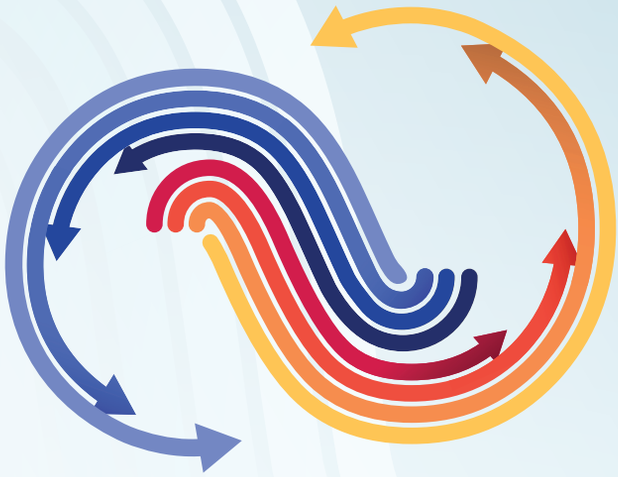

FINPIN CONFERENCE | 11TH SCIENCE-TO-BUSINESS MARKETING CONFERENCE 2012 MÜNSTER GERMANY

# ENTREPRENEURIAL UNIVERSITIES

## Conference Proceedings
## Volume 2

Thomas Baaken, Arno Meerman, Thorsten Kliewe, Marja-Liisa Neuvonen-Rauhala, Todd Davey, Matti Lähdeniemi, Timo Ahonen (eds.)

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Science-to-Business Marketing Research Centre

FINPIN CONFERENCE2012

Münster University of Applied Sciences

# ENTREPRENEURIAL UNIVERSITIES

**The proceedings of the 4th International FINPIN Conference and the 11th International Conference on Science-to-Business Marketing and Successful Research Commercialisation: Volume 2**

Münster, Germany
April 25-27, 2012

***Edited by:***
Thomas Baaken, Arno Meerman, Thorsten Kliewe, Marja-Liisa Neuvonen-Rauhala, Todd Davey, Matti Lähdeniemi, Timo Ahonen

Münster University of
Applied Sciences

Entrepreneurial Universities: Volume 2
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# CONTENT

# FOREWORD

The Science-to-Business Marketing Research Centre and FINPIN jointly organised the Entrepreneurial Universities Conference in Münster. Being the 11th Science-to-Business Marketing conference and the 4th FINPIN conference, the conference had a long history of successes to build upon. The aim of the conference was to create opportunities for lecturers, researchers and practitioners to meet and share their experiences, thoughts and knowledge on entrepreneurship and the entrepreneurial university. These conference proceedings entail a collection of papers based on presentations at the conference in Münster.

Through the promotion of entrepreneurship, innovations and the entrepreneurial university as a whole we have gathered a wide variety of authors willing to publish their findings in these proceedings. These papers address several key issues in entrepreneurship as well as the development of entrepreneurial universities. The proceeding papers cover several case studies as well as the latest research findings on entrepreneurship in higher education.

The next FINPIN conference is planned to take place in Finland in 2014, organised by Lahti University of Applied Sciences. The next Science-to-Business Marketing conference, labelled University-Industry Interaction will take place in Amsterdam in 2013, in cooperation with the VU University Amsterdam and the University Industry Innovation Network. This conference will focus on a broader view on University-Industry Interaction, entailing the entrepreneurial universities, however also topics such as IP management, collaboration in R&D and valorisation.

As the chairs of the Entrepreneurial Universities conference we would like to thank all the reviewers and the organisational committee that supported the conference and made it to be a success: Dr. Olli Mertanen (Turku University of Applied Sciences), Dr. Marja-Liisa Neuvonen-Rauhala (Kymenlaakso University of Applied Sciences), Dr. Carolin Plewa (The University of Adelaide), Anu Raappana (Lahti University of Applied Sciences), Prof. Dr. Lydia Raesfeld (Universidad Autónoma del Estado de Hidalgo), Dr. Peter van der Sijde (VU University Amsterdam), Prof. Dr. Miemie Struwig (Port Elizabeth Metropolitan University), Prof. Dr. Janusz Tezke (Cracow University of Economics), Dr. Nikolay R. Toivonen (National Research University ITMO State University), Dr. Lauri Tuomi (Haaga-Helia University of Applied Sciences), Timo Ahonen, Terhi Kuisma, Aino-Maria Pokela, Päivi Starckjohann (Lahti University of Applied Sciences/FINPIN), Todd Davey, Arno Meerman, Thorsten Kliewe, Kerstin Linnemann and Frederik Rumpf (Münster University of Applied Sciences)

We would also like to thank all conference partners for supporting and promoting the conference and its topic 'Entrepreneurial Universities': Aalto University (Finland), Nelson Mandela Metropolitan University (South Africa), Energy2B (Italy), University of East London (United Kingdom) and Universidad Autónoma del Estado de Hidalgo (Mexico).

We hope for rewarding reading experiences and further ideas to develop out of these proceedings, for developing new practices in promoting entrepreneurship and innovation in higher educational institutions and look forward to your participation in our future conferences.

Prof. Dr. Thomas Baaken

*Director of the Science-to-Business Marketing Research Centre*

Dr. Matti Lähdeniemi

*President of FINPIN*

# *INCIPIT:* A GOVERNMENT FUNDED INCUBATOR EXPERIENCE ACROSS TWO SOUTHERN ITALY UNIVERSITIES

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**Abstract: Incipit is a five years program aimed at gathering early stage entrepreneurial ideas arising from university research and to put them in a refinement process, possibly ending with the creation of new companies. The peculiarities of the program are the direct involvement of two universities and the focus on specific technologies, i.e. ICT for automation. The paper briefly describes the actual outcomes of the project and the difficulties encountered.**

Keywords: scouting, university incubator, technological auditing, early stage incubation, entrepreneurial culture.

## I. INTRODUCTION

In Latin the word *incipit* means "it begins". The incipit of a text, such as a poem, song, or book, is the first few words of its opening line; in music, it can also refer to the opening notes of a composition. In our meaning it stands for starting a new entrepreneurial idea.

The Incipit program was a five years project co-funded by the Italian Ministry for Economic Development mainly intended to foster university researchers to further develop their scientific or technological achievements to become entrepreneurial ideas in the field of ICT and Automation.

To this aim two universities, a large and ancient one, the *Université di Napoli Federico II* and a small and young one, *Università del Sannio,* based in Beneven- to, both located in the in Campania Region, in partnership with other organizations, *Alintec* (a consortium of Politecnico di Milano), *Aif* (the Italian Association of Venture Funds), *Redifin* (a Milan-based merchant bank), *Stoà,* a School of Management. and two regional company syndicate, founded in 2007 a consortium named Incipit.

Incipit Consortium is a lean organization in charge of the relationships with the sponsor. The activities of

Incipit Consortium are carried out in minimal part by the consortium itself and in the great part by its partners. Nowadays Incipit Consortium is a part of the Campania Region Innovation Network. This paper presents the project intended goals, its actual outcomes, the difficulties encountered, both bureaucratic and substantial, the successes, and try to extract the lessons we have learnt.

## II. OUTLINE OF THE INCIPIT PROJECT

Our project is organized in in six "actions":

i) *Action A: Feasibility Studies.* This activity is mainly intended to carry out, in the field of interests of Incipit, namely ICT for Automation, a scouting among the researchers of both universities to find high potential technological ideas, deserving support to be strengthened and being likely to evolve in valid business projects for new product or services, also evaluating the effort needed for this transformation. This action was carried out, cooperatively, by almost all the project partners. It is economically worth nearly 25% of the entire project.

ii) *Action B: Facilities.* This activity is intended to start two physical incubators for the early stage business ideas identified by the Incipit program. It is carried out by the Incipit

Consortium. In developing such action our main concern was that of finding locations as close as possible to the University School of Engineering buildings. In fact the incubators were firstly hosted in some labs of the University Departments and then placed inside the Scientific and Technological Campus at the University of Naples Federico II or very close to the Engineering Department at the Sannio University. This action is worth 13% of the entire project.

iii) *Action C: Financial and organizational counselling.* This action is worth 12% of the entire project and is conceived to support advanced entrepreneurial ideas, selected by Action A, to develop market analysis, business model, commercial strategy, and finally the business plan. Through this action (and the next one) assistance to the patents registration for technological ideas was also delivered. This action was carried out mainly by the non-academic partners of the Consortium.

iv) *Action D: Technical Assessments.* The aim of this action is delivering a diligent third party evaluation of the technological component of the business ideas considered in actions A and C, as well as a support to patent registration. This action was developed mainly by university personnel and is worth nearly 30% of the project.

v) *Action E: Training.* This action is intended to disseminate entrepreneurial culture among scientific and technological researchers and vice-versa a bit of scientific culture among finance and economic operators. This action was mainly delivered by the STOA' partner, a School of Management and by university partners. It is worth 17% of the project.

vi) *Action F: Project management.* This was the second main task of the Incipit Consortium, worth 3% of the project.

All those actions were delivered along the five years of the project at different intensities, creating the stages of the Incipit incubation process depicted in figure 1.

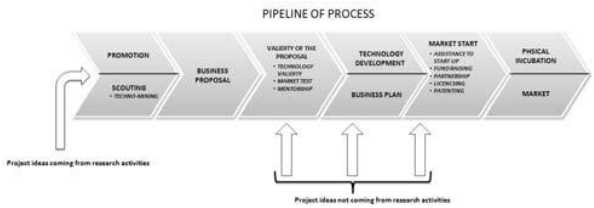


**Figure 1: Stages of the Incipit incubation process**

Indeed, from the viewpoint of entrepreneurship fostering and support, the effort of the Incipit project was deployed along a "pipeline", i.e. a sequence of activities having ideas as input and embryonic or young companies as outcome. The digesting process of ideas was started with a "call", but then it was left asynchronously open to ideas. The stages of the Incipit process are:

i) Stage 1: Scouting, Promotion, Technology mining. It is mainly supported by Action A previously described.

ii) Stage 2: Business proposal. The coarse ideas collected in stage one are organized in business ideas again with the support of action A. The surviving rate in the flow from stage 1 to stage 2 has been evaluated, for Incipit Project, as nearly 50%.

iii) Stage 3: Technological and Economic Assessment. This stage falls under Actions A and C previously described. Notice that it has an external entry point in the process flow as showed in the figure, meaning that Incipit Project has been open to adopt business ideas born outside the community of the university research. In this respect an important role has been played by the syndicate organizations participating to the Consortium in selecting business ideas coming out from entrepreneur, more substantial and close to market.

iv) Stage 4: Technology and business plans. At this stage the future entrepreneurs are assisted to write down their business plan and to detail the technological steps necessary to bring their product or service ideas to the market. This stage is mainly supported by actions C, D and E previously described. Also this stage has an external feed which, however, has brought very few ideas in the main stream.

v) Stage 5: Fund raising and start-up. In this stage, mainly supported by action C, on the basis of the documents prepared in the preceding phases, we looked for some form of partnerships for the future companies bringing the business ideas to the attention of financial investors.

vi) Stage 6: Physical Incubation. Future new companies can be officially hosted in the spaces organized by Action B of the project, where they can start their first activities, wait for formal constitution of the Company and/or maybe continue the search of larger spaces in other incubators of the region or in the open market. At the present 8 new companies are hosted in the Incipit incubators.

## III. PROJECT SPENDING

We think it may be interesting to examine the development of the project in terms of spending, and also to relate this with the funding procedure by the Italian Ministry on Economic Development. The maximum budget for the overall project was set to €2.897.500,00 with a support from Italian Ministry for Economic Development covering almost 80% of the approved costs. The remaining funding was guaranteed, in terms of personnel costs, by the organizations associated into the Incipit Consortium. It must be stressed that the expenses relative to Action B were completely covered by the Ministry.

The budget sharing among the actions A-E is depicted in figure 2 (blue polygon).

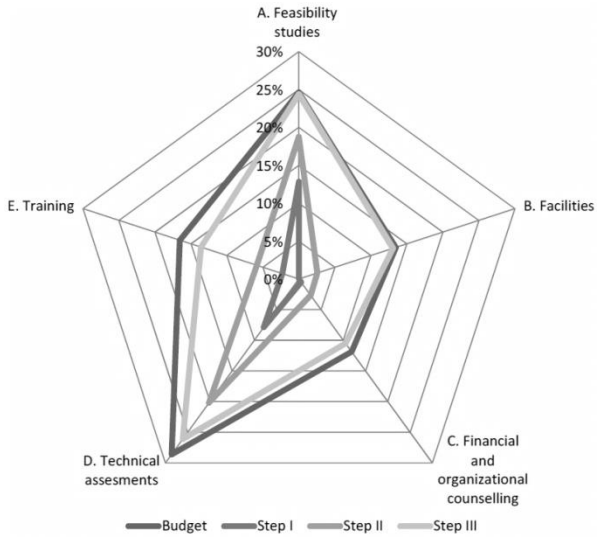


**Figure 2. Budget spending**

A year by year trend toward the accomplishment of the project can be appreciated in figure 3. It is easily understood the asymmetry in the enhancement of the various Actions of the project. This was basically due to the very nature of the project actions. Training, for instance, could not be started until the personnel to be trained had been recruited from the development of other Actions.

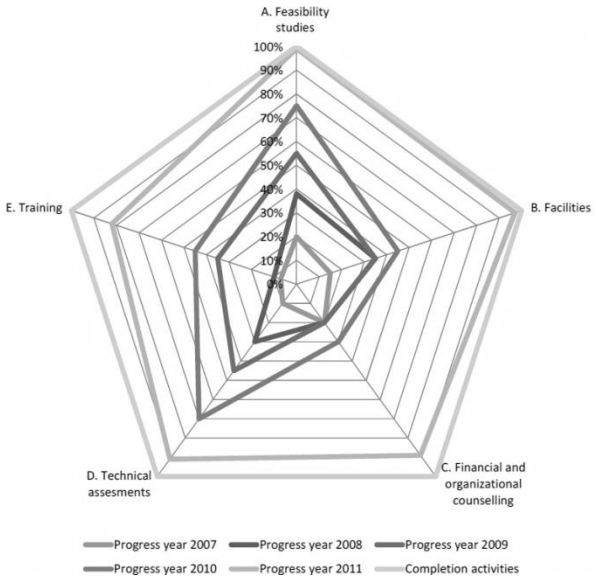


**Figure 3. Year by year spending**

## IV. THE "TECHNO-MINING" PROCEDURE

In our view the process we called *Techno-Mining* is a bit more than a technological scouting. Basically it has the same final objective of collecting rough business ideas. However we consider it different from technological scouting because of the effort we devoted to communication, listening and, above all, to spurring and to inquiring to make the business ideas to surface from dialogs initially focused on technical questions. That was made possible mainly by the very high technological skills of the techno-miners, selected among experienced people with at least five years of activity on technological transfer projects. Techno-Mining process is roughly organized in the following actions.

i) Communication. This action is aimed to communicate to the potential beneficiary of the opportunities given by the Incipit process.
ii) Organization. As already said, Incipit program objective is to foster university researchers to transform in entrepreneurial ideas their scientific achievements in a well-specified field, i.e. ICT and Automation. In this respect organization has meant primarily an a priori selection of the research groups possibly interested in this opportunity, that is the definition of potential targets in both University.
iii) Digging, listening and spurring. It has been the major effort of our team, having in their toolbox just a questionnaire to fill. The results of this effort have produced two types of outputs. On one hand they fed "Action D: Technical Assessments"

described in previous section and, on the other hand, they nourished the "Stage 2: Business proposal " of our pipelined process.

To collect the results of Techno-Mining activity we used a questionnaire. It was partially compiled by the interviewee an partially by the interviewer. The general contents of the various sections of the questionnaire are described below.

i) Section A: This section is intended for collecting the interviewee profile and its orientation. In order to understand his possible goals (enterprise creation, achievement of a patent, technology transfer).
ii) Section B: This section is functional to gather the rough entrepreneurial ideas. It presents implicit and explicit questions, open-ended as well as multiple-choices. In this latter case, the order in which key technologies are listed is taken as a measure of the importance that the discussant gives to them.
iii) Section C: This section is conceived as a close examination undertaking ideas collected in Section B. It is left to the interviewer judgment to accomplish or to postpone the filling of this part of the questionnaire in relation to the degree of ripeness of the proposal. The section is formed exclusively by explicit questions open answers.
iv) Section D: This section is functional to catch the true mood of the interviewed to patent its research achievements and his needs to accomplish this scope.
v) Section E: Here the training needs (usually in non technological fields) of the interviewee are collected.

