but related outcomes are specified, pursued, attained and evaluated in a learning event [1]. The Integrated Task Training presents the student with a problem similar to what they will have to solve when entering the industry environment. At lower levels, students are assisted through breaking the bigger task into smaller, simpler, or basic sub-problems. Towards the exit levels, the task becomes larger, complicated, and realistic. Both theoretical and practical aspects are tackled without the traditional artificial distinctions. For example, depending on the level of complexity, aspects covering basic survey theory, management, mathematics, drawings and computer skills, are assessed together with teamwork and communication skills. The higher the level, the more integrated the task and the higher the outcome assessed. In addition to giving a realistic feel of real-life challenges in their discipline, ITT provides the student with a global view of how all the different subjects support, augment, and enhance each other and that they must not view each subject as a separate entity to be mastered separately. As accurately as in reality, the assessment of the integrated task is continuous, where both formative and summative aspects are usually integrated without separation. So, in what innovative teaching ways has integrated task training been used to teach engineering surveying to a large number of civil engineering students?

2. BACKGROUND TO THE STUDY

The technological developments are increasing the demands and complexity of the engineering and survey professional applications [1]. The continuously evolving technology creates a challenge for lecturers who have to decide whether to change the curriculum through expanding the course content or undertake teaching of basics and allowing students to develop skills and competencies to adapt to the changes and challenges they might face in industry [2]. In a developing country such as South Africa, curriculum expansion comes with increased teaching time, higher lecturer workload, and overstretching on an already strained resource base, which is not feasible economically and at times politically. The latter alternatively requires more preparation, monitoring and evaluation time than a structured curriculum, which most lecturers are against, but the primary purpose of teaching, is not an outcome on the lecturer, but that of a competent, skilled and knowledgeable student.

Since the democratic government of 1994, increased pressure on available resources has resulted in less and less funds being channelled to higher education in comparison to social issues among them housing, social grants [1]. Other social and economic challenges such as poverty, social welfare etc has taken precedence. This leaves the South African higher education environment faced with significant challenges emanating from dwindling resources and fewer professionals committing to an academic life while expectations such as intake of students increase [1]. The private and public industry in South Africa continues to offer a more attractive remuneration than what UoTs currently can offer, enticing the best professionals out of academia. Although politicians argue that no correlation exists between increased resources, increased quality and reduced intakes, those involved in lecturing can clearly see these correlations.

As stakeholders, professional bodies such as Engineering Council of South Africa (ECSA) or South African Council for Professional and Technical Surveyors (PLATO) and standards setting body, the South African Qualifications Authority (SAQA) continue to enforce the highest standards expectations from higher education institutions. Maintaining high standards require resources, innovation, and a balancing act with high student intake levels.

3. RESEARCH METHODOLOGY

A research methodology can be viewed as an act of succumbing to view or views of conducting research [4]. In it, assumptions, research tools, perceptions, techniques, and data, which mould and bound the research output, are defined. Symonds and Gorard’s [5] recommended that, the researcher first took note of core elements in the problem statement without reference to qualitative and quantitative dichotomies. Although the outcome of introducing innovating instructional designs is to improve pass rates which and qualitative and to improve understanding, skills and competencies of learners which is qualitative measure, the creation of a learning environment is qualitative for the teacher. The learners apply quantitative knowledge to measure, process, and present engineering data, but the assessment of these is combined with qualitative aspects such as planning, working with others as a member of a team etc. Although the overall research can
be viewed as mixed methodology paradigm, this paper concentrates on the instructional environment and observed or reported stimuli by the learners. This is and can be tackled in qualitative methodologies.

In engineering, qualitative methodology is not as dominant as the quantitative/positivist methodology. Qualitative methodology is characterised by subjective and in-depth descriptions of dynamic reality [6], while engineering involves constructing, making and analysing physical, observable, and verifiable events. Qualitative research argues for constructivism, idealism, relativism, humanism, hermeneutics and post-positivism in which theory is generated inductively from observations [7]. This creates a learning environment appropriate for learners to create opportunities to regulate and be involved in their learning. The research measurement, learning, remains qualitative as it is determined by perceptions expressed by the learners through feedback questionnaires on their learning. In a quantitative paradigm, purist such as Popper [8], Schrag [9] considered all observations be treated as physical entities and inquiries be objective [7]. As qualitative methodologies emphasise objectivity, confirmation of laws, studying static reality [6], they are inappropriate to assess learning or impact of learning. Though quantitative approach gained dominance through dependability and replicability [6], the aspect under study is neither. An evaluation of teaching approaches requires qualitative approaches that results in primary data that is richer in meaning and likely insights and/or improving breadth and depth of research [10]. In this case, the outcome is perceptive and descriptive as success and failures are highlighted in an attempt to inform and improve the next suite of instructional methods.

Two methods were used in this study with objectivity of the researcher rejected. Firstly, observations were made on the resources (other than financial) that the two institutions have for teaching engineering surveying students including human resources, equipment, and open fields. An instructional design of the Integrated Task Training (ITT) was then developed at two National Qualifications Framework (NQF) levels, one at NQF level 5 and another NQF level 7 and administered as both institutions. One institution adopted the NQF level 5 instructional materials only and administered it in the first semester of 2011. The other developed both NQF level 5 and 7 and administered the former in the first semester of 2011 and the later is still ongoing over two semesters for 2011. However, responses were collected from both ITT courses in the middle of the year. Secondly, learners were then invited to respond through teacher questionnaire to their learning experiences of the instructional ITT through questionnaires during and at the end of the course. Both closed (5-point likert scale) and open questions were posed to learners soliciting their experiences and perception on the impact of the ITT. At one institution the questionnaires were administered in hard copy while the other was online, both were anonymous to the researchers. The results were then summarised through commonalities in responses whether emanating from closed or open question responses.

This paper thus acknowledges the growth of qualitative research, the role of softer skills for engineering and the need for a social bias in informing engineering and Geomatics projects. In addition, the author disputes Bryman, Becker, and Sempik [11] argument that qualitative research lacks consensually established standards for assessing its rigour, quality, and attainment of outcomes. While students, teachers, professional bodies and the public are recognised as important influences on teaching, being a subjective phenomenon requires that stakeholders come up with consensus views on good teaching. In semester and end of semester, evaluations are used as the basis of acquiring data on what the students feel about the integrated task.

4. RESULTS

The result first describes the study setting for Integrated Task Training (ITT) at the two institutions under study. This is followed by the description or summary of what learners feel about the learning from the experience with integrated task training.

4.1 THE STUDY SETTING

Two Universities of Technology (UoTs) that employ Integrated Task Training (ITT) at different levels are studied. For the purpose of this paper, the authors will refer to them as institutions A and B. Institution A employs Integrated Tasks (IT) at NQF level 7 and 5 while institution B uses it at NQF level 5. Both institutions are under-staffed and benefit from innovative ways that appear to extend effectiveness of staff.
At institution B, there are three lectures teaching the course surveying for Civil Engineering students while B has two. The institutions use technical staff and student assistance in their Integrated Task management. While institution A has 1 technician and 12 tutors for 4 civil surveying classes, institution B has two technicians and 15 student assistance for 5 classes. Both institutions have undergone tremendous changes in the mid 2000s including mergers, relocations and re-staffing making the environment uncertain.

**Figure 1**: Students Numbers and Class Sizes, 2011

Figure 1 shows the number of students for each institution. Both institutions have very high student numbers with institution A having 280 and B 250 students at NQF 5 civil surveying. The students are divided into manageable groups to accommodate effective management. Institution A having 4 groups of around 70 students per class, while institution B has 5 classes averaging around 50 students per group. The class sizes and student numbers vary on a year-to-year basis.

Figure 2 indicates the quantity of the different instruments each of the two institutions have for use. Both UoTs have enough automatic levels, while the Total Station quantities vary tremendously the reason for the low quantity of Total stations at institution A was that they combine electronic theodolites with total stations. Due to high student numbers and change in technology, the institutions have been in the process of acquiring and upgrading equipment and instruments used in the Integrated Task. The target is the latest and applicable to industry today. For example, institution A this July purchased an additional 7 GPS units.

**Figure 2**: Instrument Quantities, 2011
4.2 STUDENT PERCEPTIONS ON INTEGRATED TASK TRAINING

This section summarises the student opinions on the learning that has occurred during and after the conduct of Integrated Task.

Students 10 and 11 felt that the Integrated Task requires good strategic skills in order to complete the stages involved. As a result, they felt that their strategic skills were developed during the course of the entire project. These students acknowledged that they had applied management skills theory in order to cope with the length of the project and the time required completing it. The advantage of the skill developed by this learner is that it was developed by discovery, which is inductive in nature, was in an environment similar to a working environment. Hence, as the student enters the working world, they are likely to continue learning from their experiences.

Students 1, 3, and 4 commented to the effect that they felt strong communication skills had been developed through interacting with peers, staff, and the presentation at the end of the project. It was an opportunity to test the students inter and intra personal skills and discovers what had to be changed before they are faced with the make or break environment of the work world. In other words, should they find that they are not good at either of these skills; they could enrol in suitable courses to improve themselves while they are working. Inter and intra personal skills are expected but rarely taught in structured courses at UoTs. Student 3 particularly noted that their “ability to research was improved.” The value they place in basic concepts such as time management skills, leadership skills had been enhanced. Student 1 added that that they felt “the integration between the two subjects [Surveying and Communications skills] serves as a basis for being able to [improving their] understanding of different methods used in surveying.” This show the impact the Integrated Task had on the need to manage not only the due dates, but also the time they spend and their team interactions. The students also gained organising skills, as they had to keep all the data, calculations, and hand it all in file as a portfolio of evidence (POE), the portfolio of evidence would have to be organised in a specified structure. Management is just one of the many skills the students apply and learn through the course of the semester while working on the Integrated Task.

Students 2 and 5 commented in their report: “We learnt to manage our time, to do more accurate survey fieldwork, we improved our calculation skills for the fieldwork, we individually improved our communication skills with each other and the consultant and as a group and we improved on our drawing skills because we did a drawing that we surveyed ourselves. This project is a good experience in general and is a must in this course.”

The students also have to apply the survey knowledge that they were taught in the theory module of the subject. This knowledge would be applied on a continuous basis as the Integrated Task was designed to complement the theory module. The theory was taught in class and now the students have to apply that knowledge to the project. This will enable them to collect the data they require to fix control points, determine their heights, and do a tachometric survey, which the data would be used to draw a topographical plan. Student 11 commented on that they had not realised how much they had learnt until they started preparing the reflective feedback report. Initially, they thought that they had perfected the theory, and practice of surveying when they started getting very high marks on specific tasks, until they realised, there were connections throughout. Theory is learnt not for the examination, but to “apply the theory we learn in class out there in the real world of work and in other aspects” (Student 12). In addition to applying basic theory and practical skills learnt, the softer skills increasingly mentioned include time management, interaction with oneself and with others and organisational skills.

The last few components involve the students using the newly created topographical plan to decide where to place a building and a horizontal road curve, these have specific dimensions stated in the Integrated Task. The very last part of the project was to write a comprehensive report. The report consisted of details regarding how each section of the Integrated Task was conducted. Problems that occurred and their solutions were included in the report.

Student 19 commented in their report: “The learner could easily find solutions to problems using management skills,” Student 17 added the value of integration in their perception in particular Mathematics,
Survey, and Drawings is very clear during integrated tasks. In his word, he felt “... allows the learner to think logically and practically with the use of creativity and precision” (Student 17). Communication skills help the learner to communicate effectively and teach the learner to work in teams and establish leadership roles. Therefore, the integration of these subjects in this project successfully equips the learner with the necessary skills needed in the Civil Engineering work industry. Drawing skills were taught in the first semester and the students have to draw on that knowledge to complete a component of the integrated task, they have to draw a topographical plan with the data that they collected in a previous component of the integrated task.

Student 11 concluded that: “... it is generally accepted that learning takes place in many sites as formally organised activities as well as informal experiences. This project should provide to the Civil Engineering student community, an experience that goes beyond providing a subject matter to students.” Student 14 added, “... indeed, there should be a number of desirable attributes among the students after this experience. I noted the ability to work with others and to respect and learn from peers and know when help should be sought.” Both students felt that the effective use of properly governed Survey and Civil methods had led them in improved understanding on how to get better results in a project.

Communication skills were a crucial aspect in the Integrated Task, as students had to interact with each other in the group, between groups and with their lecturers who play the role of a consultant. The students also applied written communication skills when they compiled their reports and organised the files (POE) where they kept all the data and information. Student 4, 7, and 9 commented on value Integrated Task attributed in gaining better communication skills in engineering after despising the communication skills subject when it was offered to them in the previous semester. Student 9 felt they had to communicate throughout the project. There was a link, student 7 further noted between good communication skills and inter and intra personal skills. Communication and interaction with the lecturer also improved, and student 4 highlighted they now know when, and when not to ask for assistance. The students became more aware of how their actions influenced the outcome and they all believed that they had grown, during this whole process.

The completed Integrated Task would be presented for assessment as a portfolio of evidence in the files, the POE have a pre specified format that the students will have to adhere too. The POE must contain all the raw data the students collected, the processed data, all calculations in the correct format, a newly compiled co-ordinate list, report and the maps and plans used and drawn during the duration of the Integrated Task.

The students do not realise that if they did not have these skills before, they are learning these skills as the Integrated Task progresses. Only towards the end of the Integrated Task did they realise that they are learning other skills apart from Survey.

5. CONCLUSION

From the pass rates and the student generally positive feedback, the two institutions can conclude that Integrated Task Training has far more advantages to the students learning and should be encouraged for use in mostly skills and competence based courses in engineering. This not only allows teaching in a short space of time, but also exposes the students to the reasons for most courses covered and where in the work world, the theory would be applied. Other learning usually not taught as structured courses are assessed together with technical and professional skills. The most important additional learning from the experiences are the values of project planning, time management, that inter, intra personal skills are just as important as theory, skills, and competencies commonly emphasised in the engineering programs.

6. REFERENCE


*FIG Commission 2 Symposium.* Czech Technical University, Prague, Czech Republic, 7-9 June 2007.