To briefly summarize the results of Techno mining action we can say that out of 247 planned contacts, the working group managed to visit 66 research groups and completely filled 22 questionnaires. Out of these 22 questionnaires Incipit got 17 requests of specialized services (multiple requests were allowed):

i) 6 research groups asked for a support into the business proposal drafting,
ii) 7 groups asked for a support to take out a patent,
iii) 4 groups asked for a support in technical development,
iv) 3 groups requested training services,
v) 4 groups requested physical incubation.

The remaining interviews have examined research activities not yet ripe for the creation of enterprise or the realization of patents. However a strong interest in learning activities has been detected. To the 22 groups selected by Tecno-Mining action, 9 more groups added spontaneously answering to the initial open Incipit call. They were put in the pipelined process through one of the entry points showed in figure 1.

## V. A FEW NUMBERS FROM THE PROJECT

Interesting information can be gathered looking at the data of 55 groups that reached the final part of the pipeline.

### *A. Incubator*

The groups declared their interest in one or the other of the two incubators located in: Naples: 77% Benevento: 23%

This depends on the larger audience of the Neapolitan incubator, considering the very large size of the university (the School of Engineering counts nearly 17000 students to be compared with 1600 at Beneven- to; not to mention the fact there are other two schools of engineering related to Second University of Naples and University Parthenope) and even larger gap in population (the Naples Province has more than 3 million inhabitants versus 300.000 of the Benevento province).

### *B. Age classes of "young" entrepreneurs*

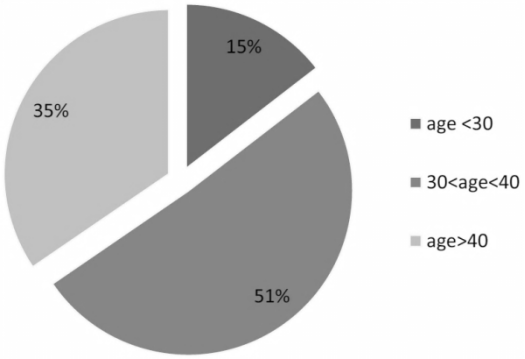


**Figure 4. Age classes of entrepreneurs**

It turns out that they are not very young, but this is reasonable

i) taking into account that a certain maturity is needed and that on average engineering students in Italy complete university usually in a longer period than their European colleagues, due to the different structure of the university curriculum, the organization of the exams, and so on (a much debated issue which we cannot analyze here);

ii) considering that the great part of the groups were collected through the Tecno-Mining process, an action addressed to university research groups.

### *C.* Employment status of entrepreneurs

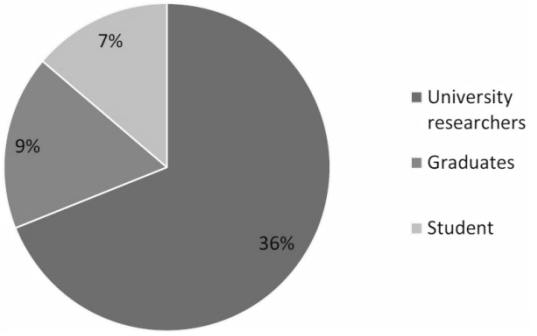


**Figure 5. Employment status of entrepreneurs**

Here again we see that some years of experience are usually necessary to push an engineer to start a company. Thus university graduates and students are a minority and the push to become independent grows with the age.

### *D.* *Reference market*

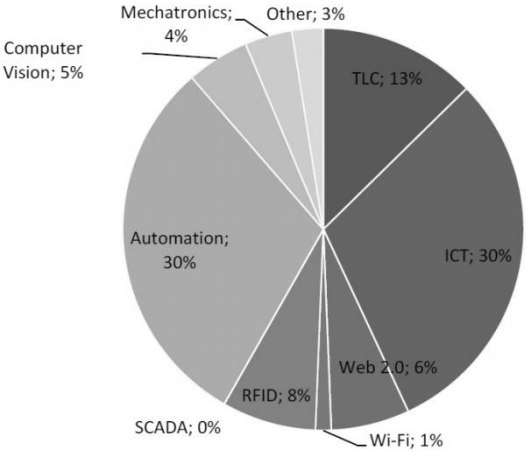


**Figure 6. Reference market**

The numbers reflect the emphasis of the Incipit project on the Automation of the industry sector rather than service sector.

### *E.* *Sector of application*

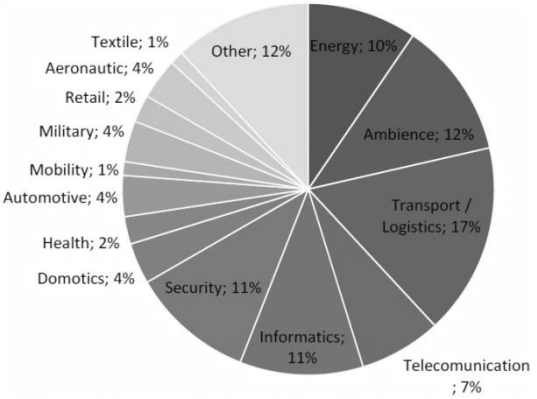


**Figure 7. Industrial sectors (more than one answer was allowed)**

The large number of proposals in manufacturing is also a consequence of the focus on Automation, which is usually intended for production; however it is promising the interest on Energy applications and Home automation; we would like more attention on the Transportation sector where probably there will be many opportunities in the future for innovative enterprises.

### *F.* *Technologies involved*

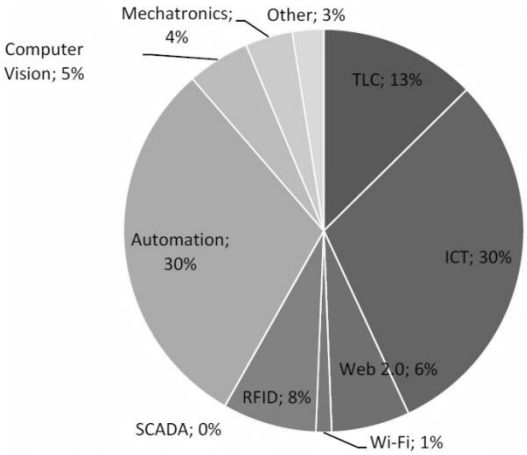


**Figure 8. Technologies involved (more than one answer was allowed)**

Though SCADA (Supervisory Control And Data Acquisition) is a relatively old concept, related to the control room or control desk of many industrial applications, it is now meant as a container of innovative technologies retrieving data from the field to be processed in real-time or off-line (i.e., via data-mining algorithms). Security applications, for example, are often targeted to the design of a SCADA system which controls an infrastructure through cameras and other distributed sensors.

### *G.* *Services requested from Incipit*

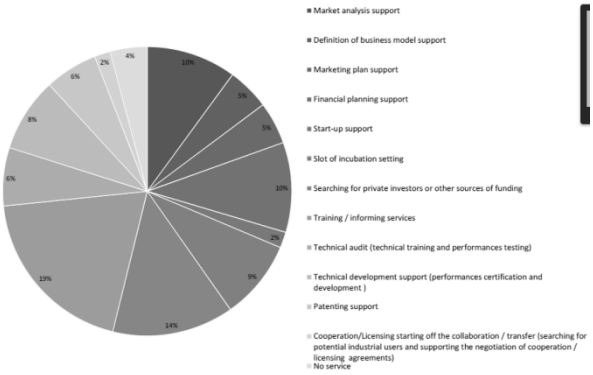


**Figure 9. Services requested (more than one answer was allowed)**

The requests were quite homogeneous; this is also due to the fact that our animation activities were aimed at preparing proposers to the innovation scenario and made clear the various step

necessary to set-up a successful spin-off company.

### *H.* ***Status of company***

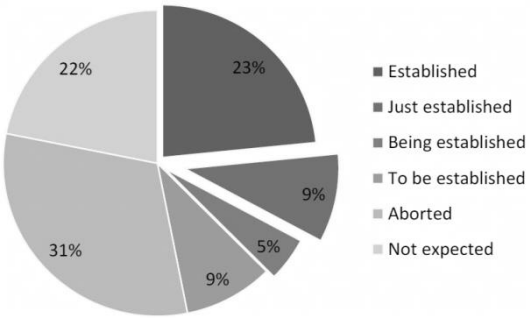


**Figure 10. Status of companies**

The above numbers seem to reassure that the action of our project was quite effective in exciting the "animal spirits" of would-be entrepreneurs.

### *I.* **Competences in the team**

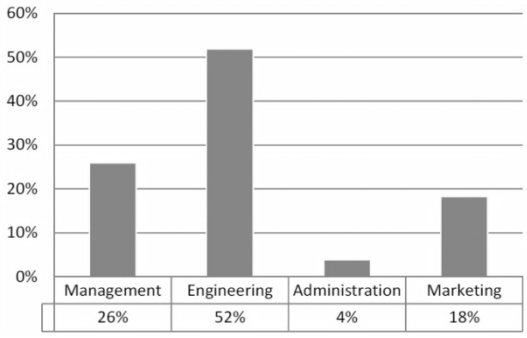


**Figure 11. Competences in the team**

Obviously there's no lack of engineering skills around a school of engineering; a little bit of cross-analysis straightforwardly showed that the crucial additional competence need to actually start the initiatives is the management one, so that 80% of non-completed proposals just lack that one!

### *J.* ***Business idea based on a patent***

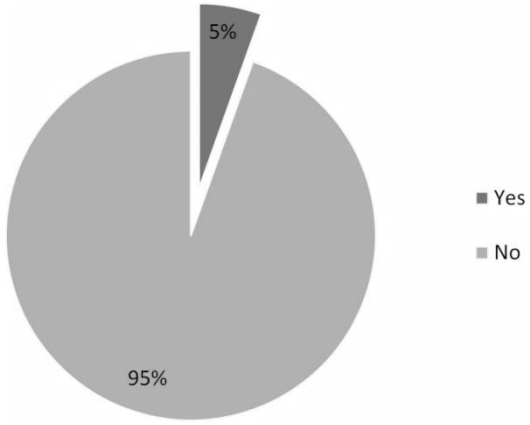


**Figure 12. Business idea based on a patent**

Of course one expects a stronger business idea when a patent is involved, and so this may be a weak aspect. On the other side one it is a matter of fact that intellectual property protection is not diffused yet in Italy and hence the numbers reflect a this general attitude.

## VI. EDUCATIONAL ACTIVITIES

With the support of Stoa (a business school, partner in the Incipit project) "Incipit Academy" was developed, as a training model designed to deliver a flexible training support to teams and ventures at very different stages of entrepreneurial readiness. A model based on "on-demand" education and training (a catalogue of courses). Our model has a lean, part-time faculty and a polycentric structure based on the incubators of Naples and Benevento, the Business School of Stoa in Herculaneum and a virtual academy, designed as an on-line infrastructure providing contents, services and tools for continuous training of aspiring entrepreneurs.

The model of training design, which has been developed as a standard for future activities, is based on a 4 phases cycle methodology of educational design: Plan > Design > Train > Evaluate (Goodyear, 2001; Goodyear, 2005).

The main problem encountered is that of few applications to training programs emerged in the early stage of development of the incubator (due to a low readiness of the teams and the inhomogeneity of the projects).

Having identified the "learning community" as a whole resulted from 1) the ventures in different stages of readiness, 2) the components of the Incipit partnership (also, somehow, to be trained), 3) the potential users of the incubator, in the academic community, and 4) the stakeholders (including potential investors), we have established a set of basic assumptions in terms of educational design, which included "pedagogical" assumptions (at strategic and tactical level) and a set of time and costs constraints. In logic of functional deployment, during the educational design phase, the following functions of the Academy have been defined: Content; Context; Services; Communication.

During the project, the content of distance learning was better focused and, at the same time, the user experience was improved: from SCORM content, rather rigid and time demanding, to "tips", videos and links published in the Incipit Academy blog, with on-line questionnaires. As a result we had a better user experience. This 'Web 2.0 learning environment" also provides interesting and stimulating content to users who want to "learn more" on start-ups. Some content

are designed to arouse curiosity and interest to potential users of the incubator and to increase the awareness of the project. The user can access the Academy by the institutional website of the project, the blog and the newsletter. The online Academy is the userknowledge interface, including the access to the OPAC (Online Public Access Catalog) of the Stoa Library.

The communication and marketing of courses was "the" critical success factor for the training impact and a training feature itself: as a matter of fact it is often necessary to promote the "idea of entrepreneurship", in order to encourage, motivate and stimulate new ventures. The Academy was therefore designed as a polycentric and mobile organization capable to reach local communities. The Incubator in Naples University the University of Sannio in Benevento, the Stoa Business School in Herculaneum, were the sites designated to train and meet the learning community and to reach possible users of the incubator. The academy also developed short seminars during PhD schools, specifically dedicated to the community of computer scientists.

The "Road-show" was the format developed, that pursues both educational and awareness objectives: an itinerant program, synchronized and integrated with the online Academy. The road show has the function of aggregating new trainees also providing an initial basic training on entrepreneurship.

## VII. CONTACTS WITH VENTURE CAPITALISTS

One of the key actions in favor of the groups in the late stage of the pipeline was the found raising support and the preparation to meet potential investors. Three partners of Italian venture capital funds and a representative of the Italian business angels association cooperated with these activities, which were coordinated by AIFI, the Milan-based Italian Private Equity and venture Capital Association, one of the Incipit partners.

At the present time, the venture capital activity in Italy is not very developed. There are only about ten vC funds specialized in early stage and in 2010 they made 77 investments for an amount of 89 Million Euro, compared to 458 investments in France (605 Million Euro) and 304 in Spain (130 Million Euro). In Southern Italy the situation is even more difficult: between 2004-2008 private investors made only 5 early stage investments, for an amount of 5,8 Million Euro. There is a wide equity gap. Four VC funds specialized in digital investments were launched in 2009 in Southern Italy, thanks to a Decree of the Ministry of Innovation and Technologies that financed half of the commitment of such funds. As a consequence of this, from 2009 to the second quarter of 2011, in the regions of Southern Italy 13 early stage investments were made for an amount of 15,2 Million Euro. Italian venture capital has a high potential for growth, considering that there are about 870 active spin-offs in Italy (50,6% in the Northern regions, 25,7% in the Center and 23,7% in the South) (see Netval Report, 2011). University incubators and business angels can be the first step (financing seed projects) in giving resources and support services to these initiatives, since vC funds are more focused on further development stages.

The business ideas selected by Incipit were presented to vC funds during a standard "elevator pitch". The projects have been evaluated by the vC funds as more interesting than other similar initiatives. They also considered it as a potentially interesting target in the future. The main concerns were raised about the financial forecasts, the business development analysis and also the management skill level of the entrepreneurs. All projects have been assessed on the basis of some parameters (authenticity of the business ideas, management skills, attraction of the potential market, technical and economic feasibility, grade of interest in the project by vC investors).

The business ideas that received the highest scores got the opportunity to benefit from services specialized in start up creation, a business incubation area in the In- cipit incubator and the possibility to participate in national and international contests.

## VIII. IDICATORS FOR BENCHMARKING

Promoting incubation and growth of small innovative firms is singled out in the EU2020 strategy as one of the ways of creating value by basing growth on knowledge. To this aim, in February 2010 EU published "The Smart Guide to Innovation-Based Incubators (IBI)", prepared by the EBN team. It is an easy- to-read booklet conceived for those who create and design the projects that make innovative businesses strive, that bring new entrepreneurs to the market place, and that help to transform ideas into action. It also suggests a number of process and performance indicators to be used and adopted for benchmarking among similar initiatives.