ABSTRACT

Enterprise 3.0 which penetrates our society more thoroughly with the availability of broadband services has already been widely integrated into the contemporary processes and work environments. The synergy between Enterprise 3.0 and clustering advances innovation-stimulating environments in engineering education. The present research proposes phases of clustering to enhance engineering students’ use of Enterprise 3.0 in tertiary education. Aim of the research is to analyze effectiveness of clustering for the development of engineering students’ use of Enterprise 3.0 in tertiary education. The meaning of the key concepts of “Enterprise 3.0” and “clustering” is studied. Moreover, the study demonstrates how the key concepts are related to the idea of “engineering education”. The explorative research has been used. The empirical study was conducted within the Sixth Baltic Summer School Technical Informatics and Information Technology at Kaunas Technical University, Lithuania, August 13-28, 2010. The sample involved 28 participants of the Sixth Baltic Summer School. Descriptive statistics (mean and standard deviation) were used for primary data analysis. The empirical results reveal that clustering with use of Enterprise 3.0 within the Sixth Baltic Summer School Technical Informatics and Information Technology is effective for the development of engineering students’ use of Enterprise 3.0. Finally, directions for future research are proposed.

1. INTRODUCTION

Innovation – the creation, dissemination, and application of knowledge – has become a major engine of economic expansion and social development [6]. Innovations are driven by various sources [6]. The synergy between various sources serves as an innovation catalyst.

Web 3.0 which penetrates our society more thoroughly with the availability of broadband services has already been widely integrated into the contemporary processes and work environments. All dimensions of Web 3.0, namely, the infrastructure dimension, the functionality dimension, the data dimension, and the social (or socialization) dimension, as depicted in Figure 1, are on their path into the enterprise [17]. Therein, Web 3.0 includes Enterprise 3.0 used for enterprise (business) purposes. In turn, the development of innovative products, processes and services in the European economy is advanced by a geographic concentration of the synergy between interconnected businesses, suppliers, service providers, and associated institutions in a particular field known as a regional industry cluster [11]. Thus, the synergy between Enterprise 3.0 and clustering contributes to innovation-stimulating environments [10] in engineering education.

Aim of the research is to analyze effectiveness of clustering for the development of engineering students’ use of Enterprise 3.0 in tertiary education.
Figure 1: Four dimensions of Web 3.0

Analysis of engineering students’ use of Enterprise 3.0 on the pedagogical discourse involves a process of analyzing the meaning of the key concepts of “Enterprise 3.0” and “clustering”. Moreover, the study demonstrates how the key concepts are related to the idea of “engineering education”. The study presents how the steps of the process are related: a historical perspective of the development of Enterprise 3.0 → defining Enterprise 3.0 → determining clustering in tertiary education → an empirical study within a multicultural environment.

The methodological foundation of the present research is formed by the System-Constructivist Theory based on Parsons’s system theory about any activity as a system, Luhmann’s theory about communication as a system, the theory of symbolic interactionism and the theory of subjectivism [4]. The application of this approach to learning introduced by Reich [14] emphasizes that human being’s point of view depends on the subjective aspect [8]:
- everyone has his/her own system of external and internal perspectives that is a complex open system as shown in Figure 2 by Ahrens and Zaščerinska [2], and
- experience plays the central role in a knowledge construction process [8].

Therein, the subjective aspect of human being’s point of view is applicable to the present research.

Figure 2: Developing the system of external and internal perspectives

The remaining part of this paper is structured as follows: Section 2 introduces the theoretical framework on Enterprise 3.0 and clustering. 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

A general conception of Enterprise 3.0 is determined as use of Web technologies for enterprise (business) purposes. The study of the Enterprise 3.0 concept and pedagogical perspective on Enterprise 3.0 has not had a long story as demonstrated in Table 1.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Historical period</th>
<th>Approach</th>
<th>Elements of Enterprise</th>
<th>Educational settings</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Enterprise 3.0 as organization</td>
<td>Online networks</td>
<td>Practice of the Enterprise 3.0 curriculum</td>
</tr>
</tbody>
</table>

Enterprise 3.0 is defined to be an ideal organization for the 21st century to form new business functions of collaboration with the focus on information sharing within the enterprise and the eco-system partners [12]. “Organization” and “agency” are used synonymously in many publications. However, the distinctive use of these terms is emphasized by Barker [3]. Organization is a social arrangement which pursues collective goals, controls its own performance, and has a boundary separating it from its environment [15], thereby influencing or limiting the choices and opportunities that individuals possess [3]. In turn, agency refers to the capacity of individuals to act independently and to make their own free choices [3]. Hence, Enterprise 3.0 is an agency based on the practice of curriculum [4].

Moreover, the paradigm shift from socialization within Web 2.0 to peer contribution within Web 3.0 has increased the need in sustainable communication networks. This change reveals that the elements of Enterprise 3.0 include online networks.

Online networks as a form of peer contribution today bring a dimension to the Web that goes beyond simple links between pages; they add links between people, between communities [17] and between organizations. In such a network, direct links will typically point to our closest friends and colleagues, indirect links lead to the friends of a friend, and etc.

A network on the Web is typically the result of employing some software that is intended to focus on building an online community and, consequently, organization for a specific purpose [17]. Social networks connect people with common interests and may be as simple as a blog, or as complex as Facebook or MySpace for mostly private applications, as LinkedIn or Xing for professional applications, or as Twitter for both. The primary impact that the current Web developments are having in this area are that connecting people, communities and organizations constantly becomes easier, and it is not difficult anymore to maintain a professional or personal network of buddies worldwide. Yet another impact is that a social network may open up novel sources of revenue, in particular through advertising. Finally, Vossen [17] underlines that technology enables functionality, which as a “byproduct” leads to data collections, and users have a new tendency to socialize over the Web, by exploiting that functionality and the technology.

In 1990s, clusters became a target for local and regional initiatives to promote competitiveness and job-creation [10]. Clusters were expected to stimulate the innovativeness and competitiveness of companies, especially small and medium-sized enterprises [10]. Therein, enterprises are a basis for prosperity and economic development.

The concept of cluster is not static. The cluster concept changes in time. First, cluster in education was the concept of a number of neighbouring school districts working together for the benefit of all. The potential benefits were greater when such working relationships took place in close co-operation with institutions of higher education, intermediate service agencies and the state education agency [13]. A cluster was formed in four essential steps, namely,
- first, the group of interested schools must be identified,
second, the identification of individuals within a neighbouring institution of higher education that have the interest, technical assistance skills and commitment to work in a cluster over time,
- third, the establishment of contact with key persons in the state education agency to work in the cluster,
- the final step is the development of an agenda to be addressed by the cluster which must be that of the participating districts, not that of the institution of higher education or the state educational agency.

Then, the emphasis was put on regional industry clusters, namely, geographic concentrations of interconnected firms and supporting organizations in a particular field, which represent a potent source of productivity at a moment of national vulnerability to global economic competition [11]. Finally, the authors of the present research define cluster as the unity of educational and research institutions, enterprises, centres, agencies, companies and other interested organizations that implement a joint activity as depicted in Figure 3.

![Figure 3: Components of a cluster](image)

University as part of a cluster provides engineering students with the appropriate skills and competences for innovation and creates new knowledge within the “knowledge triangle” of education, research and innovation [6].

In its turn, clustering is determined as the cluster process or joint activity. From the point of view of the paper authors, clustering is defined as shared aim oriented joint activity as according to certain common norms, over some period of time, that provides joint social interaction and cognition for each participant and increases opportunities of gaining social experience [18]. The implementation of the cluster’s joint activity comprises three phases: it gradually moves from initiation in Phase 1 to application in Phase 3 through explication in Phase 2 as shown in Figure 4 by the paper authors.

![Figure 4: Phases of clustering](image)

Each phase of the joint activity is separated from the previous one, and the following phase is based on the previous one.

The initiation phase starts with preparing the cluster participants for the implementation of the joint activity, planning its procedure, equipping the participants, determining the aim of the joint activity, etc.
Then, the explication phase is aimed at making a decision. The application phase focuses on the outcome evaluation.

There are two possible forms of clustering: co-operation and collaboration. On the one hand, clustering is not provided by co-operation inside a cluster: the relationship between firms, between firms and institutions, and between the private and the public sector is weak, in particular when it comes to activities that go beyond common business transactions [10]. On the other hand, collaboration forms strong relationships inside clusters [10] as collaboration is product orientated. Hence, the form of clustering is determined as collaboration.

3. EMPIRICAL RESEARCH

This study is oriented towards the revealing of effectiveness of clustering within the Baltic Summer School 2010 to improve the engineering students’ use of Enterprise 3.0. Its topicality is determined by ever-increasing flow of information in which an important role is laid to Enterprise 3.0 as a means of getting information and gaining experience.

Interpretative research paradigm which corresponds to the nature of humanistic pedagogy has been determined for the research as it creates an environment for the development of any individual and helps them to develop their potential [7].

An explorative research has been used in the study. The explorative research is aimed at developing hypotheses, which can be tested for generality in following studies [9]. The study consisted of the following stages: exploration of the context of use of Enterprise 3.0 through thorough analysis of the documents, analysis of the students’ feedback regarding their needs in use of Enterprise 3.0, data processing, analysis and data interpretation, analysis of the results and elaboration of conclusions and directions of further research.

The present empirical study was conducted during the implementation of the Sixth Baltic Summer School Technical Informatics and Information Technology at Kaunas Technical University, August 13-28, 2010, Kaunas, Lithuania. The sample involved 28 respondents.

All 28 participants of the Sixth 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. The 28 participants of the Sixth Baltic Summer School Technical Informatics and Information Technology are with different cultural backgrounds and diverse educational approaches from different countries, namely, Latvia, Lithuania, Estonia, Russia, Great Britain, China, India, Nigeria, Romania and Mexico. Whereas cultural similarity aids mutual understanding between people [16], 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, namely, appropriate materials, teaching/learning methods and forms, motivation and friendly positioning of the educator [1]. Moreover, the sample of the participants of the Sixth Baltic Summer is multicultural.

The cluster of the Baltic Summer School 2010 comprised the organizations shown in Figure 5.
The International Summer School offers special courses to support the internationalization of education and the cooperation among the universities of the Baltic Sea Region. The aims of the Baltic Summer School Technical Informatics and Information Technology are determined as preparation for international Master and Ph.D. programmes in Germany, further specialization in computer science and information technology and learning in a simulated environment. The Baltic Summer School Technical Informatics and Information Technology does not contain a special module on Enterprise 3.0. The Summer School Technical Informatics and Information Technology contains a special module on Web 2.0.

The Web 2.0 module examines the advantages and problems of this technology, namely, architecture and management, protocol design, and programming, which makes new social communication forms possible. The Web 2.0 module involves Ajax (Asynchronous JavaScript and XML) and Advanced Javascript Programming Libraries, Security for Web Portals, Web 2.0 Design Paradigms, Patterns for Rapid Web Prototyping and Ruby on Rails. The Web 2.0 module does not reveal the concept of Enterprise 3.0. However, the Web 2.0 module comprises Enterprise 3.0 technologies, namely, online networks.

Between the pre- and post-survey of the participants’ use of Enterprise 3.0 clustering with use of Enterprise 3.0 technologies, namely, online networks, was implemented within the Sixth Baltic Summer School Technical Informatics and Information Technology. In order to promote engineering students’ use of Enterprise 3.0, clustering involved visiting an IT company in Kaunas, courses in technical informatics and information technology, preconference tutorials for introduction into advanced research topics, participation in the conference “Learning in Networks”, tutorials and practical tasks, language training for talk and presentation (optional in English or German) and leisure activities and social contacts. Clustering with use of online networks of Enterprise 3.0 technologies was implemented in a variety of forms, namely, discussion, prepared talk, communication games and information-gap activities within the Baltic Summer School 2010.

Criteria of use of Enterprise 3.0 in engineering education are based on student engineers’ needs. Need is defined by the reasons for which the student is learning [5]. A need can vary from study purposes, for example, following a course in Enterprise 3.0, to work purposes, for example, participating in business and/or working in an enterprise. Thereby three groups of needs are outlined:
- use of Enterprise 3.0 for individual purposes,
- use of Enterprise 3.0 for organizational purposes and
- use of Enterprise 3.0 for professional purposes.

By individual purposes private use of Enterprise 3.0 is meant: business functions are used within the family and friends. By organizational purposes use of Enterprise 3.0 between the colleagues is determined: business is made between the participants within the enterprise. And by professional purposes Enterprise 3.0 is used
for business with the partners of the enterprise. These needs are the starting points which determine what should be taught [5].

Analysis of the students’ feedback regarding their needs in Enterprise 3.0 was based on the following questionnaire:

Question 1: Do you know the concept of Enterprise 3.0?
Question 2: Do you use Enterprise 3.0 for your individual purposes?
Question 3: Do you use Enterprise 3.0 for your organizational purposes?
Question 4: Do you use Enterprise 3.0 for your professional purposes?
Question 5: Do you participate in activities for your professional development, namely, education, in-service training and/or learning, in use of Enterprise 3.0?

The evaluation scale of five levels for each question is given where “1” means “disagree” and low level of experience in use of Enterprise 3.0 technologies and “5” points out “agree” and high level of use of Enterprise 3.0 technologies.

It should be mentioned that the emphasis of the System-Constructivist Theory on the subjective aspect of human being’s point of view and experience that plays the central role in a knowledge construction process does not allow analyzing students’ needs in Enterprise 3.0 objectively: human beings do not always realize their experience and their wants in use of Enterprise 3.0.

After having implemented the process of clustering with use of online networks of Enterprise 3.0 technologies, the results of two surveys of the participants’ needs in use of Enterprise 3.0 within the Sixth Baltic Summer School 2010 demonstrate the positive changes in comparison with the pre-survey:
- the level of the participants’ experience in terms of knowledge of the concept of Enterprise 3.0 has been enriched,
- the level of the participants’ experience in terms of use of Enterprise 3.0 for individual needs, for organizational and professional needs increased and
- the level of the participants’ experience in terms of participation in activities for professional development, namely, education, in-service training and/or learning, in use of Enterprise 3.0 has been improved.

The Mean results of the descriptive statistics as highlighted in Table 2 demonstrate that the level of the students’ use of Enterprise 3.0 has increased in the post-survey (3.28) in comparison with the pre-survey (1.68).

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-Survey</th>
<th>Post-Survey</th>
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<tbody>
<tr>
<td>1</td>
<td>1.86</td>
<td>3.25</td>
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<tr>
<td>2</td>
<td>1.75</td>
<td>3.44</td>
</tr>
<tr>
<td>3</td>
<td>1.54</td>
<td>3.33</td>
</tr>
<tr>
<td>4</td>
<td>1.57</td>
<td>3.16</td>
</tr>
<tr>
<td>5</td>
<td>1.68</td>
<td>3.21</td>
</tr>
<tr>
<td>mean</td>
<td>1.68</td>
<td>3.28</td>
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The comparison of the Standard Deviation results as shown in Table 3 reveals that the scores of the post-survey are spread wider than the scores in the pre-survey. Therein, in the pre-survey the levels of the students’ use of Enterprise 3.0 are homogeneous and in the post-survey – heterogeneous.
The surveys of the students’ needs in Enterprise 3.0, as emphasized in Table 2, reveals that the students do not realize the possibilities offered by Enterprise 3.0 properly. The results of Mean and Standard Deviation within the surveys of the students’ needs in Enterprise 3.0 reveal that most of answers are concentrated around Level 2 and 3. Thus, there is a possibility to increase the students’ use of Enterprise 3.0 within Web 3.0 technologies.