As contribution to this valuable initiative we list in the following table the figures of some of these indicators related to our project. For more figures and details refer to (Caldara and Garofalo, 2012).

| Indicators | Values |
|---|---|
| Number of complete business plan produced | 10 |
| Number of new start-up established | 6 |
| Number of start-up under way of being established | 3 |
| Start-up ideas at the planning stage | 3 |
| Business ideas aborted during incubation | 23 |
| Number of partnership proposal supported | 19 |
| Number of patent requests supported | 3 |
| Number of already established SME companies supported | 18 |

Since indicators per-se loose much of their meaning if they are not related to the reality in which they have been calculated, the same guide recommend to use cost-benefit ratios, that will allow to understand the quantified indicators in relations with the resources used to achieve the results. Next table gives some figures of our cost/benefit indicators.

| Cost/benefit indicators | Values |
|---|---|
| Number od new entrepreneurial ideas supported per 100 K€ of project total cost | 2,05 |
| Number od new entrepreneurial ideas supported per100 K€ of supporting action cost | 5,19 |
| Number of new entrepreneurial ideas supported per Full Time Equivalent engaged in the project | 6,82 |
| Number of supported new business ideas per FTE engaged in the project | 17,19 |
| Number of established or under way of being established new companies per 100 K€ of project total cost | 0,34 |
| Number of established or under way of being established new companies per FTE engaged in the project | 1,12 |

## IX. CONCLUSIONS

Aim of the Incipit Program was to gather early stage entrepreneurial ideas arising from university research in a well specified technological field and to put them in a multi sided enhancement process ending with the creation of new companies. With the aid of the University partners we had the opportunity to care for the technological refinement of the new business ideas and to support them in the patenting process. With the aid of non-university partner we managed to let these ideas grow from the managerial viewpoint and from the economic plans viewpoint. We also managed to disseminate a bit of entrepreneurial culture among young researchers.

That was one of the first of such experiences in Campania Region and we do not know about similar experiences in others European regions. The peculiarity of our action makes it difficult to benchmark with other incubation initiatives.

In our opinion the strength points of our program were a) the composition of the Consortium that gave to the program the opportunity to deliver professional support in a variety of heterogeneous fields with internal resources; b) the location of the incubators very close to the university buildings, that enabled a cultural step ahead in considering the creation of new companies a possible outcome of scientific research, both among the researchers and in the public understanding of the university activities.

Weakness point was certainly the management of the expenditures of the project that suffered from some delays in the transfer of economic resources from the sponsor to the Consortium that caused the project to last 18 months more than what planned. We hope that the publication of our experiences and of our statistics will help us to get in touch with similar project for an exchange of experiences and for a benchmarking of the results of our project.

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# SCIENTISTS' TRANSITION TO ACADEMIC ENTREPRENEURSHIP: ECONOMIC AND PSYCHOLOGICAL DETERMINANTS

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**Abstract: This study investigated academic scientists' transition to entrepreneurship by studying their academic entrepreneurial intentions (to found a business in order to market their research knowledge) and actual founding behavior. We developed and tested a conceptual model integrating both economic and psychological perspectives. Applying the theory of planned behavior, we examined the economic factors (scientists' human capital, social capital, expected entrepreneurial benefits) as distal predictors (background factors) of academic entrepreneurial intentions. The psychological factors (entrepreneurial attitudes, norms, control perceptions) were examined as proximal intention predictors. Findings were derived from a path analysis utilizing archival and survey data on German scientists (N = 496). We found that attitudes and perceived control predicted entrepreneurial intentions. Social norms in turn had no effect. As regards the economic factors, human and social capital exhibited indirect effects on intentions via entrepreneurial attitudes and control perceptions, while additional direct effects of both capitals showed up significantly as well. Expected benefits from engaging in academic entrepreneurship (i.e., expected financial and reputational gain) only showed indirect effects on intentions via attitudes and perceived control. In addition, longitudinal results indicated that entrepreneurial intentions indeed forecasted entrepreneurial behavior, while certain barriers have a diminishing influence on this relationship. Our results are discussed with an emphasis on the long-neglected importance of the interplay of economic and psychological determinants for scientists' transition to academic entrepreneurship.**

Keywords: Academic entrepreneurship; entrepreneurial intentions; human capital; social capital; occupational choice; theory of planned behavior

## I. INTRODUCTION

In today's globalized markets, economies rely more and more on new knowledge and innovation (Audretsch, 2007), and academic science is seen as the hotbed for these new ideas facilitating competitive advantage (OECD, 2003). For example, academic research has been a crucial ingredient for the development of a large amount of new products and processes (Mansfield, 1998) and for the emergence of entirely new industries, like biotechnology (Audretsch & Stephan, 1996).

One important direct channel through which new scientific knowledge reaches the wider market sphere is *academic entrepreneurship*, that is, scientists becoming entrepreneurs by developing new products and starting their own companies to market their research knowledge and inventions (Shane, 2004). Given the largely tacit nature of new research knowledge (Pavitt, 1988), it often requires scientists' active involvement when transforming the raw knowledge into a marketable product. This implies that a complete picture of academic entrepreneurship may only arise when considering the individual scientists and the factors that may drive their transition to the world of entrepreneurship.

Research on the entrepreneurial scientist, however, is still emerging and our knowledge about the determinants that may underlie enterprising behavior among scientists is very limited (Rothaermel, Agung, & Jiang, 2007). Caution must further be taken when simply assuming that more general entrepreneurship models also apply to the specific domain of academic entrepreneurship without actually testing such assumptions. For example, Fini and Lacetera (2010) argued that, resulting from the peculiarities of the traditionally non-commercial

university environment, such as the distinct incentives and rules in academia, the processes governing the emergence of academic entrepreneurship are likely to differ from those related to the emergence of entrepreneurship from the private sector. Others called for a unique research agenda of academic entrepreneurship, given the specific nature of scientists' transition from academia to entrepreneurship, e.g., negotiating their scientific career and entrepreneurial activity, dealing with highly innovative products, etc. (Aldridge & Audretsch, 2011; Shane, 2004). In this regard, experts particularly criticized the lack of research on the entrepreneurial mindsets of academic scientists (Audretsch & Erdem, 2005) – a call that concurs with Hisrich, Langan-Fox, and Grant's (2007) general call to psychology for more research on entrepreneurship.

So far, studies on academic entrepreneurship have been dominated by economic approaches and have focused on specific economic factors when explaining why some scientists engage in entrepreneurship and others do not (Fritsch & Krabel, in press; Landry, Amara, & Rherrad, 2006; for an overview see Rothaermel, Agung, & Jiang, 2007). For example, scientists' human capital endowments and social networks were identified as relevant determinants of their entrepreneurial engagement (Aldridge & Audretsch, 2011; Mosey & Wright, 2007). Other studies modeled the entrepreneurial career decision of scientists as an "occupational choice" (e.g., Lacetera, 2009), taking into account expected benefits that may result from private business (e.g., financial gains) and comparing it with the concurrent income and reputational benefits as a scientist. However, the picture that arises from this literature may be incomplete as it largely disregards psychological theories and research. Entrepreneurship scholars have long been emphasizing that enterprising behavior in general is purposive, goal-directed, and driven by complex decision-making processes (Baron, 2004; Bird, 1988; Krueger, Reilly, & Carsrud, 2000). In particular, psychological factors described in the theory of planned behavior (TPB, Ajzen, 1991), namely attitudes as well as perceived social norms and behavioral control, have been shown to be relevant determinants of an entrepreneurial career choice (Souitaris, Zerbinati, & Al-Laham, 2007; Liñán & Chen, 2009).

Our study attempts to integrate both economic and psychological perspectives into one conceptual framework of scientists' transition to academic entrepreneurship (in our case captured by their entrepreneurial intentions and actual entrepreneurial behavior). Following the TPB literature and entrepreneurship studies (e.g., Krueger & Carsrud, 1993; Fishbein & Ajzen, 2010), we examined the economic variables (human capital, social capital, expected entrepreneurial benefits) as distal predictors (background factors) and the psychological variables (attitudes, social norms, perceived behavior control) as proximal predictors of academic entrepreneurial intentions. Human and social capital were deemed to be associated with intentions via the more proximal psychological variables, but should also exert direct effects. Expected entrepreneurial benefits, in turn, should only exert a direct effect on intentions.

The paper continues with the introduction of academic entrepreneurial intentions as the central variable of interest. We then turn to a literature review on the economic and psychological approaches. Finally, we develop our conceptual model on scientists' entrepreneurial career intentions to be tested in this study.

## II. THEORETICAL BACKGROUND

### *A. Academic entrepreneurial intentions*

In recent years, the study of entrepreneurial intentions has become a key approach in entrepreneurship research dealing with the complex factors underlying an individual's transition to entrepreneurship (Krueger, 2009). Both psychological and economic entrepreneurship researchers are increasingly interested in adopting an intentions-based view on entrepreneurship because entrepreneurial intentions can be seen as a conceptual hub connecting entrepreneurial behavior with a wide range of both psychological and economic factors that may influence this behavior through such intentions (Carsrud & Brännback, 2009; Fini, Grimaldi, Marzocchi, & Sombrero, in press; Krueger, 1993).

It is widely acknowledged that entrepreneurial behavior is inherently intentional because acting entrepreneurially is something that people choose or plan to do (Bird, 1988; Krueger & Carsrud, 1993). Consistent with longitudinal findings (e.g., Lee, Wong, Foo, & Leung, 2009), the most proximal and important predictor of the engagement in entrepreneurial behavior is seen in entrepreneurial intentions (Bird, 1988). Simply put, these are cognitive representations of an individual's readiness to engage in entrepreneurship. Entrepreneurial intentions signal how intensely one is prepared and how

much effort one is planning to commit in order to carry out entrepreneurial behavior. Even if people may have significant potential, they will refrain from making the transition into entrepreneurship when they lack the intentions (Krueger, Reilly, & Carsrud, 2000).

In the specific field of academic entrepreneurship, entrepreneurial intentions have not yet received much attention (for exceptions see Obschonka, Silbereisen, & Schmitt-Rodermund, 2010; Obschonka, Goethner, Silbereisen, & Cantner, in press; Prodan & Drnovsek, 2010). Because we were interested in combining economic and psychological approaches to get the bigger picture, we adopted the intentions-based view to the specific case of entrepreneurial scientists and investigated *academic entrepreneurial intentions* in this study.

### *B.* ***The economic perspective on academic entrepreneurial intentions***

Drawing from the economic literature on entrepreneurship in general, and academic entrepreneurship in particular, it is important to consider economic variables when setting up a prediction model of academic entrepreneurial intentions. Entrepreneurship research already has a long tradition in studying an individual's current *human capital* (Unger et al., 2011) and *social capital* (Kim & Aldrich, 2005) as antecedents of entrepreneurial outcomes (i.e., one's decision to pursue an entrepreneurial career). *Human capital* comprises an individual's knowledge and skills which are acquired through education, on-the-job training, and other types of experiences which may increase one's productivity at work (Becker, 1964). From an entrepreneurial perspective, human capital is assumed to provide the (potential) entrepreneur with superior cognitive abilities regarding the exercise of demanding activities, such as starting one's own business (Davidsson & Honig, 2003; Schultz, 1980).

The concept of *social capital* was originally developed in sociology. Social capital is concerned with one's social ties to other individuals, groups, or organizations (Granovetter, 1973). Social capital resources stemming from these ties have been shown to particularly affect the early stages of the entrepreneurial process, i.e., the initial decision to engage in entrepreneurship (Liao & Welsch, 2005; Samuelsson & Davidsson, 2009). For example, Davidsson and Honig (2003, p. 309) argue that social capital assists nascent entrepreneurs "by exposing them to new and different ideas, world views, in effect, providing them with a wider frame of reference both supportive and nurturing to the new potential idea or venture".

The study of human and social capital may also contribute to a better understanding of academic scientists' transitioning to entrepreneurship. Human capital endowments and social networks are recognized as the two pillars supporting scientists' ability to contribute new knowledge to society (Bozeman & Mangematin, 2004). Throughout their careers, academic scientists seek to enhance both. Moreover, while human capital models have developed separately from social capital models, in the academic entrepreneurship context the two theoretical approaches are not easily disentangled (Mosey & Wright, 2007), suggesting that both should have a significant bearing on the entrepreneurial career decision among scientists. Indeed, the academic entrepreneurship literature emphasizes that network ties to industrial firms or governmental support agencies are conducive to an entrepreneurial career (Aldridge & Audretsch, 2011; Karlsson & Wigren, in press; Landry, Amara, & Rherrad, 2006). Interactions and linkages, such as working together with industry partners, are posited as conduits not just of knowledge spillovers but also of a demonstration effect providing knowledge and information about how scientific research can be commercialized via entrepreneurship (Bercovitz & Feldman, 2008; Stuart & Ding, 2006). Similarly, personal entrepreneurial experience adds to the academic scientists' specific human capital by providing direct learning and episodic knowledge about the entrepreneurial process, which in turn predicts recurrent entrepreneurial activity (Hoye & Pries, 2009). Azoulay et al. (2007) further highlight that scientists' patenting productivity may be regarded as an indicator of their commercial research orientation. Patenting is a purposeful activity motivated to protect intellectual property that stems from research and development efforts. A general requirement for a patent is a technological invention that is novel, industrially useful, and non-obvious (Acs & Audretsch, 1989). While of minor importance to some fields of academic science (i.e., scientific disciplines in which technological inventions naturally do not play a central role, such as in social sciences), experience with applying for patent protection for the results of their research efforts has been shown to be a robust predictor of later entrepreneurial activity of academics (Krabel & Mueller, 2009; Landry, Amara, & Rherrad, 2006; Stuart & Ding, 2006).

Moreover, drawing from an economic paradigm, a considerable body of literature models the transition from employed work into entrepreneurship as an occupational choice decision where *expected benefits* are central (e.g., Campbell, 1992; Kihlstrom & Laffont, 1979). In the simplest form of this model, individuals choose between starting a risky entrepreneurial endeavor or working in paid employment and earning a risk-free wage (as the wage is usually fixed in an employment contract). Assuming that one possesses the necessary resources to start up and given the individual risk-taking propensity, one will choose to engage in entrepreneurship if the expected future profits from becoming an entrepreneur are larger than the sum of expected future benefits from employed work. Such economic models have recently been developed to predict scientists' transition to academic entrepreneurship, taking account of the peculiarities of an academic work context (Lacetera, 2009). Accordingly, besides receiving a fixed wage, the academic scientist also derives direct benefit from performing research, e.g., in the form of publications and peer recognition. Hence, for an academic to choose an entrepreneurial career, the expected entrepreneurial benefits need to be large enough to compensate (1) for the risk-free wage in academic sector employment and (2) for the recognition benefits of academic research.

### C. *The psychological perspective on academic entrepreneurial intentions*

A widely researched psychological framework for understanding and predicting behavioral intentions is the theory of planned behavior (TPB; Ajzen, 1991; Fishbein & Ajzen, 2010). This parsimonious and coherent model of behavioral intentions received strong empirical support in a wide range of studies predicting very different kinds of planned behavior (Ajzen, 2001; Conner & Armitage, 1998). Recent studies broadly confirmed the TPB's predictive utility also with respect to entrepreneurship as planned behavior (e.g., Krueger et al., 2000; Liñán & Chen, 2009). Given the general and basic nature of the TPB approach, we expected this framework to also apply in the specific domain of academic entrepreneurship with its special focus on scientists' active participation in the entrepreneurial exploitation of new research knowledge (Shane, 2004). The core assumption of the TPB is that behavioral intentions are an additive function of three conceptually independent factors: attitudes, social norms, and perceived behavior control.

*Attitudes* reflect an individual's enduring evaluation – positive or negative – of the behavior in question. Existing literature suggests that academic scientists allocate their efforts and time toward academic entrepreneurship if they have a favorable appraisal of entrepreneurial activity and the commercial use of research knowledge (e.g., Gulbrandsen, 2005; Owen-Smith & Powell, 2001).

*Social norms* refer to perceived normative pressure from a specific reference group toward engaging or not engaging in a particular behavior (Ajzen, 1991). In line with the literature on academic entrepreneurship (Bercovitz & Feldman, 2008; Stuart & Ding, 2006), our study considered individual scientists' workplace peers as salient referents determining their entrepreneurial behavior. Previous research suggested that scientists feel pressure to become involved with the commercial exploitation of their research knowledge, and are thus more likely to do so, if they sense that their academic peers look favorably on such activity (Rahm, 1994). Note that whereas in earlier times scientists' active involvement in the commercialization of their academic research knowledge was met with consternation among academic peers, the scientific community has recently experienced a significant change of view (Owen-Smith & Powell, 2001). University faculties have come to accept and, in many institutions, to endorse the participation in entrepreneurial endeavors. As Etzkowitz (1998, p. 824) stated, "The norms of science which traditionally condemn profit-making motives are beginning to change to allow for . . . entrepreneurship".