4. CONCLUSIONS

The empirical results reveal that the process of clustering with use of Enterprise 3.0 within the Sixth Baltic Summer School Technical Informatics and Information Technology is effective to contribute to the engineering students’ use of Enterprise 3.0. Thus, it might be stressed that clustering is effective if students’ needs are met and a support system is created that would secure their learning outcomes, students demonstrate better results.

The present research has limitations. Use of Enterprise 3.0 in the Sixth Baltic Summer School was studied paying attention to the students’ needs. Therein, view of educators and researchers on students’ needs in use of Enterprise 3.0 is necessary to analyze. 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. As well as the empirical study outlines the opportunities of the development of students’ use of Enterprise 3.0. Nevertheless, the results of the research, namely, the process of clustering and the stages of the empirical study, may be used as a basis of the development of students’ use of Enterprise 3.0 of other tertiary institutions. Moreover, if the results of other Baltic Summer Schools had been available for analysis, different results could have been attained. There is a possibility to continue the study.

Enterprise 3.0 demonstrated the technology of online networks to assemble and manage large communities with a common interest in peer contribution, where organisations and enterprises have made use of the potential of Web 3.0 with single solutions such as online networks. However, Enterprise 4.0 as demonstrated in Table 4 will be derived from the full application of Web 4.0 concepts such as ambient intelligence, WebOS or Web operating system, artificial intelligence, rather than Web 3.0 point solutions.

<table>
<thead>
<tr>
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</tr>
<tr>
<td>4</td>
<td>2010 - up to now</td>
<td>Enterprise 4.0 as society</td>
<td>Ambient intelligence, WebOS or Web operating system, artificial intelligence</td>
<td>University Degree</td>
</tr>
</tbody>
</table>
This remains as an open point for the future as depicted in Figure 6. It should be mentioned that the concept of a Web operating system or WebOS is distinct from Internet operating systems. Web operating system or WebOS is independent of the traditional individual computer operating system.

5. REFERENCES


BRINGING MARITIME ENGINEERING EDUCATION TO ANGOLA – THE CASE OF THE NAMIBE FISHERY ACADEMY

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ABSTRACT

The paper discusses experiences and draws conclusions from the first stage of a project aiming at establishing the Namibe Fishery Academy in Angola. In the paper are outlined barriers and problems encountered and a discuss milestones before project goals could be reached. The first stage of the project has been completed and construction works in carried-out according to schedule. A substantial part of laboratory equipment including ship handling and ship engine simulators was delivered. Detailed curricula and laboratory manuals covering specializations subjects taught at the bachelor of science level were prepared and accepted by the Angola Ministry of Fisheries. Discussed economic and political contexts of the project, an outline of the project’s history and goals, the project scope and its results at the completion of the first stage, evaluation project, future and conclusions. The main final conclusion is that government – business – academia partnership was necessary but in sufficient only requirement in building and implementing an engineering higher education institution to a developing nation.

1. INTRODUCTION

Angola, one of African’s emerging economies, suffers lack of educated and skilled professionals able to support development of its economy and effective use of available resources. Among possible approaches to address problems the case of using foreign-aid resources with a view to building a viable academic institution starting practically from nothing is analysed. The project in question involved governments of the Republics of Poland and Angola, Gdynia Maritime University and the company Navimor (Poland). Under an agreement reached by Navimor became a major supplier of hardware, including laboratory equipment and simulators, Gdynia Maritime University, a leading European centre for maritime education, became a supplier of the know-how, including academy organisation, course curricula, manuals, text books and instructor training. The Polish government covered a substantial part of project costs and the Angola Government remains responsible for implementation and coordination of tasks with outside subcontractors responsible for construction of buildings and with the social and communication infrastructure of the Namibe campus.

The first stage has been completed. Construction works was carried-out according to schedule. A substantial part of laboratory equipment, including ship handling and ship engine simulators, was delivered. Detailed curricula and manuals for degree use were prepared and accepted by the Angola Ministry of Fisheries. Yet, the project remains for being successful. Establishing a higher education institution, starting practically from zero, is a tough task. Implementing a project with stakeholders consisting of two government bureaucracies plus a privately owned company and a public university is difficult.

The goal of this paper is to analyse Namibe Fishery Academy with a view to draw conclusions on rationale and methods of bringing higher engineering education to a developing country using resources provided through government assistance programs was. economical and political context of the project will be considered, provide an outline of the project history and goals provided, provided project scope and its results at completion of the first stage, presented and evaluated of the projects future lead to conclusion

2. ECONOMIC AND POLITICAL CONTEXT

According to [8], Angola's high growth rate has been driven by high international prices for its oil. Angola became a member of OPEC in late 2006 and in 2007 was assigned a daily production quota of 1.9 million barrels. Oil production and its supporting activities contribute about 85% of GDP. Diamond exports contribute an additional 5%. Subsistence agriculture provides the main livelihood for most, but half the
country's food is imported. Increased oil production supported annual growth averaging more than 15% from 2004 to 2008. A postwar reconstruction boom and resettlement of displaced persons led also to high rates of growth in construction and agriculture as well. Much of the country's infrastructure remains damaged or undeveloped after the 27-year civil war. Since 2005, the government has used billions of dollars in credit lines from China, Brazil, Portugal, Germany, Spain, and the EU to rebuild public infrastructure. The global recession was temporarily stalled economic growth. Lower prices for oil and diamonds during the global recession led to a contraction in GDP in 2009 and many construction projects stalled because Luanda accrued $9 billion in arrears to foreign construction companies when government revenue fell in 2008 and 2009.

However, Angola has enormous reserves of oil, gas and diamonds, as well as considerable hydroelectric potential, varied agricultural land, good rainfall and considerable marine resources. It is reported in [1] that encouraging the implementation of aquaculture was a priority for the Angola Secretariat of State for Fisheries for 2011. Using available resources in a manner to assure sustainable growth appeared to be the primary challenge to Angola authorities.

Angola has also undertaken several schemes to support development human capital. A shortage of qualified and educated personnel remains a primary barrier to economic recovery and development. Although much has been done towards developing an educational system, the gross primary enrollment rate in Angola remains at a level between 60% and 70% with literacy of 67% as reported by [8] and university yearly enrollment of about 6 500 students [3].

The raising of an educational system in sub-Saharan Africa to meet global standards was difficult. As is observed by [4], policy and curriculum implementation does not follow the predictable path of formulation—adoption—implementation—reformulation, but is recontextualised through multiple processes and mechanisms. Additionally, most implementation occurs with little regard for available capacities or resources. These factors make obscure outcomes predictions of government-supported educational projects.

3. PROJECT HISTORY AND GOALS

As observed by [10] there was a general presumption among policy-makers secondary and higher education was not necessary for economic growth and development. But is proven secondary and higher education in development is vital and that post-elementary was an imperative in the fight against poverty, in reducing infant mortality and to extend life expectancy, plus, it course, economic growth. Contrary to many administrations where secondary and more strikingly higher education have been, neglected, the Angola has recognised the advantages of and the need to develop national competencies in various fields, including use and management of their ocean resources.

Poland as a member of the Organisation for Economic Co-operation and Development (OECD), has undertaken an obligation to promote policies to improve the global economic and social well-being. As a consequence Poland signed the UN Millennium Declaration agreeing to contribute towards achievement of Millennium Development Goals, which include support of the education institutions and ensuring environmental sustainability in developing countries; the EU pledged to spend 0.56% of GNI on poverty reduction by 2010, and 0.7% by 2015.

In 2003 Poland adopted and published a Strategy of Cooperation for Development. The strategy named priority countries, which include Georgia, Moldova, Afghanistan, Angola, Iraq and Vietnam. The case of Angola sectors included agriculture and environment protection, health care and education with particular focus on human resources development in shipping, fisheries and geology.

Examining a history of Angola the following are noted. Portuguese colonists traded as long ago as the 15th century and established a settlement at Luanda in the 16th century. Portugal annexed the territories in the region which were ruled as a colony from 1655. Angola was incorporated as an overseas province of Portugal in 1951. After the Angolan War of Independence (1961–1974) which ended with an army mutiny and leftist coup in Lisbon, Angola's independence from Portugal was achieved on November 11, 1975 through the Alvor Agreement [5].
Polish ties with shipping and fishery industries in Angola enjoy a tradition. In 1975, immediately after Angola’s independence, a Polish mission visited Luanda to support recovery and reconstruction of public services and administration structures. One project, discussed and mutually accepted was establishment of an educational institution providing professional training to Angola Ministry of Fisheries requirements. In 1979, an agreement between the Angola Ministry of Fisheries and two Polish companies – Gdansk Repair Shipyard and Foreign Trade Enterprise Navimor (Gdansk) was signed and the “Helder Neto Center for Professional Development” in Namibe, Southern Angola, began its operations. The Center included a school providing post-primary education professional courses and a middle education school offering technical diploma. Until the early Nineties, professional and technical subjects were taught by Poland specialists, mostly from Gdynia Maritime University. The Center was equipped with tools, laboratory equipment and teaching aids by participating Polish companies. Today the Center maintains its profile and remains in full operation with about 1 500 pupils and students. Its head Dr. Domingos Napoléão Machado is a graduate of the Center and involved in the establishment of the Namibe Fishery Academy.

It is clear the selection of Poland as a strategic partner in developing the higher marine engineering education in Angola was motivated by previous experiences and a positive contribution by the Polish specialists. In 2004 the Angola Ministry of Fisheries began negotiations with the Polish company Navimor and Gdynia Maritime University on possible cooperation to establish a higher education institution named Namibe Fishery Academy. The project materialised after agreement on financial assistance. Credit agreement was signed between the Republics of Poland and Angola in 2006.

In 2007, Navimor, as the main co-ordinator on the Polish side and the Angola Ministry of Fisheries agreed on Polish possibilities:

- Fishery Academy “software,” including educational goals and strategy, specialisation profiles, organisational structure, courses and curricula design, procedures and processes design;
- Polish expert assistance with courses and curricula implementation, and the training of academic faculty members;
- participation in setting academy infrastructure and,
- delivery of laboratory equipment and teaching aids, including specialised ship simulators.

A partner in delivering the software and lending expert assistance was Gdynia Maritime University, the largest institute for higher maritime education in Poland and one it is most prestigious. Since 1920 the university had been training officers merchant marine vessels and for managerial positions at land based institutions and companies allied to the sea. The university’s four faculties offer degree in navigation, marine engineering, marine electrical engineering and business administration. Each faculty bachelor, master of science and Ph.D. qualifications. Today, Gdynia Maritime University has about 7 000 students. Programmes curricula satisfy both Polish educational standards provided by the Ministry of Education and the requirements of the international maritime organisation (IMO). The academic staff – doctors of science and scientific professors in many cases, by the highly qualified, mariners chief engineer officer and electrical engineers – supported by the laboratory facilities offered 25 specialised simulators and ISO 9001 education quality management systems, the university actively co-operated in joint research projects, preparation of young academic staff and in the exchange of students with 25 maritime institutions of higher education such as: the European University Association (EUA) and the International Association of Maritime Universities (IAMU).

4. PROJECT SCOPE

Several courses were presented, for example, [7] and [2], have disclosed the engineering education faced problems such as theoretical approaches to problem solving, insufficient understanding of real-life problems, and poor communication skills. Thorough understanding engineering education stakeholders requirements and adequately responding to them these problems can be overcome. Identifying the stakeholders in higher education has been a different task. In general, students, their parents, taxpayers, faculty, prospective employers, administration and the public at large are involved in the education, their roles differ at various stages of educational institution development. In the case of the Namibe Fishery Academy project the goal
was to enable establishment of a specialised higher education institution with the major stakeholder clearly the Angolan government.

After negotiations with the Angolan Ministry of Fisheries it was decided the future Namibe Fishery Academy would be a public higher education institution, offering BSC level engineering education in the broadly understood fields of fisheries, shipping, fish processing and aquatic resources exploration. Tuition would be Portuguese and studies be open to citizens of other African countries. It is expected the Academy to engage 1 500 students. Further negotiation with the Angola Ministry of Fisheries led to decision on a detailed academy profile (see Table 1).

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<tr>
<th>Faculty</th>
<th>Direction of Studies</th>
<th>Specialization</th>
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<td>Fishery</td>
<td>Economics and Management</td>
<td>Administration and Management</td>
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<td>Operation of Ports and Fleet</td>
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<td>Fish Processing</td>
<td>Fish Processing Engineering</td>
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<td>Aquatic Resources</td>
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It was also agreed study methodology and curricula should meet the standards of the Bologna Declaration [9], Polish higher education standards and IMO requirements including full compliance with the standards of training, certification and watchkeeping convention provisions enabling graduates to obtain STCW Compliant Licenses and Certificates of Competency. First year studies would cover basic subjects (mathematics, physics, computer science, etc.) and would be identical curriculum for all faculties.

5. PROJECT RESULTS AT THE COMPLETION OF THE FIRST STAGE

The first stage of the Namibe Fishery Academy (NFA) project was completed in 2010. The Angola Ministry of Fisheries received and accepted soft deliverables prepared by experts from Gdynia Maritime Universities, these were:

- Organisational and educational concept of the NFA;
- Proposal of documents regulating all internal procedures of the NFA in respect of studies, faculty and students rights and responsibilities, management processes, collective bodies, decision-making procedures, academic documentation, etc;
- A syllabus for each specialisation and course including the description of and rationale for the sequence of topics, format for class presentations and activities, description of materials students required textbooks and other suggested literature, student assignments and requirements, the course calendar, including specific opportunities for student feedback and other important dates, additional sources for students;
- A list of laboratories and equipment with required materials assuring laboratory operation for one academic year;
- A list of basic textbooks and laboratory manuals and,
- A complete set of laboratory manuals for each faculty and specialization course.

The concept of the fishery faculty (maritime specialisation) is shown in figure.1. Similar concepts have been designed and proposed for each NFA faculty and educational stream.

A quantitative view of soft resources delivered to Angola can be summarised as follows:
- for the fishery faculty 213 course curricula and 140 laboratory manuals were designed and written by 86 experts;
- for the fish processing faculty 38 course curricula and 27 laboratory manuals were designed and written by 20 experts and,
- for the Aquatic Resources Exploration Faculty 66 course curricula and 35 laboratory manuals have been designed and written by 14 experts.

All soft deliverables had been translated into Portuguese, the NFA tuition language. The project at the Gdynia Maritime Academy was managed by a steering committee consisting of experts, each responsible for a particular specialization. The committee was led by a senior official from university management. The committee co-operated closely, with the Navimor. The most difficult task was to co-ordinate syllabuses, curricula and course content with a view to maintaining consistency, avoiding redundancies and meeting educational goals. Another important task was to assure that the 120 experts involved delivered their contributions in time and accordance with requirements; this was not always achieved.

Parallel to developing and delivering soft educational resources, the process of constructing the NFA campus and equipping it with hardware, including laboratory equipment and other installation, was begun. Buildings and the campus infrastructure were constructed by independent contractors selected by the Angolan government. Laboratory equipment and installation as well as educational aids are delivered by the Polish company Navimor.

Figure 1. Concept of education at the Fishery Faculty (maritime specialization) NFA
In figure 2 results of building and construction work illustrations (b) and (c) are compared with the state of the building site (a) just before the project was initiated.

![Image](image1.jpg)  
**Figure 2.** Namibe Fishery Academy – building site at the beginning of the project (a) and the current state of construction (b) and (c). Photos provided by the company Navimor.

6. PROJECT FUTURE

By the end of 2010 the Polish government decided the second stage of the Namibe Fishery Academy project would receive Polish assistance in a developing countries programme. Again, Navimor was selected by Polish authorities to manage the second stage of the project under contract with Angola’s Ministry of Fisheries and Gdynia Maritime University as the main supplier of knowledge and know-how in the form of a soft deliverable. Navimor representatives, in August 2011, negotiations with the Angolan partner are still going on but seem to be close to reaching an agreement.
It was expected Navimor would remain as a provider of hardware and supervise delivery and installation of laboratory equipment to specification and design provided by Gdynia Maritime University. Angolan authorities remained responsible for providing complete infrastructure, including the buildings.

At the second stage input from Gdynia Maritime University was:

- Concept and full course materials for the Professional Development Center, including specification of required materials and equipment. The Center was expected to offer an extensive range of professional courses, including basic courses (Elementary First Aid, Fire Prevention and Fire Fighting, Personal Survival Techniques, Personal Safety and Social Responsibilities) and a range of professional courses (Advanced Fire Fighting, First Aid, Rescue Boat, GMDSS, ARPA, etc.);
- strategy and a plan of action for Angolan maritime administration, enabling Angola to be included on a list of countries assessed by the IMO as properly implementing the STCW-95 convention;
- consultancy aid and direct supervision of the initial period of NFA functioning by experts from Gdynia Maritime University;
- writing, editing and producing in Portuguese a set of about 30 textbooks covering main professional subjects in accordance with the study curricula;
- provision of a number of visiting professors and lecturers prepared to train Angolan faculty members on-the-job and,
- graduate and postgraduate (including PhD.) fellowships enabling Angolan personnel to study at Gdynia Maritime University.

All those above points were of assistance in establishing the Namibe Fishery Academy as a worthy and credible higher education institution, providing several requirements were met by the Angolan administration. First the academy would require substantial support in financial and material resources for many years. The academy would also require motivated local specialists to undertake academic teaching roles and continue their careers as faculty members of the NFA. Angola’s educational system had to be prepared to assure middle education graduates were adequately prepared to continue to Bachelor of Engineering levels.

Establishment of the Namibe Fishery Academy was regarded as an important step towards a long-term strengthening of Angola’s economy through contributing to the development of the country’s intellectual capital. If the project was to succeed then its importance and value to the country should not be overestimated. It should, however be kept in mind there were several serious threats and risks involved to be overcome before the Namibe Fishery Academy became a sustainable institution. For an academic institution to achieve ultimate educational and research goals it was necessary to reach in reasonable time a stage where academic personnel could reinvent themselves. To succeed Namibe Fishery Academy would require considerable and consistent organisational and material support from its government and industry for at least the 15 to 20 years. Such support should include resources consistently available for personnel development including, for example, financing of local and PhD. studies abroad, fellowships and traineeships. Another vital success factor was an assurance on academic career at NFA was a competitive option for educated, talented young people. Unfortunately, it was clear allocating the required resources would not produce immediate results and decision-makers, looking usually for a short term if not immediate political gains, might have to think clearly.

7. CONCLUSIONS

The essence of the Namibe Fishery Academy project was transfer of knowledge and know-how from one established university to another one in statu nascendi. Such transfer was constrained by several barriers. Usually the knowledge and know-how subject to transfer is perceived as difficult and, to be successful, required frequent contact with knowledge sources [6]. At this state of the project such contacts were infrequent and difficult. A main reason for that is, could be, inadequate effort by responsible Angolan authorities in respect to establishing the required intellectual capital in the form of necessary teaching capabilities, competencies and future faculty members’ development. So far all contract provisions concerning development and training of NFA staff have been postponed. In the trio of partners involved in the project two, including government authorities and a private company seem far more interested in
developing hardware/software infrastructure and deliverables than in developing human resources to provide the sustainable operations of a higher education institution.

It appears Angola authorities have realised that internationalisation can not be considered as a marginal, add-on activity. To the contrary, it is becoming an important dimension in higher education policy to be developed at institutional and national level, relating to the challenges of globalisation, which increasingly affected the higher education sector.

Secondary and more strikingly higher education, were not often subject to assistance provided by government agencies to developing countries. In majority of cases, donor countries preferred to offer fellowships and support to students studying abroad, instead of development support for potentially competitive educational institutions. The NFA project appears to be a rare exception. As such it must be evaluated as a risky venture. The main risk is a danger of building a white elephant institution, which in the course of the next few years, might vanish. To prevent that, much determination and effort from Angola authorities and continuing support from the donor country (Poland) were required.

The Namibe Fishery Academy might be an exception from the above rule. From Polish experience with the NFA project the most important problems were:

• False belief on the part of the recipient country administration that erecting a campus and buying equipment, concept, curricula, textbooks, manuals and other soft elements assured project success;
• lack of consistency and leadership by recipient country administration with changing requirements specification pursuant to personell changes in administrative bodies;
• lack of resources allocated to the project as a consequence of changing political and economical situations at both the local and global level and,
• inadequate intellectual capital, resulting in difficulties in assuring required competency levels of both – faculty and students.

Finally any government/business/academia partnership is a necessary, but not fullysufficient requirement for building and implementing an engineering higher education institution in a developing country.

8. REFERENCES


DEVELOPING THE ROLE OF UNIVERSITIES IN CONTRIBUTING TO POVERTY REDUCTION

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ABSTRACT

Africa is unique as the only continent in which the proportion of the population in poverty is growing. By 2015 the number of African poor is expected to rise to over 400 million. Economic growth remains a fundamental factor underpinning the alleviation of poverty in Africa. In order to halve poverty by the year 2015, as set in the United Nations Millennium Development Goals, economies will need to grow by 7 per cent a year, nearly double the current rates.

Universities have a unique role in the development process. As part of the formal education system they provide a principal institutional mechanism for the development of human skills and knowledge. Traditionally and uniquely, universities combine this role with the creation of knowledge through activities including research, R&D, knowledge transfer to business and consultancy. This combination of intellectual capital and capacity building provides compelling reasons for universities to be at the forefront of efforts to accelerate economic growth in Africa.

Yet, economic growth alone does not automatically benefit the poor. This paper describes and analyses the lessons learnt by a consortium of higher education institutions who since 1994 have collaborated to identify and implement strategies through which higher education institutions can directly contribute to economic growth and poverty reduction.

1. INTRODUCTION

Africa is unique as the only continent in which the proportion of the population in poverty is growing. Between 1981 and 2000 the number of people living in absolute poverty rose from 136 million to 312 million. By 2000 over 46% of the African population lived in poverty. This trend is expected to continue, the number of African poor rising to 404 million by 2015, [1]. Underlying this poverty is economic decline and stagnation. In contrast to the developing economies of Asia, Sub-Saharan Africa (SSA) has since 1975 seen a decline in per capita gross domestic product [2].

Based on established university roles in higher level skills development, applied research and, increasingly, innovation and technology management activity, a legitimate role for universities in facilitating long term economic growth is often taken for granted. While we will in this paper examine aspects of this assumption, our main purpose is to consider whether and how universities can through their activities achieve direct impact on poverty reduction. To this end we analyse the nature of poverty reduction from a higher education standpoint and elucidate how universities can seek to undertake activities which achieve a direct impact on poverty reduction.

Both our analysis and examples are based on work conducted in Africa under the auspices of the Tabeisa organisation. Tabeisa was established in 1994, as a consortium of four South African and two UK universities with the purpose of collaboration to assist disadvantaged African communities. The community focus of Tabeisa emerged in the context of a post-apartheid South Africa in which issues of inequality and locality are closely intertwined, not least due to the Group Areas Act which, as part of the statutory framework of apartheid, effectively systematised large economic differences between legally and geographically distinct communities. Supported with Department for International Development (UK) and European Union funding Tabeisa has inter alia established university based enterprise centres with the purpose of developing and supporting new companies in such a way as to create sustainable jobs within poor communities. As part of its first EU funded project, Tabeisa achieved over 200 start-ups with the creation of over 800 new jobs. [3] These companies vary across service and manufacturing sectors; low to high
technology base; and with local to national markets. Higher Education expertise supports them in terms of technology (product development manufacturing processes, IT support etc.) and business processes (business planning, investment finance, intellectual property protection, marketing etc.).

Since its first large scale project Tabeisa, encouraged by its funders, has extended the scope of its work elsewhere in Sub-Saharan Africa and further developed its methods, not least in the area of mentorship of small businesses post start-up. In Ghana the small business mentoring function has been reconceptualised to include assistance with the development of international export trade opportunities. Manufacturing for European rather than local African markets has involved addressing a number of technology management challenges from product development and design through to manufacturing processes and marketing. The work on developing international trade opportunities that was initially developed through Tabeisa in Ghana has subsequently been applied to Tabeisa supported businesses in South Africa. Through further EU funding and UK government funding, as at June 2011, Tabeisa has supported the development of over 2000 small businesses based in poor communities in Ghana and South Africa. [4]. As the scope of its work has increased, Tabeisa has retained its original focus on disadvantaged communities with the consequence that its activities remain consistent with the poverty reduction priorities within the Millennium development goals. [5]

2. HIGHER EDUCATION AND INTERNATIONAL DEVELOPMENT

The 1995 UN Summit for Social Development in Copenhagen marked a shift of priority for international development from ‘structural adjustment’ to poverty reduction. The earlier emphasis on correcting macro-economic imbalances and market distortions had been most intensely applied in Sub Saharan Africa over the preceding two decades but without resulting in much progress either in poverty alleviation or economic development. Indeed these programmes coincided with an overall increase in poverty in Africa [6] From the late 1990’s poverty reduction became the main objective of international development programmes in low income countries. In the UK a new Labour Government White Paper on international development represented an early manifestation of this new priority [7]

During the structural adjustment period, economic stagnation in Africa was accompanied by regressive changes in income distribution. Between 1980 and 1995 the drop in average income for the poorest 20% of the SSA population was estimated as twice that of the population as a whole [8]. Such trends suggested that the poverty reduction effort must prioritise income redistribution i.e. activity focussed specifically on increasing the income to poor communities. It is generally recognised that economic growth is an essential underlying feature of improvements in income distribution towards the poor, not least as income redistribution without growth carries the political problem of redistributing income from more affluent groups. In any event in Africa since the average level of income is so low, income redistribution without growth would be unlikely to have much significant effect on the problem. Where average income is low, rapid growth is considered an essential component of poverty reduction. [9]

This two component approach to poverty reduction (growth and redistribution) represents a recognition that economic growth does not necessarily “trickle down” to the poor. In policy terms it emphasises the need to facilitate access for the poor to the human, physical and financial assets needed to improve earning capacity alongside conventional measures for general economic growth. Consequently since 2000 international development activity has prioritised the allocation of resources to projects which can have a direct impact on the wellbeing of the poor in the short as well as the long term.

A consequence of this new emphasis on poverty reduction was a decline in international aid funding designed to strengthen higher education systems. While it is often accepted that universities play a role in economic development by virtue particularly of their capacity to grow intellectual capital in the form of skills, the benefits of higher education were seen to be marginal in relation to the new emphasis on poverty as represented by the UN Millennium development goals, which target the eradication of absolute poverty and achievement of related improvements such as universal primary education by 2015.[5]

A reconsideration of the importance of higher education in relation to international aid took place in 2005. Activity focussed particularly on the G8 summit at Gleneagles Hotel, Scotland in 2005 which included a
major theme on Africa and its development. Notable among preparations for the Gleneagles summit was the establishment by the UK Government of the Commission for Africa in 2004. The Commission for Africa Report [10] emphasised the importance of development of a shortage of professional staff, generally and scientifically proficient staff in particular. It argued that “fundamental to the shortage is the loss of much of Africa’s pool of skills to the developed world” (page 137). The Commission argued that higher education could be a solution to this skills deficit, were it not for the fact that many of Africa’s higher education institutions were still in a “state of crisis”. On the basis of this argument the Commission supported recommendations received from the Association of African Universities (AAU) and the Association of Commonwealth Universities (ACU) for the implementation of a ten year university partnership programme entitled “Renewing the African Universities”. The formal recommendations of the Commission for Africa asked the international community to: “commit in 2005 to provide US $500 million per annum over the next ten years to revitalise Africa’s institutions of higher education” and to provide up to US $3 billion over ten years to develop thirty centres of excellence in Science and Technology including African institutes of technology.

A few days before the G8 summit AAU and ACU held a conference of invited delegates at the University of Abertay in Dundee, not far from Gleneagles. Around 50 delegates attended including representatives from African higher education institutions and a variety of development specialists and practitioners. Shortly after the Abertay conference a communiqué was sent to the G8 summit.[11]. The communiqué welcomed the endorsement by the Commission for Africa of the AAU/ACU ten year universities partnership programme, called for immediate financial support to enhance the institutional capacities of African HEI’s and invited the G8 governments, among others, to implement fully the recommendations of the Commission for Africa relating to higher education. The communiqué made no mention of poverty reduction. Similarly the subsequent report on the “Abertay Conversation” [12] while it does once mention “the reduction of economic and cultural poverty among all citizens” as likely to be among the strategic priorities for higher education, largely neglected the issue.

In the event, a G8 communiqué accepted that support for “networks of excellence between African and other countries’ institutions of higher education” would help develop skilled professionals for Africa’s private and public sectors. However, decisions on G8 funding were put off. [13].

We will examine this question partly through an analysis of the issues and partly through a case study on Tabeisa. In our conclusion we argue that Universities’ contributions to poverty reduction are better delivered through projects which include both economic development and income redistribution components, rather than through the conventional roles of Universities in developing elites.