*Perceived behavioral control* is closely related to Bandura's (1997) concept of self-efficacy and reflects the perceived ease or difficulty of performing a particular behavior successfully. The TPB would expect that scientists who do not perceive themselves to have control over entrepreneurial behavior and its outcome are unlikely to form strong entrepreneurial intentions, even if social norms and attitudes toward entrepreneurship are favorable. This is supported by entrepreneurship research which stressed the importance of self-efficacy as a mechanism for overcoming perceptions of the higher financial, technological, and legal uncertainties that are often associated with the commercialization of research knowledge via entrepreneurship (Markman, Baron, & Balkin, 2002; Obschonka, Silbereisen, & Schmitt-Rodermund, 2010).

## III. HYPOTHESES

Figure 1 presents our conceptual model, which combines the economic and psychological perspectives outlined above. In the following, this model is discussed in detail. Note that in this conceptual model we also included the intention–behavior link and possible barriers that may impede this link. Although this is not the core focus of this study, and therefore not relevant in the following detailed description of the model, in an additional analysis we used a small follow-up sample to test whether academic entrepreneurial intentions indeed translate into subsequent academic entrepreneurship (i.e., founding a business in order to market one's own research knowledge), as predicted by the TPB.

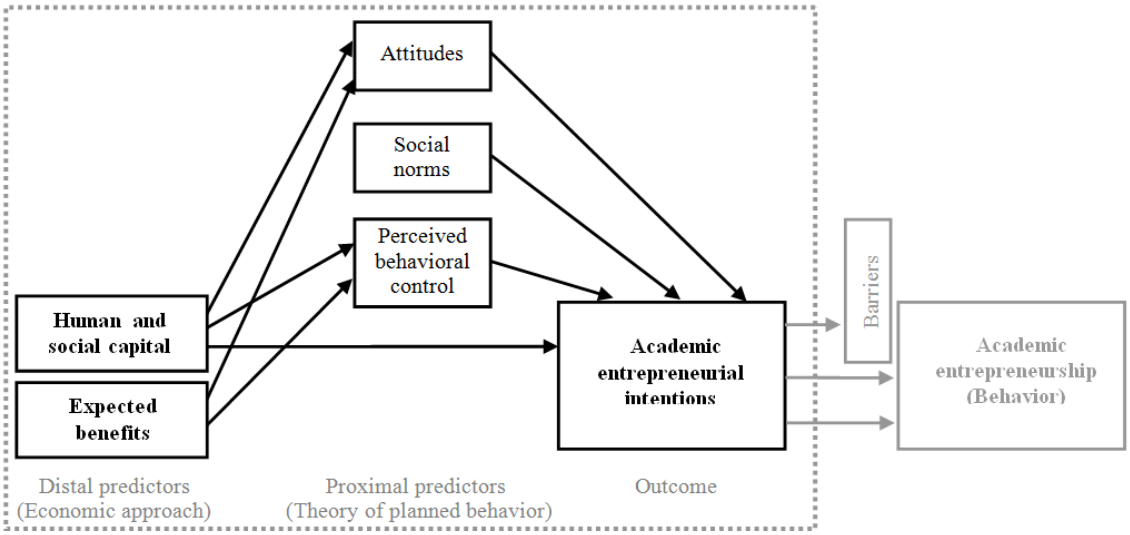


**Figure 1. Conceptual model for the prediction of academic entrepreneurial intentions**

According to the TPB, the psychological factors (attitudes, social norms, perceived behavioral control) should be seen as proximal intention predictors, whereas the economic variables refer to distal intention predictors, or so-called background factors in the diction of the TPB literature (Fishbein & Ajzen, 2010). As such, background factors are proposed to affect intentions via the psychological factors. More specifically, the TPB states that behind attitudes, social norms, and perceived behavior control are salient beliefs and that these beliefs "are not innate but instead are acquired in daily encounters with the real world" (Fishbein & Ajzen, 2010, p. 224). After reviewing the TPB literature and relevant entrepreneurship studies (e.g., Fini, Grimaldi, Marzocchi, & Sombrero, in press; Prodan & Drnovsek, 2010), we decided to investigate the economic variables as predictors of attitudes and perceived behavioral control (because we could relate them to salient beliefs in these domains) but not of social norms. Consistent with entrepreneurship research, we hold that social norms, in contrast to attitudes and perceived control, are less relevant for indirect effects of background factors because entrepreneurs are characterized as being inner-directed and striving for social distinction (instead of conforming to social norms; Krueger, Reilly, & Carsrud, 2000; see also Schumpeter, 1934). Applying the TPB framework, Fini et al. (in press), for example, showed that background factors such as perceived environmental dynamism (e.g., industry opportunities) or individual skills predict corporate entrepreneurial intentions (intentions to act entrepreneurially within existing small and newly established companies) indirectly via attitudes and perceived control – but not via social norms. Moreover, our literature review revealed no clear indications for a meaningful effect of the economic factors that we study (human and social capital, expected benefits) on social norms.

### *A. Indirect effects via attitudes*

Psychological research on attitude formation identified several factors as important determinants of behavioral attitudes (Ajzen, 2001). For example, prior behavioral experiences connected with the target behavior, either made during one's own past behavior in this domain (comparable to human capital factors) or made via networks (comparable to social capital factors), are deemed important. Likewise, researchers examining the entrepreneurial scientist argued that direct learning through practical experience in different entrepreneurial aspects (e.g., earlier patenting and firm-founding activities) as well as the values and beliefs transmitted by network ties to the business world (e.g., through research cooperation with industrial partners and through advice and support from

government-sponsored institutions) raises scientists' awareness that their research has commercialization potential and eventually increases their desire to exploit this potential by founding their own business (Gulbrandsen, 2005; Fritsch & Krabel, in press; Mosey, Lockett, & Westhead, 2006).

Moreover, besides prior experiences, the psychological literature on attitude formation further emphasizes the role of salient outcome expectations (Ajzen, 2001; Fishbein & Ajzen, 2010). This approach draws from the expectancy-value model of attitudes, which states that positive outcome expectations (beliefs about the likely consequences of a certain behavior) result in positive attitudes regarding this behavior when these consequences are valued. From a psychological perspective, expected benefits, as examined in economic studies on entrepreneurial career transitions (e.g., financial gains), are comparable to expected consequences that are indeed valued (i.e., financial gains are most likely seen as something positive). In other words, such benefits, also referred to as hypothetical incentives (Williams, 2010), imply the coincidence of outcome expectation and value, which taken together should determine respective attitudes (Ajzen, 2001). To illustrate this point, academic scientists may develop a positive attitude towards academic entrepreneurship when they expect to gain reputation (which is generally valued in the scientific community as necessary for the advancement of an academic career) as a likely consequence of commercializing their research (Göktepe-Hulten & Mahangaonkar, 2010; Lam, 2011).

### *B. Indirect effects via perceived behavioral control*

Social cognitive theory highlights prior mastery and helpful role models as important determinants of personal control beliefs (e.g., whether one feels able to successfully perform a certain behavior; Bandura, 1997). Seen from this perspective, economic factors such as human and social capital may be indirectly associated with entrepreneurial career intentions via perceived behavioral control. More precisely, through providing opportunities for enactive mastery during earlier entrepreneurial episodes (Krueger, 1993; Zhao, Hills, & Seibert, 2005) and access to business-related information, resources, and positive recommendations (Ozgen & Baron, 2007; Peterman & Kennedy, 2003), both human capital and social capital may make entrepreneurial behavior more feasible to the academic scientist. Vocational research further suggests that social networks such as having contact with entrepreneurial promotion agencies may enhance scientists' perceptions of control over an entrepreneurial career due to role model effects (Lent, Brown, & Hackett, 1994; see also Zhao et al., 2005) and beneficial effects of mentoring (e.g., Day & Allen, 2004).

Past psychological research further indicates that outcome expectations directly affect feasibility perceptions (for a review of this literature see Williams, 2010). Hence, higher levels of expected benefits of academic entrepreneurship (i.e., expected financial and reputational gains) should make scientists more likely (or more motivated) to perceive that they are able to engage in such behavior.

### *C. Direct effects of economic variables*

The TPB further assumes that background factors can have additional direct effects on behavioral intentions, above and beyond their indirect effects via the TPB factors (Fishbein & Ajzen, 2010). Put differently, background factors may affect behavioral intentions also independently of attitudes, norms, and perceived control. For example, empirical studies employing the TPB consistently found that the link between past behavior (i.e., when the target behavior has been shown before) and current behavioral intentions is not fully mediated by the TPB factors (Ajzen, 2002a; see also Conner & Armitage, 1998). It is argued that, with repeated performance, the respective behavior habituates and comes under the direct control of stimulus cues, affecting intentions directly (Fishbein & Ajzen, 2010; Trafimow & Borrie, 1999). These residual effects of past behavior on behavioral intentions should be particularly strong in situations where contexts are unstable and behavioral outcomes are uncertain (Ajzen, 2002a; Trafimow & Borrie, 1999), such as in the case of academic entrepreneurship (i.e., starting a business venture based upon scientific research knowledge). Empirical support is also evident in the more general entrepreneurship literature, suggesting that exposure to entrepreneurial experiences channels individuals into different "knowledge corridors". Experienced entrepreneurs, as compared to novices, may then engage in recurrent entrepreneurial behavior with less conscious effort, that is, without carefully considering one's behavioral attitudes and beliefs (Ronstadt, 1988; Shane, 2000).

Yet, routinization and habit with regard to entrepreneurial behavior may not only be driven by human capital attributes but may also be induced by scientists' social capital, i.e., their

embeddedness in business networks. Often described as "boundary spanners" between the academic and commercial sphere (Gulbrandsen, 2005; Rahm, 1994), academic scientists with personal ties beyond academia (e.g., to industrial research partners) should exhibit a lower threshold toward forming entrepreneurial intentions. As they routinely move back and forth along the university–industry boundary while interacting with their commercial network partners, these academics may decide to engage in entrepreneurship without invoking the cognitive processes described in the TPB.

We had no expectations regarding direct effects of expected benefits (financial and reputational gains) on academic entrepreneurial intentions. Arguably, these benefits, other than human and social capital, are conceptually more closely linked with the psychological TPB factors such as attitudes and perceived control because they represent salient beliefs that, according to the TPB literature, may directly underlie these TBP factors (Fishbein & Ajzen, 2010). As such, expected benefits from own entrepreneurial activity may primarily affect entrepreneurial intentions via attitudes and perceived control, instead of reflecting more general behavioral habits or "automated" activities which do not involve the cognitive processes described in the TPB.

Taken together, and in accordance with the TPB and related research, in our proposed model (see Figure 1) we expected scientists' entrepreneurial human and social capital to exert both direct and indirect effects (via the TPB factors attitudes and perceived behavioral control) on entrepreneurial intentions. In contrast, entrepreneurial benefits were expected to predict intentions only indirectly (via attitudes and perceived control).

## IV. METHOD

The present study is part of the interdisciplinary research project *Thuringian Founder Study* ("Thüringer Gründer Studie"). This large-scale project examines the process of business foundation in the Federal State of Thuringia, Germany, from the perspective of economics and psychology. In this paper we present data from an online survey. Web-based surveys allow for highly standardized data collection at low cost and have been shown to collect data in a valid way (Gosling, Vazire, Srivastava, & John, 2004). Furthermore, such surveys are expected to increase the response rate because the questionnaire can be completed without having to mail any forms (Mann & Stewart, 2000). Before we conducted our study we pilot-tested and optimized the questionnaire and the procedure in an independent sample of 133 scientists in the Federal State of Saxony, Germany. We supplemented the survey data with archival information on patent applications of the participants. Accessing the database of the German Patent and Trademark Office (DPMA), we counted the number of patents which scientists had applied for within the five years prior to our survey.

To test our hypothesized path model, we employed the technique of path analysis using AMOS (Arbuckle, 2006). On the basis of fit indices this procedure tests whether, and how well, the hypothesized model fits the data. In this study, we focus on $\chi^2$, CFI, and RMSEA as fit indices. A non-significant $\chi^2$ indicates good fit but relying solely on $\chi^2$ as a fit statistic is problematic as it is affected by the sample size and the size of the correlations in the model. Thus, experts suggest considering other fit statistics such as CFI and RMSEA when evaluating model fit. As a rule of thumb, a CFI value greater than .90 indicates a reasonably good fit. With respect to the RMSEA, values $\leq .05$ indicate a close approximate fit, and values between .05 and .08 suggest a reasonable error of approximation (Kline, 2005).

### *A. Participants*

In a first step of sample selection we accessed the Internet websites of all research organizations in the German Federal State of Thuringia in order to collect contact names and email addresses of scientists working there. Located in the center of Germany, Thuringia has a broad spectrum of research organizations, like universities and non-university research institutions (e.g., Max Planck institutes, Fraunhofer institutes), providing a fertile ground for the emergence of academic entrepreneurship. Using the resulting list of all available email addresses (4,638 entries), a random sub-sample consisting of 2,319 email addresses was then selected as the basis for our survey. In June 2008, we received completed questionnaires from 565 participants, representing a response rate of 24.4%. Compared to other web-based studies, this is an acceptable rate (Cook, Heath, & Thompson, 2000). Before conducting our analysis, we excluded 15 participants due to incomplete data or non-serious responses. We also excluded 54 participants who reported that they do not conduct any research, as this study targeted scientists' intentions to commercialize their *own* research. The final sample consisted of 496 scientists.

On average, participants were 38.8 years old (*SD* = 11.55, range: 23–65) and male (70.8%). About two-thirds worked in a university (65.4%), 24.1% worked in a non-university research institution, and 10.5% worked in a university of applied sciences ("Fachhochschule"). Regarding their occupational status, 69.8% worked as research associates, 18.5% were professors or university lecturers, and 11.7% reported another field of activity, for example as technical assistant. Half of the sample (53.3%) described their type of engagement in research as applied science, and the remainder (46.7%) as basic science. The largest group of participants worked in the field of natural sciences (49.8%), whereas 31.5% worked in engineering and 18.7% in economics, law, or social sciences. Compared with official statistics on research personnel in Germany (Statistisches Bundesamt, 2008), this survey sample appeared to be representative in terms of age, gender, and academic rank.

### *B.* ***Measures***

#### *1) 4.2.1 Academic entrepreneurial intentions*

Three items assessed *scientists' intentions to engage in a start-up firm to market their own research* (Krueger et al., 2000) (Item 1: "In the foreseeable future, do you intend to participate in the founding of a firm to commercialize your research?"; five-point Likert scale; 1 = no, 5 = yes; Item 2: "In your opinion, how high is the probability that, in the foreseeable future, you will participate in the founding of a firm to commercialize your research?"; 1 = 0%; 6 = 100%; Item 3: "I have recently sought information about the ways and means of founding a firm with the object of commercializing my research"; five-point Likert scale; 1 = no; 5 = yes). We z-standardized and averaged the three items, resulting in the final variable academic entrepreneurial intentions (*M* = -.00, *SD* = .88, $\alpha$ = .86).

#### *2) Human capital indicators*

*Patenting experience* captured whether participants had applied for at least one patent between 2004 and 2008 (0 = no; 1 = yes; *M* = .12, *SD* = .33) (Landry, Amara, & Rherrad, 2006). *Entrepreneurial experience* (whether successful or not) was measured with "Have you already participated in the founding of a firm in the past to commercialize your research?" (0 = no; 1 = yes; *M* = .11, *SD* = .31) (Krabel & Mueller, 2009).

#### *3) Social capital indicators*

We measured *cooperation linkages with industry* with the item "I have many business contacts/contacts with research partners in industry." (1 = completely disagree; 5 = completely agree; *M* = 2.36, *SD* = 1.24) (Karlsson & Wigren, in press; Krabel & Mueller, 2009). Scientists' *linkages to entrepreneurial promotion agencies* were measured with the item "I know of public promotion agencies which would support me in the founding of a firm for the commercialization of my research." (1 = completely disagree; 5 = completely agree; *M* = 2.33, *SD* = 1.23) (Liao & Welsch, 2005).

#### *4) Expected entrepreneurial benefits*

Two items were included to capture scientists' expected entrepreneurial benefits, following Göktepe-Hulten and Mahangaonkar (2010). Both items were preceded by the stem "Please assess the likelihood of these consequences if you were to participate in the founding of a firm in order to commercialize your own research." The first consequence referred to *expected reputational gain* and was measured with the item "Additional scientific reputation" (1 = very unlikely; 5 = very likely; *M* = 2.81, *SD* = 1.02). The second consequence referred to *expected financial gain* and was measured with the item "Higher personal income" (1 = very unlikely; 5 = very likely; *M* = 2.99, *SD* = 1.18).