3. UNIVERSITIES AND INCOME Redistribution

For some decades it has been relatively uncontroversial to assert that while capital and natural resources are the passive factors of production, it is human resources that determine the character and pace of development. [14] The principle institutional mechanism for the development of human skills and knowledge is the formal education system. In the past, many assumed that rapid expansion of the number of places in education is the key to development. Whilst there is evidence in support of the case that an expansion of educational opportunities contributes to aggregate economic growth, it has long been recognised that any evaluation of the role of education generally, and higher education in particular, in the process of economic development needs to go beyond that macro-level analysis and consider also the patterns of benefit within African societies. [15].

In the years prior to the Copenhagen summit, despite considerable investment and rapidly expanding enrolments in formal education, the plight of the average citizen in many parts of Africa was little improved. Absolute poverty remained a chronic problem and economic disparities between rich and poor often widened. One reason for this is that educational systems more often than not, reflect the nature of the society within which they are operating. If the society is not egalitarian in its economic and social structures the educational system will probably reflect that bias in terms of who is able to proceed through it successfully. By reflecting the socio-economic structures of the society in which they operate education systems tend to perpetuate them and consequently can have the effect of increasing rather than decreasing income inequality.
The mechanism for this relates to the generally positive correlation between level of education and level of earnings over a person's lifetime. This holds true, especially for workers who are able to complete secondary and higher education where the income differentials over those who completed only part or all of their primary education can be typically from 300% to 800% [18]. It follows that income inequality would be reinforced, if for example, students from upper income families are represented disproportionately in higher education enrolments. If the poor are effectively denied access to education opportunities, the education system simply reflects the divisions within society and perpetuates inequality.

Moreover, even the potentially positive general benefits of higher education on economic development can be drastically attenuated due to the positive correlation that has been shown to exist between educational attainment and propensity to migrate. Recognising this point the Commission for Africa report refers to the loss of much of Africa’s pool of skills to the developed world, exemplified by Ghana’s loss of around 70% of its medical officers, trained in the 1990’s [10]. Also it has been estimated that there are more African scientists and engineers working in the USA than there are in the whole of Africa [19].

Therefore the benefits of higher education for economic development and poverty reduction cannot be taken for granted. This raises the question as to whether investment in African higher education is the best use of limited development funds when the primary strategic objective of funders is poverty reduction. After the Copenhagen summit the answer to this question was by and large no, with consequent refocusing of aid funding away from university development. In this context recent support for a renewal of such funding by the Commission for Africa, whose report is ostensibly fully committed to poverty reduction, needs exploration. Asserting the links between the development of higher education and professional skills, science, capacity and leadership in Africa is in itself inadequate as a rationale for deploying significant aid funding to universities when set in the context of the continuing pre-eminence of poverty reduction in the development strategies of governments and international aid funders.

4. POVERTY REDUCTION IN PRACTICE: THE TABEISA CASE STUDY

Established in 1994 Tabeisa (Technical and Business Education Initiative in Sub-Saharan Africa) was a consortium of four South African Technikons1 and two European Universities2. The participating South African technikons were classified as “historically disadvantaged institutions” having been established under apartheid to cater exclusively to the educational needs of the “coloured”, “Indian” and black communities, and located in townships and former Homelands. In August 2004 Tabeisa was established as a Section 21 (not for profit) South African company. The original consortium and the subsequent company sought to identify and implement mechanisms by which higher education could act as a catalyst to reduce poverty in disadvantaged communities.

The millennium development targets focus on poor socio-economic groups in the developing world, not on the elite and middle classes which constitute the traditional and still typical beneficiaries of higher education. Any poverty reduction rationale for aid funding to universities must therefore be rooted in direct benefits for those strata of society with which higher education is least familiar. International aid funders were sceptical about claims from universities of the (indirect) benefit to the poor of their activities through “trickle down” from general economic development. Consequently the period since 1994 saw a drastic reduction in aid funding for higher education based projects.

In contrast Tabeisa has, over the same period, received significant funding. The distinctive and original features of Tabeisa which have led to this support, relate to the exclusive focus on measures through which higher education can directly impact the lives of poor people. Tabeisa projects promote enterprise in poor communities in order that disadvantaged people can operate more effectively in the formal economy and in higher education, and as a consequence rise out of poverty. Tabeisa has developed through a number of stages. Early needs analysis work was funded by the two UK universities. This was followed by corporate funding from Eskom and Anglo American/De Beers Chairman’s

1 Peninsula Technikon, ML Sultan Technikon, Eastern Cape Technikon and Technikon Northern Gauteng.
2 Coventry University, University of Greenwich
Fund. Further research identified reasons for success and failure in South African Higher Education including a lack of learning materials specifically designed to meet the needs of disadvantaged African students. Development work on designing such materials was funded initially by the South African Foundation for Research and Development.

After a successful evaluation of the new approach the UK Department of International Development (DFID) funded a significant expansion of the Tabeisa learning materials work. The DFID project included a substantial element of enterprise development. This project was successfully delivered and resulted in a significantly larger EU funded project.

To achieve its aims Tabeisa develops the capacity within poor communities to engage in commercial activity and social enterprise projects. It also supports small business development by new and existing entrepreneurs and develops export markets with Europe.

The Tabeisa model of business support has been developed specifically to address the needs of marginalized groups who may have sound business ideas but have neither understanding of entrepreneurship nor security to provide collateral for loans. Tabeisa is dealing mainly with people who need micro-finance and is achieving success in an area of work where many other initiatives have failed. Tabeisa succeeds by establishing an entrepreneurial culture through training programmes for staff, students and local communities, providing small business support and advice to fledgling and existing entrepreneurs and by researching entrepreneurial issues to inform the development of good practice.

This work has led to the establishment of partnerships with financial institutions which have committed ring fenced finance for “start ups” supported through the Tabeisa process. Since its inception Tabeisa has channelled around thirty million rand of such external finance to entrepreneurs from disadvantaged communities. The work is coordinated through Tabeisa Enterprise Centres (TECs) which are now based at all the African partner universities.

Thus the development of Tabeisa has been a staged process involving:-

Stage 1 Early needs analysis/partnership building
Stage 2 Development of models and approaches (funded by Eskom, British Council, Anglo American, De Beers Chairman’s Fund, Foundation for Research and Development).
Stage 3 Implementation (funded by Department for International Development.)
Stage 4 Scaling up the model (funded by European Union)
Stage 5 Is the next stage for Tabeisa and will involve the implementation of a longer term sustainability strategy so that Tabeisa becomes independent of international aid funding.

As part of this longer term sustainability strategy Tabeisa has already developed a trading enterprise (Exclusive Roots) www.exclusiveroots.com which specialises in retail/wholesale in Europe of quality fairly traded products from disadvantaged African communities. All profits from Exclusive Roots are reinvested in the work of Tabeisa. Through this new initiative Tabeisa is not only providing business advice and support to people from disadvantaged communities to create their own businesses but it is also providing product development and market access to European markets for some of those businesses and using the income generated to provide further support to disadvantaged communities.

The development of export markets to Europe serves to connect the spending power of affluent European populations with poor communities in Africa. Tabeisa has worked with Ghanaian small textile and garment manufacturing businesses with the purpose of exporting to the U.K. The project called “Design 4 Life” had as a central organising theme a competition through which young European designers were encouraged to submit designs for Batik cotton garments for European markets. A panel of competition judges were assembled including U.K. retail industry buyers and a timeline was established leading up to a prize giving and catwalk presentation at the launch event for the 2006 Ethical Fashion Show in Paris. As a result of this activity Topshop, U.K.’s leading High Street fashion chain, ordered the winning designs as part of its Spring 2007/8 collection.
The project’s focus on garment manufacture was informed by earlier research by Tabeisa investigating relationships between gender, poverty and entrepreneurship [20]. In Ghana batik production and garment manufacture is a female dominated activity employing handmade processes. Tabeisa has developed a partnership with 38 independent women cooperatives. Equipped with the necessary basic skills, the women concerned had the potential for business growth but critical barriers relating to product design, manufacturing processes and market access stood in the way of growth through export.[21] Manufacture for export necessitated significant changes to production processes in order to achieve the necessary standardisation of product and consistency of quality, both in terms of the batik materials and the garment manufacturing.

The manufacture of consumer goods in developing countries for Western European markets is known in some cases to involve unethical exploitation of labour. Tabeisa requires a transparent and fair distribution of benefits for all components of the supply chain and has been independently cited by BBC News 24 as a contrast to “sweatshop” exploitation. Topshop launched the Tabeisa collection on 2nd April 2007. The BBC reported that this project was the first time that a UK mainstream high street retailer had developed a garment range in which both the textiles and the garments had been produced on the basis of fair trade principles. [22]

Seeing the market limitations of the original Fair Trade model based on traditional products sourced from low-capability enterprises, Tabeisa have sought to approach it with a more commercial attitude. Products are either sourced from the new generation of design savvy FT enterprises or Tabeisa provides design assistance to groups with production capabilities. As their business has expanded, Tabeisa has sought to adopt a fair Trade code both to gain market credibility, and also to establish for the benefit of themselves and their suppliers, the rights and responsibilities of chain actors in fulfilling pro-poor trade. It soon became clear however, that the current IFAT standards failed to capture what is fair for the majority of the people who make the products supplied to them, as suppliers use mostly flexible labour and some formally employed labour. This prompted Tabeisa to commission further research into the relations of production existing amongst producing actors in their current supply base, with a view to developing their own credibility framework which would better protect and promote pro-poor trade. The new credibility framework developed from this research is novel for Fair Trade non-FLO sectors as it starts by defining the relations of production between Tabeisa (the northern buyer), the Southern supplier, and those that make the products being bought. [23]

5. THE TABEISA TRADE DEVELOPMENT MODEL

The previous work described amongst other research and development activities has informed the development of the Tabeisa Trade Development Model.[24][25][26][27] The Tabeisa approach to supporting trading development is shown diagrammatically in Figure 1. The model typically involves 5 stages as follows:

Stage 1. Opportunity & aspiration building
Stage 2. Product development & business planning
Stage 3. Manufacturing & business processes
Stage 4. Market entry & testing
Stage 5. Business development

The model is a simplified representation of a complex process that is applied flexibly according to sector and local need. Each stage consists of various activities, each represented by a box in the diagram overleaf and outlined below. While the stages are normally delivered sequentially, the activities within a stage are normally addressed simultaneously.
Through the Tabeisa Trade Development Model contracts have been obtained from major retailers both within South Africa and the UK. It is these wholesale orders that will start to provide the basis for sustainable income for businesses based in poor communities in Africa.

6. CONCLUSIONS

First amongst the Millennium development goals is the eradication of poverty. The target is to half between 1990 and 2015 the proportion of people whose income is less than US $1 a day. This target is ambitious and increasingly short term. In this context we have raised the question above as to whether it is legitimate for international aid funding to be invested in higher education projects. If the answer to this question is to be yes then the argument must be strong as scarce funding must be focussed for maximum benefit as the opportunity costs of investing in projects without direct impact on poverty will be borne by the world’s most vulnerable communities.

The Millennium development targets focus on the lower echelons of societies in the developing world, not on the elite and middle classes which constitute the traditional and still typical beneficiaries of higher education. Any rationale for aid funding for higher education must therefore be rooted in benefits for the strata of society with which it is least familiar. In our view the case for funding higher education is not persuasive if it relates only indirectly to poverty reduction. We do not here dispute the idea that higher education is important for long term economic development. However, economic development is different from poverty reduction. We have referred above to the two component strategy for poverty reduction which necessarily involves both economic development and income redistribution. We have also described a university based project designed to deliver both in order to have direct benefit in terms of poverty reduction.

The Tabeisa case study described serves to illustrate the point that Universities can deploy their expertise in such a way as to directly reduce poverty, and on this basis we welcome the increased recognition of higher
education institutions in international development. However, we are concerned that increasing support for higher education as the recipient of international aid funding is not based on poverty reduction reasoning such as we have outlined, but rather constitutes a drift from poverty reduction priorities and the Millennium development goals. This drift is manifest in the Commission for Africa justification for higher education support which emphasises the development of elites to fulfil professional roles in society and as a basis for good government. While the Commission for Africa report raises the problems of emigration as a result of higher education, it does not seem to recognise the significance of the point in eroding the validity of its own argument.

Another illustration of this drift is provided by the World Bank Education Sector Strategy [28] and more particularly the Education Sector Strategy Update (ESSU) of 2005 [29]. The original strategy and indeed the Dakar summit on “Education for All” in 2000 focused on primary and basic education leaving tertiary education in the background. In contrast the ESSU broadens the strategic agenda through adopting a system-wide perspective and aims beyond compulsory education to develop the “advanced skills for countries to compete in global markets”.

These examples illustrate how the rehabilitation of higher education in aid terms is not promoted by arguments that relate directly to poverty reduction. The development through higher education of elites including scientists, professionals and those to be involved in government may (or may not) provide a better basis for economic growth. However, in these recent documents poverty reduction is either neglected or, by implication, considered as the same as economic growth. Bloom, Canning and Chan [30] illustrate this latter tenancy: In seeking to challenge the “long held belief in the international development community that tertiary education has little role in promoting economic growth” they express their intention to review the “evidence about the impact that tertiary education can have on economic growth and poverty reduction” in Sub Saharan Africa. However, the paper looks exclusively at the relationship between higher education and economic growth. Despite the claims of its introduction there is no examination of the relationship between higher education and poverty reduction, rather, poverty reduction is implicitly assumed to be an inevitable consequence of economic growth. Consequently an association between higher education and economic growth is taken (without justification) to imply a relationship between higher education and poverty reduction. Yet, as we have reasoned above, this connection can not legitimately be assumed.

Possible economic development benefits alone do not constitute a strong rationale for funding higher education development in the context of the Millennium development goals. If higher education is to be funded, it should be in the context of efforts to achieve both economic development and income redistribution. In the Tabeisa case study which we have described the manufacturing processes, whilst skilled, do not demand high upfront capital investment or high levels of educational achievement by participants. Consequently the development of export markets to Europe serves to connect the spending power of affluent European populations with poor communities in South Africa and Ghana.

However, our argument is not exclusively in favour of low-tech projects. High-tech projects can also directly impact on poverty provided they have income redistribution components. That is to say the benefits are directly relevant to the income of poor communities. Whether relating to low-tech or high-tech activity we believe that technology management projects with direct involvement of poor communities constitute an effective means by which universities can genuinely engage with the poverty reduction challenge.