#### *5) Intention predictors in the TPB (attitudes, social norms, perceived behavioral control)*

Scientists' *attitudes* toward academic entrepreneurship were measured with the mean of four five-point bipolar adjective scales ("My personal attitude toward participation in the founding of a firm to commercialize my own research is that this is…"; e.g., 1 = "unattractive" vs. 5 = "attractive"; *M* = 3.41, *SD* = .96, $\alpha$ = .89) (Ajzen, 2001; 2002b). *Social norms* were assessed with the mean across two items, each referring to academic workplace peers (e.g., "Most of my colleagues whose opinions matter to me…"; e.g., "…would encourage my participation in the founding of a firm to commercialize my own research"; five-point Likert scale; 1 = "not at all correct" to 5 = "totally correct"; *M* = 3.06, *SD* = .81, $\alpha$ = .68) (Ajzen, 2002b). Following Ajzen and Madden (1986), *perceived behavioral control* was measured with the mean of three items (e.g., "If I wanted to participate in the founding of a firm to commercialize my own research, I am confident that I would succeed"; five-point Likert scale; 1 = "not at all correct" to 5 = "totally correct"; *M* = 2.95, *SD* = 1.01, $\alpha$ = .84).

*6) Control variables*

Following earlier research on academic entrepreneurship (Fritsch & Krabel, in press; Landry, Amara, & Rherrad, 2006; Levin & Stephan (1991); Murray & Graham, 2007; Shane, 2004), there are other potential influences on the likelihood of academic scientists' transition to entrepreneurship. Taking this literature into consideration, we controlled our analysis for *gender* (0 = female; 1 = male; *M* = .70, *SD* = .46), *age* (*M* = 38.8, *SD* = 11.55, range: 23–65), *PhD degree* (0 = no; 1 = yes; *M* = .46, *SD* = .50), and *type of research* (0 = basic research; 1 = applied research; *M* = .53, *SD* = .50).

## V. RESULTS

### A. *Preparatory analysis on the intentions–behavior link*

Before we conducted our main analysis, which refers to the prediction model with academic entrepreneurial intentions as the outcome variable, we took a closer look at the intentions–behavior link as additionally outlined in our framework in Figure 1 (right part). In this relationship, important barriers should play a role in that they could prevent some scientists from ultimately engaging in entrepreneurial behavior (e.g., due to worsening of macro-economic conditions). To investigate this intentions-behavior link and possible barriers empirically, we conducted a follow-up survey 18 months after the baseline survey. Here, respondents were asked whether they had pursued entrepreneurship since T1. In December 2009 (T2), we were able to collect follow-up data on entrepreneurial behavior from 219 of our participants, using the item "Since the last survey in June 2008, did you participate in the founding of a firm to commercialize your research?". We found that scientists' entrepreneurial intentions (mean of the three z-standardized intention variables) indeed forecasted actual engagement in academic entrepreneurship ($r_s$ = .32, p < .001). Our expectation on the link between intentions and actual behavior thus received support.

However, although the correlation between intention and behavior is substantial it also makes clear that some scientists did not engage in founding behavior even though they had reported the intention to do so in the near future. Participants of the follow-up survey who did not report entrepreneurial behavior since T1 but had had the intention to do so were asked to rate the degree to which four potential barriers inhibited their engagement in a start-up firm to market their own research (i.e., current financial crisis, current workload, recent negative experiences of workplace peers with founding their own firm, private circumstances). As expected, the participants' reports indicate that barriers indeed played a role. The most important reasons for postponing or abandoning an entrepreneurial project since the baseline survey were scientists' current workload, e.g., research and teaching duties (five-point Likert scale; 1 = "not at all correct" to 5 = "totally correct"; M = 3.48, SD = 1.54), and obstacles in their personal circumstances, e.g., family duties, leisure opportunities (five-point Likert scale; 1 = "not at all correct" to 5 = "totally correct"; M = 2.73, SD = 1.53). Interestingly, the current financial crisis (five-point Likert scale; 1 = "not at all correct" to 5 = "totally correct"; M = 1.79, SD = 1.41) and recent negative experiences of workplace peers with founding their own firm (five-point Likert scale; 1 = "not at all correct" to 5 = "totally correct"; M = 1.70, SD = 1.02) did not seem to function as strong barriers to entrepreneurial behavior among scientists. This quite unexpected finding can be explained by the fact that the German economy performed relatively well during the global financial crisis of 2008/2009 compared to other economies (World Economic Forum, 2010).

Note that there was substantial attrition (58.7%) from T1 to T2. With regard to the baseline variables, participants who answered the follow-up questionnaire differed from those who did not in that they had a more positive attitude toward entrepreneurship (t[493] = -2.02, p < .05). In view of this indication for non-random sample attrition and the reduced number of observations, we decided not to include the follow-up data into our main analysis since the results would not be robust (and the N and thus the statistical power would be much smaller).

### B. *Main analysis*

*1) Correlations*

Appendix 1 presents the zero-order correlations between all variables used to investigate the prediction models for the explanation of academic entrepreneurial intentions. To test for the existence of multicollinearity, variance inflation factors (VIF) were computed for all predictor variables. VIF scores were well below 2. Thus, no evidence of multicollinearity was indicated (Hair et al., 1998). Among the control variables, gender and type of research were associated with academic entrepreneurial intentions: Males as well as scientists working in fields of applied research reported stronger intentions to found a new business. Age and PhD degree, in contrast,

showed no association with the outcome variable. With respect to the psychological factors described in the theory of planned behavior (TPB), namely attitudes, social norms, and perceived behavioral control, all variables correlated positively with intentions, which is in line with our conceptual model. As expected, there were also positive and significant correlations between the factors proposed by the economic approaches (social capital approach, human capital approach, expected benefits) and the TPB factors and between the economic factors and the outcome variable.

*2) Path model*

We then tested our path model in AMOS, proceeding in two steps. We first tested the hypothesized model and, in a second step, trimmed this model by eliminating non-significant paths and irrelevant variables. This more parsimonious model then served as our final empirical model that we report and discuss in detail.

As just mentioned, we first tested the hypothesized model. All effects were controlled for gender, age, PhD degree, and type of research. This model achieved a very good fit ($\chi^2$ [2] = 1.05, $p$ = .590, CFI = 1.000, RMSEA = .000). Second, aiming at finding a more parsimonious model, we excluded non-significant paths from our model. Moreover, we also left out a TPB variable, namely social norms. In the full model, we found that only attitudes ($\beta$ = .31, $p$ < .001) and perceived control ($\beta$ = .14, $p$ < .01) predicted intentions, but not social norms ($\beta$ = -.05, ns). Given this non-significant effect, we decided to leave out social norms in our more parsimonious model.

Not surprisingly, this parsimonious model (without non-significant paths and without social norms) also achieved a very good fit ($\chi^2$ [6] = 5.60, $p$ = .469, CFI = 1.000, RMSEA = .000). Again, gender, age, PhD degree, and type of research served as control variables. This final empirical model, which accounted for 44% of variance in intentions, is depicted in Figure 2.

*TPB factors as proximal predictors of academic entrepreneurial intentions*

The TPB factors attitudes ($\beta$ = .30, p < .001) and perceived behavioral control ($\beta$ = .14, p < .05) had a positive effect on intentions in our final model. Given that we had found no effect of social norms on intentions, we must conclude that our expectation on the TPB–intentions link was only partly supported. It was supported for attitudes and perceived control, but not for social norms.

*Indirect effects of economic variables*

Regarding the indirect effects of the economic variables, we found the following. Each of the economic variables, except for linkages with public support institutions, showed indirect effects on intentions via *attitudes*. The effects on attitudes were all positive and ranged from $\beta$ = .13 (patenting experience) to $\beta$ = .23 (expected financial gain). In sum, 25% of variance in attitudes could be explained in the model.

Moreover, each of the economic variables, except for patenting experience and expected reputational gain, showed indirect effects on intentions via *perceived behavioral control*. The model explained 41% of variance in perceived control and the effects on control were all positive and ranged from $\beta$ = .17 (expected financial gain) to $\beta$ = .26 (cooperation linkages with industry).

Taken these results together, we found support for our expectations that human and social capital indicators as well as perceived entrepreneurial benefits would show indirect effects on intentions via TPB factors. Entrepreneurial experience, cooperation linkages with industry, and expected financial gain had an indirect effect via both attitudes and perceived control. Patenting experience and expected reputational gain only showed indirect effects via attitude, and not via perceived control. Linkages with public support institutions and expected financial gain, in turn, only showed indirect effects via perceived control, and not via attitudes.

*Direct effects of economic variables*

We had also expected that human and social capital would show direct effects on intentions, above and beyond their indirect effects via the TPB factors. This expectation was supported for (some of the) human and social capital indicators. We found entrepreneurial experience ($\beta$ = .14, p < .001), cooperation linkages with industry ($\beta$ = .12, p < .01), and linkages with public support institutions ($\beta$ = .18, p < .001) to positively predict academic entrepreneurial intentions. Consistent with our model, there were no direct effects of expected reputational and financial gains.

*Summary of path model results*

Finally, summarizing the findings from our path model analysis, in Appendix 3 we provide an overview of the direct effect as well as of the total indirect effect and the total effect (sum of direct

effect and total indirect effect) for each of the economic variables studied in this paper. This effect decomposition allows the examining of (1) whether an economic variable has only indirect effects, direct effects, or both, (2) how large the direct and indirect effect of each economic variable is, and (3) to what extent each economic variable contributes in total to variance explanation of academic entrepreneurial intentions. Regarding the latter, we found that entrepreneurial experience and the two social capital indicators contributed the most in explaining variance in intentions (strongest total effects). Behind these total effects were both direct and indirect effects. In contrast, the total effects of patenting experience and of the two benefit variables were solely indirect and rather small.

So far, we had controlled all effects for gender in our path model analysis. Academic entrepreneurship, however, is mostly pursued by males (Murray & Graham, 2007) and simply controlling for gender would not reveal whether our final empirical model would also hold true when looking at males only. In an additional analysis, we thus re-ran the two-step path model analysis as described above but only including male participants in the sample ($n$ = 349). As a result, we ended up with exactly the same model as shown in Figure 2 (we had to exclude the same non-significant paths and social norms from the hypothesized model). Compared to the effects in the final empirical model derived from the full sample (males and females), the effects in the final "male" model were in the same direction and comparable in size. This presents evidence that our final "full sample" model illustrated in Figure 2 indeed applied to male scientists, to the protagonists of academic entrepreneurship.

## VI. DISCUSSION

Acknowledging and demonstrating the intentionality of academic entrepreneurship, in this study we tested a model that combines past entrepreneurship research, research on the entrepreneurial scientist (which mainly focused on economic approaches), and the theory of planned behavior approach (TPB), a well-established psychological model of behavioral intentions in the context of planned behavior. More specifically, we studied economic variables (scientists' human and social capital characteristics as well their expected benefits resulting from an engagement in academic entrepreneurship) as distal predictors, and attitudes, social norms, and perceived behavioral control as proximal predictors of academic entrepreneurial intentions (i.e., the intention to start a private business to market new research knowledge). It was our expectation that the economic variables would show indirect effects (via attitudes and perceived behavioral control), and, in the case of human and social capital, also direct effects on academic entrepreneurial intentions.

Referring to the *proximal intention predictors* described in the TPB (attitudes, social norms, perceived behavioral control), only social norms turned out not to be relevant in the prediction of intentions. While this result contrasts with previous research proposing that a scientist's decision to found his own firm is socially conditioned (Bercovitz & Feldman, 2008; Stuart & Ding, 2006), it is in line with more general TPB studies on entrepreneurial intentions, which also found non-significant effects of social norms (Krueger, Reilly, & Carsrud, 2000). When looking at TPB factors only, it seems that entrepreneurial intentions are mainly driven by the personal TPB factors (attitudes and perceived control), whereas norms associated with the social context (in our case perceived expectations and behaviors of scientists' workplace peers) are less important. According to social identity theory, it may well be that the effect of social norms on entrepreneurial intentions is moderated by group identification (Terry, Hogg, & White, 1999). Accordingly, perceived expectations and behaviors of scientists' workplace peers may only matter for entrepreneurial intentions when the scientists strongly identify with these peers.

Regarding the *indirect effects* of the economic variables, the other two TPB factors, attitudes and perceived behavior control, however indeed helped to better understand the effect of the economic variables on scientists' intentions to engage in academic entrepreneurship. Although our results are correlational in nature and further longitudinal evidence is needed to infer more causal interpretations, they add an important perspective to the study of the entrepreneurial scientist by tackling the question *why* economic variables may be relevant for scientists' transition to the entrepreneurial arena. In this respect our study delivers promising results on how to combine established economic and psychological approaches in order to get the bigger picture, an interdisciplinarity that is often called for but rarely applied in entrepreneurship research (Gartner, 2007).

Our results indicate that the TPB fully accounts for the indirect effect of expected entrepreneurial benefits, which is probably due to the cognitive

nature of these benefits. In contrast, regarding *direct effects* of economic factors, human and social capital indicators also seem to operate "outside" of the TPB framework in that they relate to academic entrepreneurial intentions independently of the TPB factors. This, of course, also demonstrates the limits of the TPB approach, which often cannot fully explain the link between background factors and intentions, a result well known, for example, from more general TPB research on the role of past behavior as a background factor (Ajzen, 2002a; Conner & Armitage, 1998). Interestingly, earlier studies on academic entrepreneurship broadly neglected the important role of past entrepreneurial behavior but instead seem to assume that the scientists under investigation are starting a business for the first time (Mosey & Wright, 2007; Hoye & Pries, 2009).

What are the implications of this study? Our research could inform higher education leaders and policymakers seeking to further promote the emergence of entrepreneurial activity in academia. Rather than creating rigid policy tools, our findings hint at the importance of fostering scientists' entrepreneurial mindsets and networks. Past entrepreneurial behavior as well as entrepreneurial competence growth and network-building appeared as central antecedents of scientists' entrepreneurial attitudes and control perceptions and thus of their intentions to engage in academic entrepreneurship. Measures may thus include intensive interaction with business practitioners during seminars, workshops, and other structured educational experiences such as formal university-based training (Mosey, Lockett, & Westhead, 2006; Souitaris, Zerbinati, & Al-Laham, 2007). Our results further reveal an interesting aspect of social ties to public support institutions. While we do not have information on the factual provision of counseling services by these organizations, it seems that knowing where entrepreneurship-related advice is available already contributes to scientists' perceived efficacy with respect to starting an entrepreneurial career. This suggests that entrepreneurial promotion programs should also be well advertised among the target group of academic scientists. Finally, our results on scientists' expected benefits from engaging in academic entrepreneurship (e.g., expectations of financial and reputational rewards) add to the recent debate on implementing the concept of the "entrepreneurial university" (Clark, 1998). Whereas others argued that the promotion of such reward perceptions may directly lead to an entrepreneurial career choice among scientists (Lam, 2011), our findings put the focus on entrepreneurial attitudes and control beliefs through which benefit expectations may actually affect intentions to engage in academic entrepreneurship. In this sense, policies to encourage entrepreneurship among university faculties may not primarily aim at reward perceptions, but at the more proximal determinants of entrepreneurial intentions, namely attitudes and control beliefs towards entrepreneurship. Related to this point, more general research showed that interventions targeting psychological characteristics as described in the TPB are efficacious in changing intentions and behavior among participants who, prior to the intervention, either did not contemplate performing the behavior or were disinclined to do so (Fishbein & Ajzen, 2005).

Regarding implications for future research, an aspect that deserves further scrutiny refers to additional predictors that could possibly extend our intentions-based model and add to its predictive ability. Researchers may consider other psycho-social characteristics that are known to impact on behavioral intentions, e.g., habit or self-identity (Ajzen, 1991; Conner & Armitage, 1998). Moreover, to enhance the robustness of our findings, it would be interesting to replicate this study in the US and UK, which are often referred to as powerhouses of academic entrepreneurship, and China, the world's largest developing economy. A cross-cultural validation of our path model may further provide promising opportunities for future research, as cultural aspects have recently been shown to be relevant in explaining entrepreneurial intentions (Liñán & Chen, 2009; Prodan & Drnovsek, 2010). Finally, future research could further examine *how* intentions to opt for an entrepreneurial career precipitate into entrepreneurial behavior. In this sense, we provide some evidence on potential barriers which may inspire future longitudinal testing of the intentions–behavior link in the context of academic entrepreneurship.