On this basis we assert that Universities can indeed make direct contributions to poverty reduction but not as a consequence of their general development, especially when the patterns of benefit focus on an elite. Rather genuine university contributions to poverty reduction can be achieved through projects which focus on poor people and impoverished communities thereby avoiding the pitfalls of exacerbating income inequality. If universities wish to play a part in development on the basis of international aid funding they must venture beyond their traditional and familiar roles and also embrace a poorer clientele. We have provided one example of such activity. On the basis of continuing support from the British Government and the European Union the Tabeisa Universities will continue to work directly on poverty reduction in Sub-Saharan Africa.
7. ACKNOWLEDGEMENTS

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The Tabeisa Universities are:

Cape Peninsula University of Technology
Coventry University
Durban University of Technology
Tshwane University of Technology
University of Greenwich
Walter Sisulu University for Science and Technology

8. REFERENCES


FROM INTERDISCIPLINARY TO TRANSDISCIPLINARY HIGHER EDUCATION FOR INTERNATIONAL BUSINESS: A CRITICAL REFLECTION ON THE POSSIBILITIES AND LIMITS OF INTEGRATING DIFFERENT DISCIPLINES

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ABSTRACT

This paper is about interdisciplinary higher education for international business. It discusses conceptual and practical questions related to the question of how to prepare students from different scientific disciplines for international business. It presents the concept of and the experience gained in an interdisciplinary study programme designed to facilitate and strengthen international encounter and exchange between domestic and visiting bachelor students at the University of Wismar. The programme’s curriculum is interdisciplinary and covers a wide range of issues related to international business. With regard to teaching aims and methods the programme has been developed step by step, with the focus gradually shifting from providing knowledge to developing skills and competences. With regard to this programme which is designed for business students the paper looks into the question of how students from different scientific fields can be taught in an integrated way. The paper analyses the potential benefits of a shift from interdisciplinarity to transdisciplinarity. The basic characteristics of multi-, inter- and transdisciplinarity are set out before exploring their differences in a context of designing international business education. Finally strategic options for further developing higher education for international business are discussed.

Internationalisation, globalisation and the Declaration of Bologna have all had a strong influence on higher education, whether on an international or European level in general, within Germany or specifically at the University of Wismar.

At Wismar internationalisation is part of the University’s overall mission and the University has taken a number of decisions enabling it to adjust to the changing situation. One measure taken at the business school involves the establishment of a special study programme for international students. Called the “International Class”, this programme specifically designed for business students is interdisciplinary. We have recently been seeing increased interest in the programme from students from other faculties such as architecture, mechanical and environmental engineering or multimedia design. The purpose of this paper is to discuss the strategic options involved in integrating such students. All discussions centre around the question of the right scientific, organisational and didactical structure needed to prepare students from different academic fields for international business. This question is discussed both from a general and theoretical perspective and from a practical perspective with regard to the requisite organisational structure, teaching aims and methods. We will proceed as follows: we will start by reporting on our experience with interdisciplinarity in international business education. We will then move on to present concepts of multi-, inter- and transdisciplinarity with regard to international business education before discussing the strategic options for offering higher international business education especially to students from non-economic fields. The intention of this paper is to initiate a debate on the issue at hand. The paper is based to a large extent on the author’s personal experience in his capacity as coordinator of the International Class. We would greatly appreciate your comments, questions and further information under the following email-address: andreas.buecker@hs-wismar.de

1 EXPERIENCE WITH INTERDISCIPLINARITY IN INTERNATIONAL BUSINESS EDUCATION

1.1. ORGANIZING INTERNATIONAL MOBILITY IN BUSINESS EDUCATION

The rise of the global economy and political upheavals such as the collapse of the Soviet Union or further European Union integration at the end of the 20th century saw higher education faced with substantial
challenges with regard to internationalisation at the beginning of the 21st century (Kaynak & Schermerhorn 1999, p. 1 et seq).

On the one hand, higher education institutions had to adjust their educational offering to political and market demands, while on the other hand student interest in international education increased strongly.

This led to the University of Wismar business school’s decision to create a study programme – the “International Class” - for visiting students facilitating encounter between domestic and foreign students.\(^1\)

With all courses held in English, the programme is interdisciplinary, covering a broad range of business administration, IT and law subjects related to international business. Study programme courses are also integrated into domestic study programmes, with German students able to choose “International Class” courses as optional modules and with ECTS credits awarded to students counting for domestic study programmes as well. The overall aim of this concept is to get foreign and domestic students meeting up in the classroom and to provide them with the opportunity to share their backgrounds and discuss their different views around a common topic.

The programme’s interdisciplinary design has both a scientific and organisational background. From a scientific point of view the intercultural dimension and the development of intercultural competences is a key element in international business education. Students need such competences to manage their own educational progress while studying abroad. And in the context of the Bologna process an emphasis is put on students needing to already develop key professional competences while at university (Hiller 2010, p. 19).

The International Class programme explicitly addresses such competences, with courses such as business ethics, business communication or "doing business in Germany" on offer.\(^2\)

A further highly relevant topic is the technological business environment characterised by rapidly developing information technology (Brooks, Weatherston & Wilkinson 2004, p. 148). The International Class curriculum covers this dimension with such offers as a "PC-based business simulation game" or "mobile agents - programming the Lego robot".\(^3\) With language skills being equally important (Hagen 2010, p. 23), a number of classes focus on language issues.\(^4\)

This is no exhaustive list of the academic requirements governing international business education. We are also of the opinion that needs and demands vary in different fields of business and that internationally oriented students have different interests, meaning that adopting a “one size fits all” approach would not be appropriate. But we do believe that there is one aspect all International Class students share: all have been successful in the past. They arrive already equipped with a set of skills, knowledge and experience needed in their domestic environment but not necessarily in their new setting. Our conclusion here is that they do not need more of the same skills, knowledge and experience, but instead different and new competences. In this respect an interdisciplinary environment is both a challenge and a chance to acquire new skills.

There are also organisational reasons from an institutional perspective which led us to adopt an interdisciplinary programme. First it is extremely difficult to provide a programme exactly matching the requirements of study programmes in other countries. This means that students will always be confronted with difficulties when seeking recognition of credit points gained abroad. In addition there are capacity problems involved in offering tailor-made classes for students from all over the world, all of whom have their own specific needs. It is very difficult , if not impossible , to meet all these different requirements. And, last but not least, it would be a struggle to fill such tailor-made classes.

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\(^1\) For more details see: [http://www.wi.hs-wismar.de/de/internationales_studium/international_class](http://www.wi.hs-wismar.de/de/internationales_studium/international_class) (last visited 13.09.2011)

\(^2\) For more details see: [http://www.wi.hs-wismar.de/de/internationales_studium/international_class/programm_of_the_international_class](http://www.wi.hs-wismar.de/de/internationales_studium/international_class/programm_of_the_international_class) (last visited 13.09.2011).

\(^3\) For more details see the programme of the International Class (Fn. 2).

\(^4\) For more details see the programme of the International Class (Fn. 2).
1.2. FROM CURRICULUM INTERNATIONALISATION TO STUDENT INTERNATIONALISATION

The initial focus of the International Class was on developing a curriculum suited to higher international business education. But practitioner experience and criticism have shown that just teaching international topics and raising awareness for international business do not match demands for internationalisation. Though knowledge and understanding are necessary preconditions for becoming a successful professional, they are by no means the only ones. The student himself needs to be taken into account. It is not sufficient to instil in him knowledge and understanding of international business. What is also needed is to build up a student’s competences to operate effectively in international environments (Sherman 1999, p. 30). To develop these competences, different teaching methods are necessary. These can be characterised as project based and active learning. Whereas the potential for developing intercultural competences is enormous when students from different countries and cultures meet in the classroom this does not actually take place unless the right learning environment is provided (Dalgish & Evans 2008, p. 11). As a consequence new teaching methods such as business simulation games and project based classes have been included as a way of training intercultural competencies. In these classes students need to leave their domestic environment behind them, acting as true international students when requested to apply their knowledge and draft and implement their own individual action plans in a new environment.

2. POTENTIAL BENEFITS OF A SHIFT FROM INTERDISCIPLINARITY TO TRANSDISCIPLINARITY

Though the “International Class” programme is primarily designed for business students, in recent time we have been noticing a growing interest on the part of students from disciplines other than economics. Against such a background, we would like to raise the question of how to go about integrating such students into the programme. We will analyse and discuss whether a multidisciplinary, interdisciplinary or transdisciplinary approach is appropriate to serve our interests. Moreover any move towards transdisciplinarity may potentially benefit business students. We will start by outlining the concepts of interdisciplinarity, multidisciplinarity and transdisciplinarity, then moving on to transpose these theoretical concepts into operational terms with regards to study programmes.

2.1. THE NOTION OF INTER-, MULTI- AND TRANSDISCIPLINARITY

The notion of interdisciplinarity is related to developments in various different scientific disciplines. The ongoing process of research specialisation has led to a far-reaching differentiation of academic disciplines. This in turn has led to calls for reform aimed at overcoming established discipline boundaries. The term interdisciplinarity is typically used to denote that a number of disciplines are involved in a specific case or question. Whereas in a multidisciplinary approach an academic question is subject of different disciplines that will work in a self-contained manner, an interdisciplinary approach is characterised by the integration of knowledge, theory and methodology of different disciplines (Lawrence 2010, p. 17 et seq). Typical characteristics of interdisciplinarity are that (a) the aim of the integration is for representatives of different disciplines to reach consensus on understanding and describing the problem, (b) that the final result of the research is influenced by two or more disciplines, and (c) that the results can be used in different scientific fields (Di Giulio & Delfia 2011, p. 104). There is a broad range of approaches providing a precise definition of interdisciplinarity (Frodeman, Thompson Klein & Mitcham 2010).

A transdisciplinary approach can be understood as a specific branch of interdisciplinarity (Frodeman 2010, p. 31 et seq.). Such an approach assumes that overcoming the boundaries of different academic disciplines is a most relevant and beneficial aim. However there are even more challenges needing to be taken into account. New knowledge and technologies are needed to tackle the serious problems facing the world such as climate change, poverty, etc. Links are needed between science and these real-life issues. In many cases scientific research, concepts, theories, models and methods are based on "ideal-world" concepts or assumptions, making it difficult to determine whether the use of such knowledge can actually describe, explain and solve

5 For more details see the programme of the International Class (Fn. 2).
“real-world” problems. This is particularly true when the transfer of scientific knowledge into the real world is a one-way street, ignoring the experience and knowledge of practitioners. In such cases the application of science may even be harmful (Hoffmann-Riem et al. 2008). It was against this background that the concept of transdisciplinarity emerged. One of the main characteristics of transdisciplinary research and education is that it is designed to overcome a mismatch between scientific knowledge as produced by academia and the quest for knowledge providing solutions to real-life problems. Therefore it is essential for transdisciplinary research

"to grasp the relevant complexity of a problem
to take into account disparities between the real-life and academic perceptions of problems
to link abstract and case-specific knowledge, and
to develop knowledge and practices that promote what is perceived to be the common good"
(Pohl & Hirsch 2007).

2.2. WHAT DOES MULTI-, INTER- AND TRANSDISCIPLINARITY MEAN WITH REGARD TO INTERNATIONAL BUSINESS EDUCATION?

When students from such different disciplines as business, natural sciences or design come together to study international business, then the time has come to start thinking about interdisciplinary education. Multidisciplinarity, interdisciplinarity and transdisciplinarity are three different theoretical orientations with the potential to guide curriculum development. For each of the orientations we will try to exemplify its relevance to an international business study programme.

The easiest form of combining different disciplines is a multidisciplinary approach. In this case each discipline applies its own knowledge, theories and methodologies in a self-contained manner, meaning that students are provided with knowledge in different disciplines without being able to integrate it. With regard to international business this means that students coming from technology or design courses are provided with current business knowledge at the business school - as found in any typical MBA programme on International Management.

MBA programmes traditionally offer intense management education combined with specific international business topics. Students from other disciplines are taught to act like a manager and apply business knowledge. The topics taught range from statistics, accounting, marketing or controlling to global economic integration and international business development, also including such specific skills as language, presentation or negotiation skills. The objective of any such programme is to make the student capable of acting like a businessman.6

If for example a web-based service product has been developed by engineers the student could be asked to conceive, prepare and implement the establishment of a branch office in the target country, meaning that he would need an understanding of freedom of establishment principles, company law as well as financial issues and project management.

An interdisciplinary approach is a more intensive form of combining different disciplines. More than one discipline is always involved, with their individual knowledge, theory and methodologies being pooled for a specific case study. In interdisciplinary programmes students are provided with knowledge from different disciplines and learn how to integrate this. Interdisciplinary programmes can for example combine general management topics, political science, communication and language training with methodological skills and competences in order to be able to integrate different aspects such as technology and business culture (Schorr 2000; Ancilli 2004, p. 95 and 107).7

If for example a web-based service product has been successfully developed but lacks customer acceptance in certain countries, an interdisciplinary task for students could be to analyse why customers do not accept or trust the web-based service and to link these findings with the product’s technical design.

Transdisciplinarity provides the most ambitious approach. It aims to integrate different disciplines by transcending academic boundaries, thereby becoming open to the needs and requirements of politics and society. Environmental protection, social justice and health protection are all examples of current challenges for our society which transdisciplinary projects aim to tackle.

This means that transdisciplinary education is subject to high and very ambitious scientific standards, necessitating the development of personal skills in addition to comprehensive knowledge of a particular scientific subject in order to facilitate communication and consensus-building across disciplinary boundaries. At the same time transdisciplinary teaching is strongly influenced by the need to produce a meaningful outcome relevant to society or politics (Di Giulio A. & Delfia R. 2011, p. 104 et seq.). For this reason transdisciplinary teaching will always strive for intensive exchange and cooperation with practitioners representing the interests and needs of the real world.

With the concept of transdisciplinarity still fairly new and the discussion on its development still at an early stage, it is more difficult to precisely define and describe what transdisciplinary programmes typically look like (Wiesmann et al. 2008). Although transdisciplinarity is a demanding concept we can find examples of it at Bachelor, Master and PhD levels (Di Giulio & Delfia 2011). References and information on transdisciplinary programmes can for example be found on the websites of the Network for Transdisciplinary Research8, the Association for Integrative Studies9 and the Centre for the Study of Interdisciplinarity10. A very good account of how transdisciplinarity is taught at introductory, intermediate and senior levels is provided by the Association for Integrative Studies.

With regard to our example of the development of a web-based product, a transdisciplinary approach would involve students designing the system in such a way that it provides civil society with the opportunity of becoming better informed and participative. Students could for example be requested to discuss the project with institutional and social actors and to develop and implement their concept in cooperation with practitioners. Requirements would of course differ according to the student’s level. At undergraduate level the focus would be more on understanding different disciplines and the concept of transdisciplinarity. At graduate level the focus would be more on the independent application of such methodological skills as problem formulation, identification of different scientific disciplinary insights and theories, the integrative analysis of the problem and the development and implementation of a solution. At PhD level students could be expected to draft their own transdisciplinary research project in line with their individual interests.