Before concluding it is important to consider several limitations of this study. Although the hypothesized path model is grounded in well-established theories, the correlational design of our study does not allow for strictly causal interpretations. A further limitation is the fact that all information was collected from a single source, except for archival data on scientists' earlier patenting experience. Finally, due to length constraints in the questionnaire, scientists' human and social capitals were only assessed using single-item measures. While limiting the number

of items that respondents are asked to complete is important, future research may also employ multiple-item measures for these constructs.

## VII. Conclusion

Although it is always a challenging task to work at the interface of two disciplines, this study could demonstrate the advantages of combining economic and psychological perspectives in the study of academic entrepreneurial intentions. Whereas benefits only affected intentions via the TPB factors, human and social capital indicators also exerted direct effects independently of the TPB framework, and particularly these direct effects may deserve more attention in future studies. Taken together, we thus conclude that the interplay between economic and psychological factors plays an important role for scientists' transition from academia to entrepreneurship and that future research should continue to shed light on this interplay, preferably in an interdisciplinary manner and using longitudinal designs.

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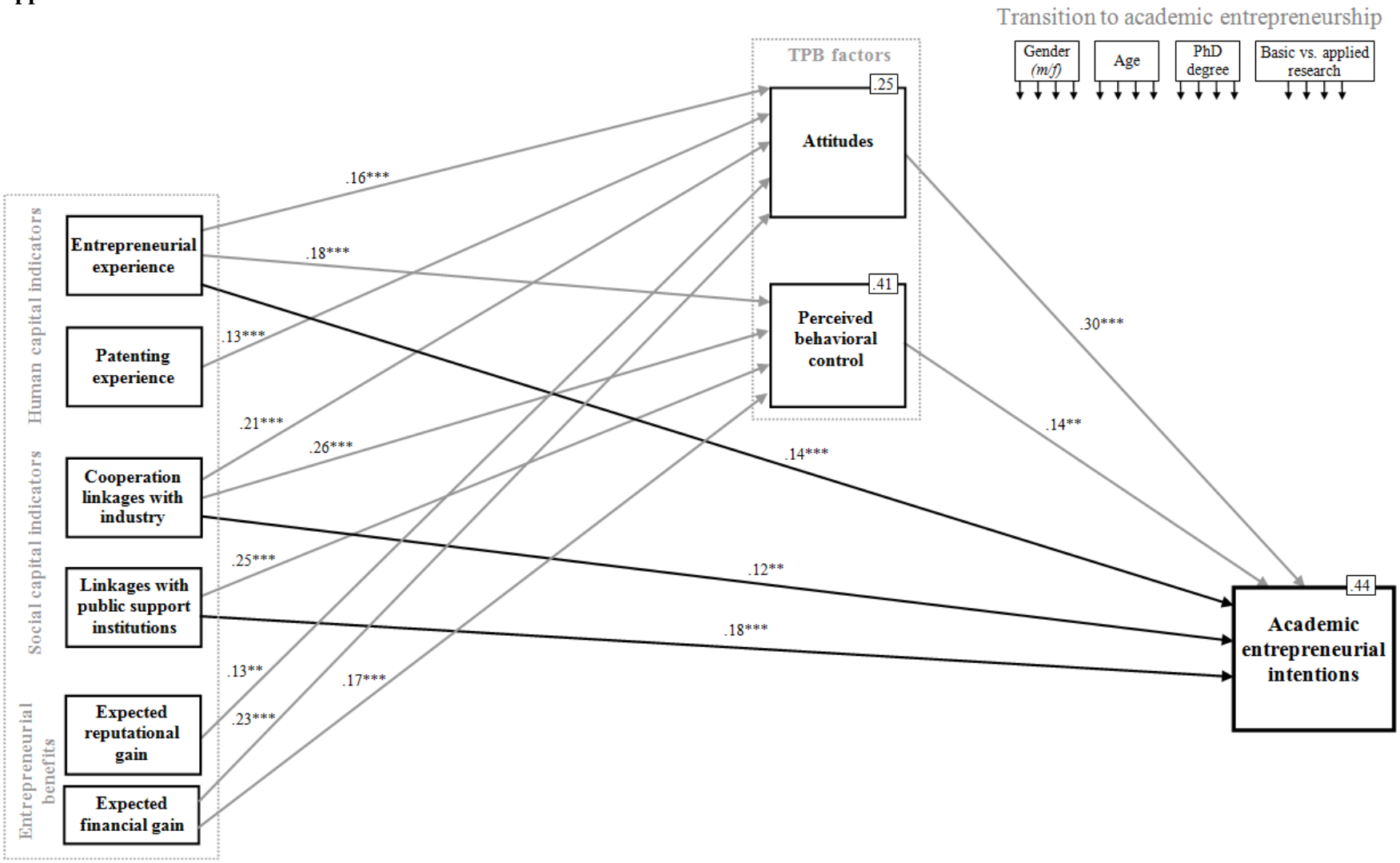
**Appendix 1**

*Correlations Between the Variables*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Control variables:** | | | | | | | | | | | | | |
| 1 Gender (male) | – | | | | | | | | | | | | |
| 2 Age | .23*** | – | | | | | | | | | | | |
| 3 PhD degree (no/yes) | .23*** | .62*** | – | | | | | | | | | | |
| 4 Applied research (no/yes) | .13** | .15*** | -.01 | – | | | | | | | | | |
| **Theory of planned behavior:** | | | | | | | | | | | | | |
| 5 Attitudes | .04 | -.06 | -.05 | .21*** | – | | | | | | | | |
| 6 Social norms | .06 | -.09 | -.02 | .06 | .38*** | – | | | | | | | |
| 7 Perceived behavioral control | .28*** | .10* | .15*** | .17*** | .50*** | .29*** | – | | | | | | |
| **Scientists' human and social capital:** | | | | | | | | | | | | | |
| 8 Patenting experience (no/yes) | .15*** | .25*** | .21*** | .16*** | .16*** | .07 | .11* | – | | | | | |
| 9 Entrepreneurial experience (no/yes) | .18*** | .24*** | .19*** | .10* | .26*** | .17*** | .37*** | .15*** | – | | | | |
| 10 Cooperation linkages with industry | .24*** | .34*** | .19*** | .34*** | .30*** | .14** | .46*** | .27*** | .33*** | – | | | |
| 11 Linkages with public support institutions | .19*** | .05 | .06 | .12* | .24*** | .22*** | .49*** | .13** | .26*** | .42*** | – | | |
| **Scientists' expected entrepreneurial benefits:** | | | | | | | | | | | | | |
| 12 Expected reputational gain | -.10* | .08 | -.06 | .13** | .21*** | .16*** | .12** | .02 | .10* | .14** | .05 | – | |
| 13 Expected financial gain | .05 | -.12** | -.08 | .12** | .33*** | .21*** | .31*** | -.03 | .15*** | .12** | .25*** | .17*** | – |
| **Outcome variable:** | | | | | | | | | | | | | |
| 14 Academic entrepreneurial intentions | .18*** | .03 | .02 | .24*** | .50*** | .21*** | .50*** | .16*** | .35*** | .41*** | .42*** | .11* | .27*** |

*p < .05. **p < .01. ***p < .001.

**Appendix 2**




Final empirical model for the prediction of academic entrepreneurial intentions. Note. Standardized effects are given. Paths depicted in black represent direct effects and paths depicted in grey indirect effects. This model only includes significant paths. The TPB factor social norms was not included in this model due to the missing effect on intentions. All effects are controlled for gender, age, PhD degree, and type of research (basic vs. applied). Correlations between the economic variables and the control variables as well as between the two residuals of attitudes and perceived control were allowed. N = 496.

**Appendix 3:**

*Effect Decomposition: Direct, Indirect and Total Effects of the Distal Predictors (Economic Variables) on Academic Entrepreneurial Intentions*

| Variables | Direct effect β | Total indirect effects β | Total effect β |
|---|---|---|---|
| *Human capital indicators:* | | | |
| Entrepreneurial experience | .14 | .07 | .22 |
| Patenting experience | – | .04 | .04 |
| *Social capital indicators:* | | | |
| Cooperation linkages with industry | .12 | .10 | .22 |
| Linkages with public support institutions | .18 | .04 | .21 |
| *Entrepreneurial benefits:* | | | |
| Expected reputational gain | – | .03 | .03 |
| Expected financial gain | – | .09 | .09 |

*Note.* Standardized values are given.

# THE COMPANY: ENTREPRENEURSHIP FOR ENGINEERS

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**Abstract: Belgian engineering education has a long tradition based on mathematical rigour and a thorough knowledge of science and technology. However, our whole education system seems to turn engineering students into company-men (and, a few, women). The alternatives of becoming self-employed or an entrepreneur seem to be ironed out of the curriculum.**

**'The Company' is a set of educational activities that engineering students of the Karel de Grote University College can choose to get acquainted with entrepreneurship and management. Some of its main characteristics are: [1] an integrated number of lessons and cooperative activities over the bachelor and master years, [2] the 'look and feel' of a real start-up, [3] based on action (learning-by- doing) and as a consequence theoretical lectures have been limited to the utmost minimum. This paper aims to provide a description of this 'experiment' and to analyse the (hypothesised positive) effects on the students' entrepreneurship skills and attitudes.**

**The last section deals with the first (preliminary) results of the real life 'experiment', where one group of industrial engineering students receives entrepreneurship and management and a second (the control group) does not. The entrepreneurship skills and attitudes are being measured and compared statistically on two levels: [1] within the 'The Company' group over the various years and [2] between the 'The Company' group and the control group. The results and implications of this type of integrated and long-term effort in entrepreneurship education for engineering students are discussed.**

Keywords: Education, engineering, entrepreneurship, competencies, action-based learning; entrepreneurial skills and attitudes

## I. INTRODUCTION

In recent decades, the attention for both entrepreneurship education in universities and university colleges and research about this subject have increased substantially (Blenker et al. 2011; Hills 1988; van der Sluis et al. 2008; Venesaar 2008). This is mainly due to a number of circumstances, amongst which the increased attention for the valorisation of research conducted in these organisations (Vesper & Gartner 1997; Kuratko 2005; Leydesdorff 2000; Etzkowitz & Klofsten 2005), the understanding that entrepreneurship contributes substantially to a region's competitiveness and economic renewal (Davidsson et al. 2006; Wiklund et al. 2003; van der Sluis et al. 2008) and the recognition that higher education organisations bear an important responsibility by participating in and contributing (in a more direct way) to society and regional economies (Sarasvathy 2004; Blenker et al. 2011; Vesper & Gartner 1997; McGowan et al. 2008). As a result, entrepreneurship education reveals itself in many forms (e.g. integration in regular courses or as extracurricular activities), at different levels (undergraduate, graduate, doctoral level and post-doc level) and using various teaching techniques or pedagogies (Blenker et al. 2011 ; Fayolle 2008).

On a general level, the positive effect of education on entrepreneurship success has amongst others been demonstrated in the meta-analysis by van der Sluis et al. (2008). Furthermore, earlier studies have shown that, although students' eagerness to engage in entrepreneurship is to a large extent determined by their attitudes prior to starting their (entrepreneurship) education, entrepreneurship education can also contribute positively to students' willingness to consider entrepreneurship as a viable career option (Teixeira & Davey 2010). Entrepreneurship is thus a process that can be learned and in which higher education organisations can play an important role (Teixeira & Davey 2010; Souitaris et al. 2007).

In view of these elements, engineering students have been considered as important breeding ground for entrepreneurial initiatives, since their

knowledge and background are close to industrial and social applications and often lead to new ideas with valorisation potential (Souitaris et al. 2007). However, prior studies in the field have also demonstrated that entrepreneurship education for engineers leads to declining entrepreneurship intentions after having followed an entrepreneurship educational programme, but simultaneously has a positive effect on students' self-assessed entrepreneurship skills (von Graevenitz et al. 2010). Some other studies have however disproven the negative effect on entrepreneurship intentions (Souitaris et al. 2007; Klapper & Léger-Jarniou 2006).

In this regard, Karel de Grote University College has developed a new entrepreneurship education program for its industrial engineering students, that is in line with the main questions and suggestions by e.g. Blenker et al., i.e. a program to educate students to start new (high-growth) ventures, to solve a broad range of societal problems entrepreneurially and to adopt an entrepreneurial mind-set (Blenker et al. 2011). Engineering is traditionally seen as one of the hardest choices a 17-year old can make when deciding what to study in higher education. Engineering students have to cover a lot of scientific subjects and they all need a solid mathematical basis. In 2006 we had our regular review of the curriculum. Representatives of companies took part in this review, and they made the observation that our students, although technically very competent, knew very little about the working of a company itself. We basically trained them to become employees, while self-employment or entrepreneurship was certainly not the first thing students considered as career option. Although this was a broad generalisation, and there certainly were a number of exceptions to this statement, we had to admit that our curriculum offered virtually no incentive to entrepreneurship and no introduction to management. This paper describes the entrepreneurship programme for industrial engineering students at Karel de Grote University College and how this programme as experiment should increase the students' entrepreneurship intentions and skills.

The remainder of the paper is structured as follows. The next section presents a case study on the way entrepreneurship has been educated to industrial engineering students at Karel de Grote University College since the beginning of the entrepreneurship programme in 2006 onwards. The same section deals with the details of the current programme, after a substantial redesign in 2011. The third section then presents the first results of this new entrepreneurship programme on competences and attitudes amongst industrial engineering students. The results are only partial, since the new programme has only been implemented since the academic year 2011-2012. Finally, some implications, discussion elements and future research opportunities are presented.

## II. Entrepreneurship education at Karel de Grote University College

As core element of this paper, this section describes the way entrepreneurship education for undergraduate and graduate industrial engineering students is currently organised (and how it has been in the past). The tradition of teaching entrepreneurship to engineering students goes back to the academic year 2006-2007, while it has been reformed and accelerated since the academic year 2011 - 2012. First, the start of entrepreneurship education for engineering students at Karel de Grote University College will be illustrated. Secondly, the main focus of this section will describe the current change towards the new curriculum, called 'The Company'.

An important side-note with regard to entrepreneurship education at Karel de Grote University College concerns the overall attitude towards entrepreneurship. The industrial engineering department has so far been the only department engaging actively in the education and fostering of entrepreneurship amongst their students through a formal educational program.

### *A. Entrepreneurship education at Karel de Grote University College - Prior history*

Industrial engineering education in Belgium is organised, according to the Bologna treaty, in a Bachelor's and Master's programme. To receive the academic degree of industrial engineer, students have to pass three Bachelor years (of 60 ECTS credits each) and one Master year (of 60 ECTS credits). Starting from 2013 onwards, one additional Master year will be introduced (prolonging the curriculum from minimally four to five years).

Students at Karel de Grote University College can choose between four graduating options within the academic degree of industrial engineering: biochemistry, chemistry, electro mechanics and electronics-ICT. These graduating options contain a package of specific courses tailored to these subject domains, besides the general and joint core. Since the academic year 2006-2007, students have to make a second choice. As overarching profile, students have the choice between an entrepreneurial and an innovating

profile (independently from their graduating option). Roughly one third of the students chose the entrepreneurial profile, whilst two-thirds chose the innovating profile. Over their complete study programme, these profiles account for about 10% of ECTS credits (European Credit Transfer and Accumulation System). The weight is not exactly the same for each year, as in the first Bachelor year only 3 ECTS credits were accredited to the profiles (allowing a smooth transition between the profiles after the first year). Anyhow, students' choice for this entrepreneurial profile already implies, at least to a certain extent, their interest and motivation to engage in entrepreneurship and/or intrapreneurship (Blenker et al. 2011).

The introduction of the entrepreneurial profile, with more emphasis on complementary entrepreneurial and management knowledge and skills (besides the traditional knowledge and skills in more techn(olog)ical domains), has been triggered by some industrial partners. Increasingly, industrial engineers have been taking up and growing towards management positions in companies. For these functions, a different set of skills and background knowledge is required. The industrial partners therefore asked if the students could receive some basic insights in entrepreneurship and management topics, which would make them more proficient for their future (management) positions in industry. Furthermore, the changing and more competitive economic environment increasingly requires companies to innovate and launch new initiatives, products and services. As a result, intrapreneurship has taken an important position in many companies. The students with the entrepreneurial background should be prepared in a better way to deal with these new challenges.