3. DISCUSSION OF THE STRATEGIC OPTIONS

In the previous section we took a look at multidisciplinarity, interdisciplinarity and transdisciplinarity as ways of combining or integrating different scientific disciplines into one study programme. In this section we focus on potential benefits and limitations and the didactical, methodological and institutional challenges and prerequisites of these approaches with regard to our specific Wismar environment, integrating students from disciplines other than economics into the International Class programme.

3.1. ASSESSMENT OF THE MULTIDISCIPLINARY OPTION

One strategic option we have is to offer the International Class study programme to students from disciplines other than economics under the multidisciplinarity concept. In doing so we would offer a programme similar to MBA programmes in international management which are open to graduates from all disciplines. This would involve training students to become managers. Experience shows that this is a widely and successfully

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implemented approach, indicating student demand for such programmes. One can expect that the students taught in two disciplines will in practice make full use of their competences and develop techniques integrating their knowledge across disciplinary boundaries.

However with regard to our Wismar programme we have to keep in mind that the International Class is a study programme designed for bachelor students coming from different fields of economic studies such as business administration, business law or business informatics which means that all students already have a basic understanding of economics. The programme is not holistic in the sense that it provides all the knowledge and skills necessary to become a successful international business manager.

Furthermore MBA programmes are designed for graduate students whereas the International Class is a study programme for bachelor students. Therefore a multidisciplinary approach designed as an MBA programme will either fail to provide all the knowledge and skills one could expect or may turn out to be too demanding should the whole range of management knowledge and skills be compressed into one or two semesters at bachelor level.

What might be possible, when adopting a multidisciplinary approach, is to offer courses not requiring specific previous knowledge such as introductory courses in business culture (e.g. "doing business in Germany"), business language or intercultural competences. One could leave it up to students to compile their own individual international learning curricula in line with their personal preferences. However the feasibility of such an approach needs to be looked into further: one would have to investigate whether it really matches the needs of other disciplines and whether the formal requirements of typical study regulations for economics students and students from other disciplines are met.

With regard to multidisciplinarity one could also think about creating a postgraduate programme. However account should be taken of the fact that there are already a large number of international MBA programmes on the market. The answer would be to offer more tailor-made programmes better serving the specific needs of students from non-economics disciplines than existing programmes. This leads us to the second strategic option: the development of an interdisciplinary and even transdisciplinary international business programme.

3.2. ASSESSMENT OF THE INTERDISCIPLINARY AND TRANSDISCIPLINARY OPTION IN THE WISMAR ENVIRONMENT

Given the major environmental challenges facing the world and the rapid change in global economic and political patterns, interdisciplinarity or even transdisciplinarity could well become relevant and appropriate orientations for international business education. We will deal with interdisciplinarity and transdisciplinarity simultaneously as from a didactical and organisational point of view both approaches present similar challenges. Although transdisciplinarity is the more ambitious approach, both require comprehensive methodological training.

The demanding conception of interdisciplinarity and transdisciplinarity is the first and most important issue needed to be considered. We have to keep in mind that the International Class is a bachelor-level study programme. From a theoretical point of view it seems logical that undergraduate students in the process of acquiring the necessary foundations of their discipline might find themselves unable to cope when confronted with complex problems and expected to integrate comprehensive theories with a view to developing new methodologies and knowledge (Newell 2006, p. 89).

This can be illustrated by the following example: students unfamiliar with business law will find themselves unable to gain the knowledge needed to apply business law methods within just one semester. Such methodologies as the so-called technique of subsumption or the drafting of expert opinions on a given subject need a lot of time and practice before students become fully familiar with them. One can assume that the same applies to a variety of methodological skills in other disciplines as well.
Such methodological requirements alone are an argument in favour of postgraduate programmes in interdisciplinary studies. The high number of interdisciplinary Master programmes covering international topics\footnote{See for example: http://www.unis.muohio.edu/aisorg/Masters/index-programs.shtml (last visited: 23.09.2011).} from an interdisciplinary perspective is an indicator of the high student demand.

In our context this means that one option could be to have two or more universities offering a joint interdisciplinary or even transdisciplinary Master programme providing students with a high degree of freedom to tailor their personal curricula to their specific needs and interests. The link between the participating universities would be their common mission regarding transdisciplinarity and the need to tackle the challenges of changing global economic and political structures.

An important prerequisite that needs to be discussed among the participating universities would be whether they can agree on a common mission for a joint master degree program as suggested above. For the case triggering this paper, students from different disciplines interested in joining the International Class - the question still needs to be answered, how their interests can be best served. Empirical evidence shows that transdisciplinarity, even though very demanding, can be feasible at undergraduate level as well, when the level of requirements is not too high and when students are provided with a clear framework for transdisciplinary research (Newell 2006, p. 102).

A simple but nevertheless meaningful level of integration could be to develop an understanding of different disciplines and their methodological approaches. A more ambitious approach could be implemented through project- and problem-based learning. In such a context, students from different disciplines could be taught to proceed in a specific order, focusing on identifying conflicts from different scientific perspectives, building a common understanding and terminology, identifying linkages between the different disciplinary approaches and finally defining their own approach for solving the problem (Newell 2006). Such an approach could for example be implemented in the context of the intercultural practice project offered by the International Class every semester.

This inter- or even transdisciplinary form of teaching could be complemented by other meaningful courses such as (business) language courses or courses covering such intercultural topics as intercultural project management or business culture (e.g. "doing business in Germany"). Before heading off in this direction we need to discuss with representatives from other disciplines whether such an approach really matches the needs of their students and whether the study and examination regulations of the other disciplines allow participation in such a programme.

4. CONCLUSION

Multi-, inter- and transdisciplinarity can be seen as different ways of preparing students from disciplines other than economics for international business. Multidisciplinarity is, at least at bachelor level, not the most suitable approach to teach international business to students from different disciplines. Interdisciplinarity and transdisciplinarity seem, in comparison to multidisciplinarity, to be more appropriate ways of tackling the major challenges and the economic and political upheavals the world is experiencing at the beginning of the 21st century.

At postgraduate level a well-coordinated joint master degree programme offered by more than one university could provide international experience and interdisciplinary competence in business and technology. A prerequisite is that the participating universities have a common mission regarding the challenges posed by changing global economic and political structures.

At bachelor level, inter- and transdisciplinarity offer a way of preparing students from different disciplines for international business, though requirement levels should not be too high. Further discussion with representatives from other disciplines is needed, checking whether such an approach matches their needs.
5. REFERENCES


ENGINEERING PROFESSION FOR SUSTAINABLE INNOVATION IN THE DEVELOPING COUNTRIES.

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ABSTRACT

For any economy to strive for sustainable innovation, the engineering profession must be given its rightful place. This is the profession that drives the economy of any nation. The awareness, impact and training, need to be evaluated without which the role or relevance of engineering will not be noticed. The engineering profession and engineering infrastructure must be sustained and updated to enhance industrialization for the globalized economy. In many developing economies, engineering is not seen as the driver of the economy. Engineers are used and dumped many a times. In this regard, this paper discusses engineering profession’s on positive innovation mostly in the developing countries. For sustainable innovation to strive, the engineering profession must be taken seriously by stakeholders as regards funding engineering education, providing adequate engineering infrastructure, manpower development, poverty reduction through entrepreneurship and creating enabling environment for engineering practice.

Keywords: Sustainability, University Education, Innovation, Industrialization, Entrepreneurship, Poverty Reduction.

1. INTRODUCTION

Engineering which is the application of science to designing, planning, construction and maintenance of buildings, machines and other manufactured systems [1], is a vital tool for improvement of the standard of living of a society. In [2], Engineering is the profession that utilizes the knowledge of mathematics and natural sciences gained by study, experiment and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. It is seen as the driver to the socio-economic development of a nation. It is a noble profession that builds great and noble work force that any Nation can be happy to have. It embraces all aspects of human activity. Health, Transport, Communication, Agriculture, Environment, Energy and Power are the numerous areas of application. On a daily bases the society experiences one problem or the other in the above mentioned areas of application. Engineers sit back to proffer solutions to these problems first from the drawing board to the implementation stage. Therefore, research carried out by engineers must be funded, encouraged, commended and rewarded; this will go along way to motivate the engineer who spends time on research that leads to sustainable innovation. For the engineering profession to maintain its dignity, priority should be given to research having higher percentage of local content with minimal cost [3,4]. When the engineer understands his society, research becomes a hobby and not a task. Quality of the engineering education results in quality engineers in society, not expatriates but indigenous. Modalities must be put in place for procedural take over by indigenous engineers from the expatriates [5,6]. As society continues to survive on planet earth, greater understanding of the planet is sort. Nations seek to move towards self reliant and security of their sovereignty. The involvement of the engineering profession in the realization of these aspirations yield faster results [5].

2. CHALLENGES OF ENGINEERING EDUCATION

2.1 TRAINING OF THE ENGINEER

Nigeria with 36 Federal owned Universities, 36 State owned Universities and 45 privately owned Universities [7], yet the quality of engineering manpower needed by the country is grossly inadequate. This situation calls for urgent redress concerning the curriculum of engineering in Nigerian Universities. Most of
these Universities don’t have enough and adequate infrastructure for teaching and learning of engineering. It is recommended in this paper that, the Nigeria government should select at least twelve (12) out of the lot, that is, two in each geo-political zone and raise these twelve (12) Universities to world standard. The accreditation of University programs by NUC should be taken seriously. Any University that cannot meet up with the minimum standard should be asked to close down. Mostly accreditation of the departments from the engineering faculties should be taken more seriously using both national and international professors. This will create sanity in the accreditation results.

2.2 ENGINEERS NOT INVOLVED IN POLICY MAKING

Engineering profession creates wealth for self reliant and opens the door to socioeconomic emancipation. It can also cause a country to become a major player in the global economy. The quality of engineering professionals and infrastructure is a measure of societal awareness of the impact and contributions of engineering to nation building. In many developing economies, engineering is not seen as the driver of the economy. Engineers are used and dumped many a times. The engineers are not included in the class of policy makers. Common occurrence is appointing a non-engineer to head an engineering concern establishment. For instance, appointing a journalist commissioner or minister of works beat every imagination. Investigation has shown that, a medical expert must always head the ministry of health. Public works department (PWD), suppose to always be headed by an engineer.

2.3 POST COLONIALISM

The engineering profession is not seen as a major contributor to the socio-economic development of the Nation. The expatriates are more respected than their indigenous counterpart. Contracts are awarded to foreigners at the detriment of the indigenous engineers. Purchases of equipments are made without the involvement of the engineer. Most times, the equipments bought do not give the desired or satisfactory results from the very first day of installation. If the engineers are involved in the policy to purchase, install and maintain the equipment, then, the following steps are taken for due process;

- Invitation to pre-qualify
- Opening of the bids and selection of the most qualified company
- The equipment is then purchased, with a guarantee of spare parts supply by the manufacturer
- The equipment is inspected without personal or political influence
- All instructional/maintenance manuals are inspected
- Installation of the equipment
- Training of operators
- Training of maintenance engineers
- Final commissioning and handover

2.4 MILLENNIUM CHALLENGES AND THE GLOBAL ENGINEER

Continued technical and professional education is very essential in preparing and updating future engineers to meet the challenges of the millennium goals. The council for the regulation of engineering in Nigeria (COREN) for instance is a professional body whose role is to defend and regulate the practice of engineering in Nigeria. In order to globalize the Nigerian engineer to be able to face the global and millennium challenges, the engineer must be equipped with millennium skills. Globalizing the engineer is to equip the engineer with skills and technical knowhow for innovation that goes beyond borderlines. Nations strive to compete and participate in the global economy, the engineering profession is the facilitator of the global competition. But, the question is does the engineer posses the skill to face these global challenges? The engineering profession creates wealth. And creation of wealth is related a nation’s ability to make products that, other nations will want to purchase. This is where innovation comes in, in order to satisfy the end-user. According to a U.S report in [8], two premises were confirmed as follows;

- ‘Global competition – that is imports, exports, cross border investments and international joint ventures – is expanding at a rapid rate. U.S firms can no longer be content with besting domestic competitors; their fiercest rivals now are often foreign firms.'
• In many markets, the basis for competition today includes not only the price at which the product is sold but the ingenuity, variety and speed of development of new goods and services.’

This is the global challenges the millennium engineer is faced with, therefore, stakeholders in this noble profession must note that the competition a global one.

3 THE ROLE OF INNOVATION TO THE ECONOMY

Innovation could be seen as the improvement of the quality of products or services for human sustainability on earth. This is one of the global concepts. Knowledge and know-how determine how well off societies are compared to other societies. Education of engineers is critical to every nation to ensure the prosperity of their citizens. Standard of living hinges on our ability to educate a large number of sufficiently innovative engineers. [9,10], R&D spending fuels innovation. Creation of wealth is related to a nation’s ability to make products that other nations want to purchase.

3.1 ENGINEERING FOR POVERTY ALLEVIATION

Poverty may be defined as human condition characterized by sustained or chronic deprivation of the resources, capabilities, choices, security and power necessary for the enjoyment of an adequate standard of living and other civil, cultural, economic, political and social right. Here, engineering and innovation is seen as a vital instrument for the overall national goal of reducing poverty and hunger. Poverty is mainly a reflection of the limited access of the people to knowledge and resource with which to address basic relative needs. This knowledge is made available by engineers, [11]. The engineering aspect of; water supply, sanitation, housing, food production, energy, transport, communication, income generation and job creation helps to improve serve delivery. These needs relate particularly to engineering innovation which is vital in this process. Enhancing the access of people living in poverty to knowledge and resources in engineering, science and technology, through innovation and capacity building at the formal and informal level is a necessary step to poverty reduction.

3.2 UNIVERSITY/INDUSTRY PARTNERSHIP

Engineering programs in the Universities must lay emphasis on a problem solving approach, introducing new dynamics in the solution of problems affecting the well-being and economic growth of the Nation. Rather than putting emphasis on the usual disciplinary division among the different engineering professions, the focus must now be on the main problem areas falling within the jurisdiction of the engineer. Engineering education must place greater emphasis on problem definition and formulation [7]. In fig 1, a block diagram showing the relationship between the University, Industry, and Government is presented. The adequate and effective training program of the 21st century engineer comes from a collaborative effort of all stakeholders in the education sector (Government, Industry and the University). It is a known fact that the engineer is integrated into the society after graduation to contribute to the socio-economic development of the society [8]. The engineer’s contribution is a direct function of;

a) The type of training received.
b) The type of engineering infrastructure at his disposal
c) The opportunities that is available to him
d) The love for his society
e) The desire to influence, change, and bring about sustainable innovation

Therefore, according to Charles, engineering is dynamic. A lot of changes have been witness in technology, it is therefore not proper to educate the 21st century engineer with the 19th century technology. The industry must contribute their quarter through the instrument of industrial training and attachment, Industrial/University resource exchange, project and research funding, etc. [9].


4. UNIVERSITY RESEARCH TO ENHANCE SUSTAINABLE INNOVATION

Graduate research should be tailored towards sustainable innovation. Technology advancement through retrofitting will greatly achieve economic set goals in the developing country. Engineering graduate programs can contribute to this by evaluating research activities with regards to sustainability of the environment. In this regard, the National University Commission, taken the lead to identify and fund research activities in the University (NUC). Every year, NUC gives the sum of fifty million naira (50,000,000) to each University in the country research funding; this is a welcome development that should be sustained. It is recommended here, that, the industrial sector, and communities should key into this to fund research activities.

5. INFRASTRUCTURAL DEVELOPMENT

The type and quality of infrastructure in the society is a function of the current technology invoke. Today product and service has improved tremendously. The world is a global village, with the presence of the internet. This has greatly affected business, education, security, communication, etc. The need to develop, improve and sustain engineering infrastructure is the societal role of the engineering profession.

5.1 LOCAL CONTENT DRIVEN ECONOMY

One of the places usually overlooked in terms of meeting the Nigerian Content directives is in terms of proper empowerment of our institutions of higher learning to be in the forefront in this matter. This means that all our departments should be adequately equipped with financial, human, teaching and research resources. In this case the era of lip service in terms of adequate tertiary institutions’ funding has passed and adequate budgeting must be made for tertiary institutions to ensure that their mandates are fully met[11,12]. The financial needs would have to be met by a more realistic government subvention, students without scholarships would have to pay more than they are currently paying, and more government scholarships have to be awarded to deserving candidates. Apart from government subvention, many other avenues must be sensitized to their responsibilities in providing functional education. Local content driven economy is to redirect the nation’s interest to indigenous product and services. This means that, products that are locally manufactured must be appreciated, desired and made use of by citizens. Technology transfer must identify areas of comparative advantage and develop local technology for the manufacture of such products. Of course, there must be funding for such innovation. Research with high percentage of local content should be funded and commended.

6. RECOMMENDATIONS

- There should be a legislation regarding University/Industrial partnership
- Industries should be encouraged to float and fund research work, mostly the one with some percentage of local content.
- Government can also float and fund research work in the University in order to solve the nation’s problems.
- Universities should be involved in sustainable innovation by their programs.
Every University in the country should run entrepreneurship programs and courses for her students; this will go a long way to reduce unemployment.

- Engineering education programs should be updated to depict a proof of technological skills by engineering graduates.
- Final year engineering projects should be chosen based on societal problem solution formulation.

7. CONCLUSION

Engineering profession is the work for socio-economic development. The engineer who proffers solution to societal problems must be equipped to the standard of being able to compete globally. Engineering must be seen as a noble profession that brings about invention and sustainable innovation for global competitiveness. If production is increased, that is, the Nigerian economy will be a productive and not a consuming economy. At the global market, Nigeria will compete favorably with other nations, and then, vision 2020 would have been realized.

8. REFERENCES


THE PLACE OF THE UNIVERSITY OF TECHNOLOGY IN SERVING INDUSTRY, BUSINESS AND SOCIETY: A DELICATE BALANCE, A STEADY HAND...

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ABSTRACT

This paper reviews the university system, which began as mediaeval theological colleges invested with a legalistic cast, to the modern university of technology. Inbetween these models lies the modern "traditional university", which is seen as distinct from the university of technology. The former had its genesis during the Renaissance and was realised in the Reformation. It embodies an educational system extolling a broad scholarship, particularly in the arts, classics, law, theology and medicine. Science was a subsequent addition to the traditional university and the latest addition applied science and engineering, which reflect a small but subtle move from an imperative to "understand our world" to that of "changing our world'. The first universities of technology came to the fore in the latter half of the 20th century with a clear aim to serve the needs of industry and business. A vigorously robust approach to learning in the university of technology model reflects a more hands-on approach, with a strong emphasis on "how to", rather than "why?" The social environment, especially in the West, that led to the University of Technology is explored, along with an evaluation of the manner in which it serves both its clients and the wider community.

KEYWORDS: Evolution of the university; democratisation of education; social and environmental change.

1. INTRODUCTION

Plato’s Academy (founded c. 387BC) is likely the earliest institution of higher learning that one can readily envisage as a forum where the disciplines studied were beyond those of a theology college. It seems the Academy survived in some form, at least until 6th Century Byzantium, but its influence in much of Europe faded following the fall of the Western Roman Empire in 476AD.

In spite of an incomplete appreciation of how Plato’s Academy functioned, it is most likely it vigorously espoused the dialectic – and this approach was certainly well established by the time Aristotle studied there in c. 378BC. Importantly, the learning environment at the time was oral; and it was male.

In 529AD, Justinian closed what had, by that time, become the Neo-Platonic Academy of Athens – the closure, apparently, became of a fundamental incompatibility with Christian dogma [1]. In the Europe that followed, loci dedicated to the pursuit of knowledge were almost extinguished, except perhaps for a flickering of learning that burned quietly in distant Irish monasteries. Throughout much of the first millennium, it is unlikely the Academy, or any place of learning following it, conformed to what we would now view as a university, i.e. a place where “non-episcopal validated faculty” provide opportunities for initiates to study in disciplines as diverse as medicine, mathematics and science. Study was different from today (Figure 1), the focus was on theology, and followed the premise enlightenment was gained only through prayer and rational reflection. It is of significance also, that this scholastic world arose from within the elite of society… and it was male.
There were, however, significant restrictions on scholars, even in the 11th Century, for although the status of academics was recognised throughout Europe, their movement between institutions was not – as their home colleges had a strong incentive, which they rigorously enforced, to retain the services of their top scholars [2].

The first university was established in 1088 [3], and the first degrees were doctorates - in law. Those undertaking legal scholarship at that time, the “glossatori”, spent much of their lives translating and interpreting ancient texts, particularly Roman law [4]. By the late 12th Century, although learning remained under the umbrella of the Church, basic education had begun to extend beyond theology and law and surprisingly perhaps, was provided by instructors whose scholarship and expertise was recognised beyond the Church [5]. The rising power of secular government began to exert pressure on the places of higher learning – particularly when famous scholars were seen to have value in municipal policy and economy [6].

Significant changes occurred during the Reformation – for prior to this, even at Oxford and Cambridge colleges, there were no candidates to the ubiquitous bachelor of arts degree – rather, the colleges were a vita contemplative for those who aspired to higher office: in Oxbridge, and in the Church [7].

2. GENESIS OF THE MODERN RESEARCH-LEAD UNIVERSITY

It is a given that today’s universities are informed and led by research, but according to Clark [7], this did not happen until at least the early 19th Century. It was during the 1830s, in Protestant Germany, that activities that we accept as central and integral to the modern university were adopted. These activities included:

- Student seminars;
- Written examinations;
- Student note-taking (during lectures) and,
- Writing assignments.
Of these developments, a more far-reaching change was the move from an oral assessment of student attainment to one of written examinations; concurrent with this was the evolution of the grading system – the means by which students were ranked. This replaced the traditional “authority of social status and seniority” [7], and began a democratisation of education. In turn, this transformed student learning from passive to active… i.e. they gradually became intimately involved in structuring a personal learning environment. This democratisation also permitted another far-reaching change: providing opportunities for women in higher education. One of the first universities to accept women was the University of London, and the first cohort of females (only four) graduated in 1880 [8].

A lack of recognised formal education was responsible for restrictive vocational opportunities for women – even as late as the 1970s. Unsurprisingly, female participation in the professional workforce lagged behind their acceptance in universities – some professions being more male dominated than others, e.g. in mining and tunnelling. When working as a geological engineer in the hydro-electricity during the early 1970s, an engineer recounts very strong opposition to women engineers and geologists even approaching subsurface operations, let alone working underground. Leadership by universities was important in achieving universal suffrage; it did this through demonstration of good practice and by adopting a special role – that of critic and the conscience of society. This role strengthened through the 19th and 20th centuries; however, in the 21st century there was reason to question whether this independence and moral status remained.

3. GROWING AWARENESS AND THE INCREASING INFLUENCE OF SCIENCE

Widespread concern regarding the modus operandi of the Church and its interpretation of scriptural lore, especially in northern Europe, led to the Reformation (c. 1500-1599). It was this questioning of the order of things that facilitated a growing quest for knowledge. As the percentage of the population educated to university entry level slowly grew, so did public awareness of the natural systems operating in their world. By the late 17th century, Isaac Newton’s coupling of reason with empirical science unequivocally demonstrated the physical properties of objects could be derived through experimentation. The comprehensive, scientific quest to understand the nature of the universe had begun.

Although Newton saw the Hand of God reflected in the precision of the universe, an intellectual rift with the humanities (including theology) began to open [9, 10]. That the rift continued into the 19th Century is well illustrated by the furor following introduction of Charles Darwin’s theory of Natural Selection in 1859 [10, 11].

In the mid 20th Century, the elegant mathematical precision with which Newton had defined the universe was shattered. Albert Einstein and Werner Heisenberg demonstrated although life could run as per Newtonian laws, that at a deeper level, the nature of the universe was uncertain. By the 1970s, scientific advances and a growing accessibility of information through technology, especially in the developed world, laid the foundations for the democratisation of tertiary education; university education had ceased to be the privilege of the few.

4. THE COMMODIFICATION OF UNIVERSITIES

As the 20th Century neared closure, governments in developed nations began the final phase of tertiary education democratisation – the removal of any barriers to women entering the universities, (Figure 2) and the elevation of ‘fachhochschulen’, technical institutes, technikons, TAFEs (=Australian term for technical and further education provider) to full university status. However
few of these new universities of technology (or universities of applied science) carried the broad plethora of course options that typified existing universities.

![Figure 2. The learning environment. Students engaged in group projects, assisted by both old technology (hard copy) and computing.](image)

Looks do not deceive; all students who attended this Royal Melbourne Institute of Technology (RMIT) seminar in 2011 were female.

Universities of technology were intellectually leaner and provided something perceived as lacking in existing “traditional” universities a strong link with industry. The emphasis was now on how to? rather than why? Less emphasis was placed on understanding the world – rather than changing the world – the latter hopefully for the better. There was something robustly anti-intellectual in this approach; it embodied a return to fundamentals – with the promise of worldlier, and perhaps more egalitarian, citizens. But it was nonetheless utilitarian, with the end justifying the means, one likely side effect being a diminished imperative for scholarship.

A the strong industry orientation began to focus on the professions. Although bachelor and post-graduate degrees were offered, many universities of technology did not initially provide opportunities for professional doctorates. This is now changing, e.g. at RMIT “professional” doctorates including the Juris Utriumque Doctor (Juris Doctor or JD) are now offered alongside the more traditional Philosophiae Doctor (PhD). It should lend thought, nonetheless, to reflect that the Juris Doctor is probably much like the first degrees offered at the first universities. Is this a case of full circle?

Not quite perhaps… for there are some not so subtle differences, e.g. the secularisation of education and the growing integration of universities, especially universities of technology, with industry. Indeed, a key performance objective of a university of technology is measured by the strength of its links with industry – and the level of industry-sourced funding obtained. Governments, especially in the developed world, have moved to make education open to all and encourage all to partake – on the premise it is good for the health of the nation. But is also expensive and unsurprisingly, free education is a distant memory.

Concurrent with these changes in the West was an awakening in developing nations that higher education was the most effective manner to improve their economies and their societies. However, as their university infrastructure was smaller and already over-crowded, they elected to send students to universities in the West to cover the shortfall. Revenue flow in these institutions grew rapidly, and governments soon saw not only the political and cultural advantages of overseas students, but also business opportunities that would surely follow. Universities responded, and have grown commensurably… thus, it follows tertiary education could now be considered a commodity rather than a service. Indeed, this is reinforced by today’s current pre-eminence of education within the State of Victoria’s revenue stream.
5. BUT IS IT ALL POSITIVE?

Universities of technology, such as RMIT and Wismar, have a reputation as industry-engaged institutions. Professionals from industry are involved in classrooms; industry is a partner in research and industry employs the graduates surely a synergy made in heaven?

Scholarship has traditionally a built-in mechanism to ensure quality: peer review. For some time peer review moved along smoothly, with any incentive to publish research and obtain grants, for the main, personal. Perhaps it is unsurprising academics, research output was poor. Nonetheless, the new university order requires greater accountability. At English speaking universities in particular, the challenged (both morally and figuratively) is for managers (both within and beyond the sector) to publish, or perish. Even more important to some managers is a need to generate grant monies especially those in collaboration with industry. Many academics have enthusiastically embraced this opportunity.

But not all is going to plan. The imperative to publish and to obtain grants, means close collaboration with industry. An unanticipated casualty of this, however, has been the integrity of the quality of the research evaluation process. In a 2011 paper [12], Kinnaman highlights a lack of rigor in reviewing reports and papers concerning energy resource management. Many of the reports he cites have full industry backing, along with the healthy funding that entailed, but are not peer reviewed. Of even more concern is they are likely to be influential in legislating public policy.

Moreover, it is not industry links only placing stress on research integrity. An increasing avalanche of manuscripts that senior academics receive for refereeing is leading many to refuse to review, or alternatively to review, superficially. This, plus a growing trend to falsify data is a further, unforeseen outcome of “publish or perish” [13].

6. CONCLUSIONS

There are strengths in the university of technology model. The engagement with industry and the broader vocational appeal are positives. However, the “how to” approach is less likely to push the boundaries of knowledge. A search for truth and understanding must remain an element of all university education, traditional or universities of technology. But these are, in general, best pursued in the traditional university, where outcomes of study and research are not always directly applicable in the commercial world.

It is the utility and the flexibility of the university of technology model that makes it so admirably suited to emerging economies – where rapid improvement, in a wide sector of the community, is a useful goal. The two university systems are indeed complementary. In developed nations, traditional universities will, hopefully remain places where revolutionary ideas are incubated and nurtured – creating new frontiers of knowledge. Universities of technology must continue to produce graduates of high employability – who in the main will actively contribute to sustaining economic growth.

It is concluded both university models are required, but stress the quality systems within them must maintain the academic rigor of the products. Without this, the university will lose public credibility and ultimately public support.
7. REFERENCES