Unlike the innovating profile (deepening the technological skills and knowledge of the students even further), the entrepreneurial profile intended to provide some basic understanding and proficiency in more entrepreneurship and management related domains. Some of the topics covered within this entrepreneurial profile comprised:

i) A general introduction on basic management and micro and macro-economic concepts.
ii) Financial management (investment analysis), portfolio management and some basics on
iii) accounting.
iv) Strategic and operations management.
v) Central concepts of jurisdiction, corporate law and contracts.
vi) International management, marketing and sales.
vii) A Small Business Project, in which the students had to come up with a new idea, draft a
viii) business plan for the idea and implement it (within a protected environment, but as close to a real-life situation as possible, e.g. including taxes, regulations etc.).

The entrepreneurship profile did not only apply to the content of the courses, but as well to the courses' methodology. *Ex cathedrae* courses and theoretical lectures were avoided maximally, while more action-based learning principles have been adopted where possible (Haase & Lautenschläger 2010; Lourengo & Jones 2006). This resulted in many case study-driven courses, problem-based learning, various forms of peer assessment and integrated projects (such as the Small Business Project in the third Bachelor year).

It should be noted that this entrepreneurial profile has been struggling (and still is to some extent) to gain some legitimacy both within the department as well as within the entire university college. Entrepreneurship education has no tradition within Karel de Grote University College and initially faced some scepticism. However, as the first positive results appeared, both in terms of number of freshmen attracted as well as in project outcomes, the acceptance by colleagues both within the department and outside have gradually been increasing.

### *B. 2.2 The new 'experiment' - The Company*

#### *1) 2.2.1 General rationale*

Although introduction of the entrepreneurial profile yielded some first small successes (amongst which one student that started his own company during his studies), the first evaluations triggered a modification of the entrepreneurial profile, for several reasons. In the first place, the industrial engineering programme of the Karel de Grote University College would merge with the same education at another university college in the city of Antwerp (the Artesis University College) and become a new faculty within the University of Antwerp (Faculty of Applied Engineering Sciences). The joint curriculum starts from the academic year 2012-2013 onwards (gradual introduction), while the transition towards the university faculty would start in the academic year 2013-2014. This merger also implies that a fifth graduation option (currently

only present in Artesis University College) would be open for students, namely construction. Secondly, the new curriculum would strive for a more integrated effort of the entrepreneurial profile. In the first version of the profile, students of the four years did not cooperate or interact. Thirdly, although the first version of the entrepreneurial profile provided a good basis, the new version (called 'The Company') would have more focus on skills, knowledge and attitudes in the domains of entrepreneurship and intrapreneurship, and less in the general management domain. The first attempt to teach entrepreneurship to industrial engineering students as such was, as is often the case, more management than entrepreneurship-driven (Blenker et al. 2011; Hills 1988). This issue mainly finds its origin in the fact that most entrepreneurship courses have been initiated in business schools or faculties of (applied) economics or management (Felin et al., 2012). Despite a number of shared characteristics, prior literature has clearly pointed to some differences between entrepreneurs and managers. For instance, entrepreneurs tend to work harder during hard times compared to good periods, while managers do exactly the opposite (de Fraja, 1996). Furthermore, entrepreneurs and managers tend to differ significantly with regard to overconfidence (overestimating the probability of being right) and representativeness (the tendency to overgeneralise from a few characteristics or observations) (Busenitz & Barney, 1997). Additionally, entrepreneurs have been demonstrated to be less risk-averse than managers (Stewart Jr. & Roth, 2001).

This new version received the initial name 'The Company', as it should reflect the look and feel of a real entrepreneurial initiative. Its main characteristics will be illustrated in section 2.2.2.

*2) Main characteristics*

The new profile for industrial engineering students, The Company, is different in a number of regards compared to the previous effort (and compared to other entrepreneurship education initiatives for engineers). Figure 1 gives a short overview of the main topics within The Company and the logical thread running through the courses and development of entrepreneurial ideas throughout the study programme.

*A continuous effort*

The Company is a long term project. Although short-term initiatives might help in raising interest and consciousness for entrepreneurship amongst scientists and engineers, we strongly believe that entrepreneurship education can only yield significant results if the effort is integrated throughout the entire study program and if there is ample room to exercise and translate theory into practice. Students need many action opportunities. In this regard, Neck and Greene (2011) pointed to the observation that learning about entrepreneurship requires practice and in a similar way Blenker et al. (2011) indicated that entrepreneurship education should be a long-term, integrated effort rather than a single activity. These suggestions are in line with prior observations that setting up a business is a process rather than a one-time effort and that as a result entrepreneurship education should be a long-term effort and process as well (Herrero De Egana Espinosa de los Monteros & van Dorp 2006). The development of engineering students as entrepreneurs (or intrapreneurs) should run in parallel with the growth of their knowledge and skills of both engineering and management/entrepreneurship (in line with the second 'means' as defined by Sarasvathy (2001)).

Concentrating entrepreneurship within a limited time span of one year, leads to situations where students stubbornly continue with a (bad) idea, because they have no time left to start all over again. For students to have the confidence to fail (early), requires an educational environment that does not punish them when they do so. In this sense, The Company is new compared to most (early) entrepreneurship education programmes, since these early programmes mostly emerged in business and management school and started from the premises of a more management-related background (i.e. meticulous planning, gathering data and insights and after careful evaluation starting a new venture if the business plan proves its potential) (Blenker et al. 2011).

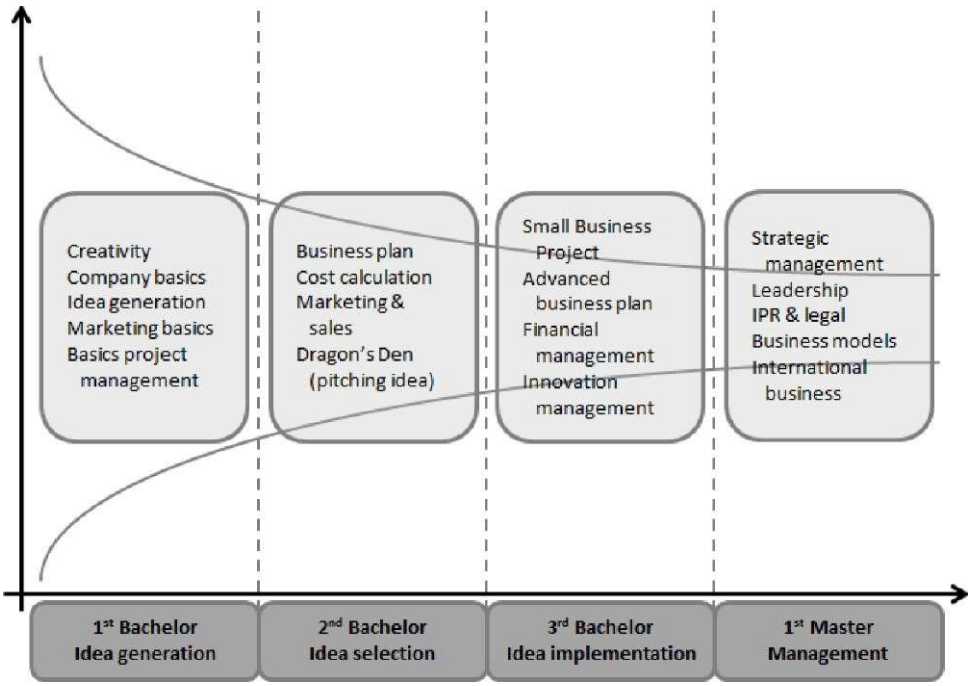


**Figure 1. Schematic overview of the Company**

*Growth in competency*

Talking about competency and competency-based education is fraught with danger and high drama. There is lack of evidence that the method is effective (Chapman 1999). There is no agreement on its definition and the validity of evaluating competencies is disputed (Korthagen, 2004). We take a pragmatic view on the subject. It is remarkable that the concept of competencies is a source of debate within education, but that it is widely used within companies, where our former students work, for selection and promotion. We could argue that the assessment of their competencies is something that our students will encounter in professional life, and that it is appropriate that they should learn how to interpret an assessment (Vasantha Kumara & Vijaya Kumar 2010).

All the students are assessed by an external company (specialised in human resource solutions and competency assessments) when they start within The Company. They have subsequent assessments every year. The main competences measured are those not necessarily inherent to engineering students (such as analytical skills), but more entrepreneurship-oriented skills and attitudes (more info on the competency assessments can be found in section three). Only the student themselves gets detailed feedback on his assessment. It is up to him (or her) whether to include this information in the portfolio. Teaching staff only get anonymised information from which average change in competencies and evolutions over the years can be deducted. Since not all engineering students choose for the profile of The Company, we also have a control group who participate in the assessments (students that have chosen for another profile).

We consider this personal assessment an important asset for our students because it helps them to establish what their talents are (and gives them a view on their 'weaker' competencies as trigger to improve on them). It can also correct their own opinion about themselves and make clear who they are. This is the first of the three 'means' that, according to Sarasvathy (2001), form the starting point of entrepreneurial action (besides the human and social capital of entrepreneurs).

*Look and Feel of a Company*

When teaching entrepreneurship and/or intrapreneurship, we believe it is important to make the situation as realistic as possible, within the given limits of the higher education system. Therefore, we have tried to give the entrepreneurship profile for our engineering students the look and feel of a real company as much as possible. This manifests itself in various ways. Not only do students of all years work together (cfr. below for more details), but graduate students have the opportunity to lead the company. In this capacity they can practise real managerial responsibilities. At present students

are CEO, director of communications and director of innovation within The Company. Students have to apply for these jobs and are interviewed by external, experienced HR managers. Master students, who do not hold management functions, are seconded to one of the directors who can delegate certain tasks to them (as middle managers).

The second manifestation happens through the activities scheduled within The Company. All educational activities take place on one fixed weekday. Given the cooperation between students of all years, every student must be able to count on the presence and activity of all the other students. A day at The Company is a day at the office: students must take part and do their best.

Thirdly, The Company has put some mechanisms in place to assure the development of a strategic plan and the realisation thereof. In order to do so, the management team of The Company (i.e. students) have drafted a strategic plan based on input from the other students and from various other internal and external stakeholders. This strategic plan has then been presented to and approved by a board of directors, consisting of representatives of relevant companies (the role models, further explained in the last part of section 2.2.2, 'Role models') and some internal representatives of the Karel de Grote University College and the University of Antwerp. After each (academic) year, the students will also have to present the annual report of The Company for the same board of directors.

In last instance, a number of small but significant symbols signal the fact that we operate like a business: students have name tags from The Company, directors have a business card, The Company has its own website and social network group.

*Action!*

Students have the idea they know too little of both engineering and entrepreneurship to be able to take the first steps. However, this does not seem to get better as they progress with their studies. On the contrary: their tendency for more analysis, more calculations and modelling seems to grow over the years. Despite their increasing knowledge levels on the various relevant topics over the years, few students take the plunge and start their own business (or become intrapreneur within an existing organisation). Therefore, the curriculum includes a number of practical activities from the first year onwards. This is in line with the suggestions of e.g. Blenker et al. (2011), Venesaar (2008) and Rasmussen and S0rheim (2006), who posited that entrepreneurship should become a mind-set and should include action from the beginning onwards, since theoretical courses and formalising elements in a business plan can prevent students from actually engaging in entrepreneurship. In this sense, entrepreneurship faces a 'teachability dilemma' and education on the subject should include as many experience-driven opportunities as possible (Haase & Lautenschläger 2010).

In their first year, students learn how they can generate ideas for new products or services. They learn to be attentive to opportunities. At present this search for potential ideas is not guided by a specific methodology. Recent research by Fiet (2007) showed that this is possible but it has not been translated into a system that beginning students can use.

Action is also integrated in teaching methods. For example in the first two Bachelor years, students are not often confronted with *ex cathedrae* courses. Instead, they are activated through case study- based courses adopting the problem-based learning principles. In small groups (10-12 students) a case study is discussed, teaching goals are formulated by the students themselves (under supervision of a tutor, who mainly keeps an eye on the process), relevant information and knowledge is collected using the self-learning techniques and afterwards discussed within the same small group again. This 'inquiry-based' form of education has been proven to positively affect (science and engineering) students' entrepreneurship knowledge and skills (Pittaway 2009). As end point of one case study, the students then present the obtained results for their peers and for Master-year students and tutors. Empowerment and action are central concepts in this way of working, since students have to actively search for and discuss relevant information to gather knowledge on certain topics and to evaluate their fellow students using peer assessment techniques. This 'learning-by-doing' should induce better knowledge internalisation and stimulate long-term knowledge remembrance (Venesaar 2008; Rasmussen & S0rheim 2006; Pittaway 2009; Lourengo & Jones 2006).

In their second year students are also made aware of that most important of stakeholders: the customer. In the article on Causation an Effectuation Sarasvathy (2001) argued that markets are not fixed entities that are waiting for the entrepreneur to be segmented so that new ventures can be positioned to conquer it. On the contrary: newly created companies seem to create

their own market. In The Company we give our students a basic understanding of marketing and sales, but not as a recipe that should be strictly followed and/or always leads to satisfactory results.

Most direct action is concentrated in the third bachelor year. All students must run a real business during one year, in the form of a Small Business Project (SBP). In the course of one academic year, they have to develop an idea, build a business plan around it and implement the business plan (actually produce and sell the product/service). This is a common exercise in entrepreneurship education, as it integrates various insights, learning moments and action (Blenker et al. 2011). The basic set of ideas they developed in the first and second Bachelor years gives them a head start for their SBP. This head start is very important, as they should have the confidence to try an idea quickly and dump it as quickly when it fails. If their reasons to abandon the project are sound, this should be applauded as much as a successful venture. In this regard, 'failure' is integrated in their study programme and is not seen as something on a personal level (failure of an idea businesswise, not of a (group of) person(s)). This is in line with the practice of entrepreneurship, which is highly iterative and stochastic (Herrero De Egana Espinosa de los Monteros & van Dorp 2006). The SBP concerns all relevant aspects of setting up a business (in a protected environment), with tax payments, salaries, obtaining equity, findings business partners and suppliers, keeping an eye on cash flow and trying to make profit. Students also have to find a relevant role model (cfr. below), in the form of an entrepreneur that is willing to serve as godfather and advise them throughout their SBP. At the end of their SBP, the business is closed down (and hopefully able to pay out a dividend to the shareholders).

*Working together*

Traditional (under)graduate education does not attempt to have students of different years (freshmen to Masters) cooperate on integrated projects. As such, the contact and knowledge sharing over the boundaries of different years is rather limited. Within The Company, we have tried to have students cross this divide and work together on projects. After all, entrepreneurship is not always about what you know (although of course relevant knowledge on how to do things can help in making the difference), but also about who you know (human versus social capital) (Adler & Kwon 2002; Sarasvathy 2001).

A few examples can clarify this integration and cooperation effort. In their first Bachelor year, the students are activated using problem-based learning principles (see earlier, under the topic 'Action!'), in which a case study-based approach is adopted to teach students some basic principles of idea generation, company basics, some marketing principles or some basic legal aspects. These case studies adopt the learning-by-doing principles (students have to discover the learning goals themselves in group discussions, find relevant knowledge through individual study in between course moments and discuss relevant knowledge in a second group session to find solid answers to the learning goals) and the role of a tutor is rather for process support rather than content delivery. In this regard, Master year's students are also used as 'tutor', to guide the freshmen through the process and help them in discovering relevant knowledge. In prior studies on entrepreneurship education, this case study format has been identified as one of the most effective (Hills 1988; Venesaar 2008).

A second obvious example can be found in the third Bachelor year, where in their Bachelor's thesis students start with one of the ideas that have 'survived' the idea generation and reduction of the two first Bachelor years, to develop and implement a business plan in a Small Business Project (see earlier). During this SBP, third-year students can appeal to first-year students when they want to run a mini market study on a product they want to launch. Second-year students help in producing the product (or service) that will be sold during the SBP. Master-year students assist in challenging the assumptions of the business plan and creating a sound story towards investors and customers.

Some other, smaller initiatives also stimulate cooperation and interaction over the boundaries of the different years. For instance, all the students participate in a business game and sometimes first-year students beat fourth-year students. They all learn that entrepreneurship is not predominantly based on knowledge, so that the difference in study year is not very relevant. Another example concerns the interaction in the LinkedIn networking group (The Company for Students), which students use to attract the attention of other students to the projects they are working on and get feedback. Besides connecting all the students, this LinkedIn group has also members from companies that support The Company, students from the business faculty of the Karel de Grote - University College, students from universities outside Belgium. This gives

them access to a lot of people outside their student circle and substantially enlarges their social capital (i.e. Sarasvathy's third 'means': whom you know (Sarasvathy 2001; Adler & Kwon 2002).

*Role models*

Raising the number of entrepreneurs is widely seen by governments as a method for stimulating economic growth. Research seems to indicate that entrepreneurship and innovation do indeed bring economic benefits (Holcombe, 2006; Sternberg and Wennekers, 2005). Being in favour of entrepreneurship education is therefore common with government and businesses. However, this does not necessarily translate in practical support.

We have identified a limited number of companies according to certain criteria (they should be innovative, show an interest in higher education and promote intrapreneurship within their own company) and asked them if they would be willing to become role models for The Company and interact on certain issues with The Company and its students. We have not limited ourselves to engineering companies because entrepreneurship and innovation goes wider than that. We did not ask for financial support, but we do want their real partnership in The Company: one company does the competency assessments for free; another does the interviews for the executive functions of The Company; a third is member of a Dragon's Den jury. One of our partners regularly posts items on entrepreneurship on our LinkedIn group; some others are part of our board of directors and provide input on the development and content of The Company. They do something practical and visible for the students and participate in The Company. The role models assure the relevancy of what The Company does and give the students some examples of how entrepreneurship and intrapreneurship can be realised in practice.

A second type of role models is presented to the students by means of 'inspirational lectures'. These are a series of guest lectures by entrepreneurs and other stakeholders in the entrepreneurial and intrapreneurial process, in which a specific topic is touched upon and discussed with the students. In this sense, these inspirational lectures contribute to the 'narratives and storytelling' as an important element in entrepreneurship education as identified by amongst others Blenker et al. (2011) and Hills (2008).

## III. FIRST RESULTS AND DISCUSSION

### *A. Competency assessment*

As introduced in the section *"Growth in competency"*, the competencies of the students are being tracked over the different years to monitor their progress. The competency tests have been developed by an external company specialised in human resource solutions and competency assessment. This way of working offers the advantage of integrating substantial experience in competency measurements and being able to compare with a much larger control group built up over the years (by the external company).

All the students have to fill in an assessment when they start their study programme within The Company. Subsequently, the same assessments are being retaken after each year, allowing us to track the progress of each individual student over the years and trace more general evolutions on group level. After each assessment, each student receives detailed feedback on his/her assessment, while teaching staff only gets access to anonymised information.

The assessments are not only taken from students within The Company. The same assessment is used to evaluate the competencies of students in the other profile (the 'innovating' profile). As these students further deepen their technical knowledge and skills, but do not receive particular training in entrepreneurship and management, they act as control group, allowing us to compare the evolution of The Company students with students not taking entrepreneurship education. Secondly, the external company that creates and organises the assessments has a large database with competency assessment of other engineers (other students and engineering professionals). The results of our students' assessments can be compared to this larger control group as well.

The competency assessment contains a number of statements and questions on a five-point Likert scale. The questions and statements relate to four large categories of competencies, namely personal, technical, social and customer-oriented. Following specific competencies have been measured in the tests (of which not all are exclusive for entrepreneurship profiles):

i) Networking
ii) Conceptual thinking skills
iii) Creativity
iv) Action orientation
v) Commercial mentality
vi) Pro-activity
vii) Result orientation

viii) Persistence
ix) Nerve
x) Drive

Furthermore, the statements and questions have been tailored to various stages in the development of an entrepreneurial idea or project. These stages included in the competency assessment are:

i) Idea inception or translation of a market demand
ii) Idea assessment / evaluation (including initial market research)
iii) Product / service design
iv) Prototype development
v) Prototype / concept testing
vi) Prototype / concept evaluation
vii) Industrialisation of the product / service
viii) Commercialisation of the product / service

### *B.* ***First results***

Given the young history of the concept and implementation of 'The Company', the data obtained from the competency assessments are far from being complete. So far, assessment results have only been obtained from four groups: the 1st and 2nd Bachelor year students from The Company ('TC1' and 'TC2') and the 1st and 2nd Bachelor year students from the 'innovating profile' ('INNO1' and 'INNO2'; those students that do not take part in The Company). Furthermore, these results can be compared with the more general reference group of engineers (including the active professionals). So far, no assessment results have been obtained for the other student group ('TC3', 'TC4', 'INNO3' and 'INNO4'), since it makes no sense to let them complete the assessments (their evolutions cannot be tracked over the years anymore, since they almost completed their entrepreneurship education).

The first results yield two main outcomes. In first instance, based on a raw and unfiltered analysis, no significant intra-group differences can be detected between the four student groups (('TC1', 'TC2', 'INNO1' and 'INNO2'). The pattern of responses over the four general competency categories and over the eight stages is similar.

Secondly, when compared to the overall group of engineers (including the professionals), the four groups have low competencies for 'action orientation', 'result orientation' and 'persistence'. It should however be noted that these competencies are not necessarily different between entrepreneurs/intrapreneurs on one hand and other engineers on the other.

In fact, these first results are in line with the characteristics of The Company, since we mainly aim for a long-term impact and we argued that relevant effects could only be attained if a continuous effort is set in place. Therefore, not seeing any significant different in this early stage of the programme is somewhat expected. The situation would be different if no significant results would be obtained at the end of the entrepreneurship programme.

An additional explanation for this initial absence of significant differences between the groups is the fact that the students within the 2nd Bachelor year of The Company, had a different starting point compared to those following the 1 Bachelor year. Given the switch between more management- focused topics and a more entrepreneurship-oriented approach, it is not entirely surprising that no significant differences have been obtained at this stage.

Furthermore, the somewhat weaker results on a limited number of competencies when compared to the overall reference group of the external company, which includes a large number of engineering professionals, is a logic consequence of the nature of our students: they are inexperienced and the overall reference group concerns the general profile of engineers (thus also including civil engineers). Therefore, some differences are a rather natural consequence of the group compositions.

### *C.* ***Conclusions***

The engineering faculty of the Karel de Grote University College is first and foremost a place where we teach engineering. With The Company we want to enlarge the world of students (and staff) so that we don't exclusively train our students to become employees. Entrepreneurship will not be the final destination for most of the students, but we are confident that the competencies they acquire in The Company will make them better engineers and enlarge the number of career options available, especially given the growing interest of and in both entrepreneurship as well as intrapreneurship. As the world of entrepreneurship is risky and uncertain, students can try their first actions in a safe educational environment within the setting of The Company.

The experiment of The Company as an integrated and long-term effort currently yields uncertain results. In this setting, students actively learn about and experience entrepreneurship, in an atmosphere of empowerment and cooperation, where failure is allowed. A quote of Sarasvathy (2001, p. 262) might summarise the basic assumptions of The Company: *"And when*

*destinations are unclear and there are no pre-existent goals, causal road maps are less useful than effectual exchanges of information between all stakeholders involved in the journey. Bold expeditions and even one-eyed pirates rule such seas, and voyages to India effectually end up in the Americas."*

Despite the promising results, entrepreneurship education at Karel de Grote University College in general and The Company in particular still face important challenges. First and foremost, its added value and perception thereof needs further strengthening both within Karel de Grote University College and towards to outside world. Secondly, the merger with Artesis University College and the estimated doubling of students within The Company in the coming years imposes new practical and conceptual challenges. Thirdly, constant monitoring and improvement of both 'course' content and staff quality should be maintained. For each entrepreneurship program, finding the right balance between more theoretical lectures and action-oriented learning moments is challenging, as is finding the right balance between 'academic' lecturers and seasoned entrepreneurs. In last instance, the programme could further be strengthened by growing a network of entrepreneurship stakeholders around The Company and keeping the ties with alumni active in the long run.

This article has summarised the characteristics and assumptions of the entrepreneurship education in the engineering faculty of the Karel de Grote University College. As the programme reflects a large number of the most recent insights into the effectiveness of entrepreneurship education (both generally and for engineers in particular), we hope that sharing these practices might somehow help other educational organisations to bring their entrepreneurship education to the next level.

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# NEW FOUNDATIONS FOR ECONOMIC GROWTH

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**Abstract: In 2005 Hurricane Katrina devastated the New Orleans area in the United States. Since then, Tulane University, one of New Orleans's oldest institutions has proved to be vital to the renewal and recovery of the region. As Entrepreneur magazine (2009) points out "in the midst of one of the worst national economies in decades, New Orleans is recreating itself as a hive of entrepreneurial initiative, and demonstrating to other cities how to recover from even the worst disaster".**

**This paper explores the role that a university can play in promoting entrepreneurial development in the aftermath of a major economic shock. By focusing on a particular case – Tulane University, it is hoped this paper will show policy makers in Ireland that despite significant economic struggles, the education sector, notably their aims to create a technology university, can assist in Ireland's economic recovery. This research aims to contribute to entrepreneurship theory building in helping to bridge the gap between academics who call on policy makers to encourage high quality policy initiatives but are reticent about "actual initiatives that policy-makers should implement" (Mason, 2011).**

Keywords: Economic Growth, Entrepreneurship, Renewal, Recovery, Policy Implications.

## I. INTRODUCTION

Since 2008, Ireland and indeed Europe's economic struggles have been well documented. For Ireland, the collapse of the commercial banking system, together with austerity has dramatically changed the economic landscape of what was once the 'Celtic Tiger'. The country is now entering a new and uncertain period.

Struggling for recovery mechanisms, the Irish government has looked to bridge the current budget deficit through creating growth by capturing lucrative Foreign Direct Investment (FDI) opportunities, stimulating indigenous enterprise and reducing spending (austerity). One area of 'austerity' interest for the Irish government is higher education. Silicon Republic (2011: 1) reported that "Ireland's education budget [in 2011] – which accounts for 17 per cent of total State expenditure or €8.6bn – is to be cut by €132.3m in 2012".

This has not come as a shock to the education sector. A review of the Higher Education System in Ireland was started in 2011. The *National Strategy for Higher Education 2030 "contains detailed recommendations for the development of a modern, flexible and responsive higher education system that is ready to meet the new challenges of the next twenty years in supporting Ireland's economic renewal and growth. It envisages a system that is more engaged with the enterprise sector and wider community"* (Coughlan in Higher Education Authority (HEA), 2011: 1). Some of the specific aims are contained in the literature review section below. Overall the HEA wishes to achieve the core objective of the "creation of a coherent and well-co-ordinated system of higher education institutions each contributing in its individual way to national economic and social objectives".

In response to this review, educational institutions, namely the Institute of Technology (IOT) sector, in receipt of government grant funding have been instructed to "commence a process of evolution and consolidation" (HEA, 2012:23). The HEA is calling for the current ethos and mission [industry focused research and innovation] of the IOT sector to elevate to a higher level in a technological university (HEA, 2011: 105).

This paper specifically focuses on the ambitions set out in the HEA report by examining the experience of a University (Tulane, New Orleans) in the United States that was given an opportunity to reinvent itself as an engine of economic growth as a result of a natural disaster (Hurricane Katrina). The authors believe that the lessons learned in New Orleans could help inform the development of a more entrepreneurial education ecosystem in Ireland which could be used to help inform enterprise innovation and growth policy in Ireland.

This paper looks to bridge the gap between strategy and practice initiatives for policy makers. It will do so by presenting the case of Tulane University's experience in reinventing itself post hurricane Katrina. This case study is supported by a literature review on entrepreneurial universities followed by a presentation of the research methodology applied. The Irish context for

creating an entrepreneurial ecosystem is discussed. Finally, the implications and contribution of this paper is presented together with a review of the limitations of the observations.

## II. LITERATURE REVIEW: ENTREPRENEURIAL UNIVERSITIES (THEORY)

The global education terrain is being nudged or shoved by the pressures to become "more entrepreneurial or enterprising" (Gibb and Hannon, 2006: 4) with increasing pressure to contribute more substantially to local economic and social development. The role of the entrepreneurial university as a driver of economic growth has been widely studied during the past twenty years. Much of this work has focused on examining the multiple ways in which universities contribute to entrepreneurial development at the local, regional and national level, and on identifying the characteristics of universities that appear to have been most successful in this role. Gibb and Hannon (2006: 5) point out that "*there is also pressure to prepare students for a life world of much greater uncertainty and complexity involving: frequent occupational, job and contract status change; global mobility; adaptation to different cultures; working in a world of fluid organisational structures (Ghoshal and Gratton, 2002; Westwood, 2000; Worrell et al., 2000); greater probability of self employment; and wider responsibilities in family and social life (IPPR, 1998; Rajan et al., 1997). This has also become associated with pressure on the sector to do more to prepare students for a world of life long learning (EC, 1996).*"

The concept of the entrepreneurial university was informed by the work of Clark (1998) who investigated five institutions and their capacity to respond to successful new external demand. Clark found five factors which turned out to be vital for the development of an entrepreneurial university: a strengthening steering core, an integrated entrepreneurial culture, a diversified funding base, an expanded periphery, and a stimulated academic heartland (Sporn, 2006: 145). In fact Sporn (2006: 146) believes that the entrepreneurial university marks higher education's shift from a social institution to an industry. Arroyo-Vazquez et. al., (2010: 26) believe the entrepreneurial university can be understood as a flexible organisation that interacts with its social and economic environment, continuously adapting to changes. Guerrero and Urbana (2010: 1) linked the entrepreneurial university to this entrepreneurial society where the universities plan an 'important role as both knowledge-producer and a disseminating institution' and believed: *in this sense, an entrepreneurial university could be defined as a survivor of competitive environments with a common strategy oriented to being the best in all its activities (e.g., having good finances, selecting good students and teachers, producing quality research) and tries to be more productive and creative in establishing links between education and research (Kirby 2005). Consequently, an entrepreneurial university is not only a promoter of multiple support measures for entrepreneurship but is also a developer of administrative techniques, strategies or competitive postures (Antoncic and Hisrich 2001). Entrepreneurial universities are involved in partnerships, networks and other relationships with public and private organizations that are an umbrella for interaction, collaboration, co-operation and among the core elements of a national innovation system many different interactions may exist (Inzelt 2004).*

It is unclear if a full definition of what constitutes an entrepreneurial university is produced by the literature. Following Rothaermel et al's (2007) comprehensive literature review of entrepreneurial universities, Sooreh et al (2011) looked to build on their work. They found that unlike university entrepreneurship, the literature on entrepreneurial universities is 'limited and emerging' (2011: 187). They do point out that although the literature on this issue has grown exponentially over the past quarter of a century (Nelles and Vorley, 2010), the question still remains which definition or perception best suits this phenomenon. It should be considered that the literature in both domains (entrepreneurial universities and university entrepreneurship) is fragmented (Rothaermel et al., 2007) and somehow at its embryonic stage (Guerrero and Urbano, 2010). The literature observations of Rothaermel et al (2007) and Sooreh et al (2011) are presented in the table below:

**Table 1: Literature Review Summary**

| | |
|---|---|
| Ropke (1998) | University as an Entrepreneur, Organisation Members turning into entrepreneurs and Entrepreneurial pattern in relation to environment. |
| Ryu (1998) | Universities and their faculty response to the demands of the market for knowledge creation. |
| Subotzky (1999) | University partnerships with businesses greater responsibility of the faculty in order to access external funds, management, and leadership. |
| Schmoch (1999) | University-industry interaction. |
| Sporn (2001) | Adaptation process to the environment |
| Kirby (2002) | Ability of this generation of universities to innovate, recognize and create opportunities, taking risks, and responding to challenges. |
| Zhao (2004), Williams (2003) | Commercialization of university research. |
| O'Shea et al. (2005) | Spinoffs and their success. |
| Guerrero et al. (2006) | Theoretical models and empirical studies. |
| Rothaermel et al. (2007) | Literature review on university entrepreneurship. |
| Franklin et al., 2001 in Rothaermel et al. (2007: 761) | University system - Policy (attitude toward surrogate entrepreneurs, preferred methods of transfer, incentives [equity, royalty shares], intellectual property protection) - Incubation models (proactive, selective, supportive, planned/ spontaneous) - Research environment. |
| Shane and Stuart, 2002, in Rothaermel et al. (2007: 761) | Technology – Quantity, Quality. |
| O'Shea et al., 2005 in Rothaermel et al. (2007) | Faculty - Time & place, Role, Personality, Department, Quality, Expectations, Experience, Strength of ties. |
| Lockett et al., 2003 in Rothaermel et al. (2007) | TTO – Presence, Expectations (return), Business capabilities, Experience, Age. |
| Clarysse and Moray, 2004 in Rothaermel et al. (2007) | Founders & Teams – Experience, Social capital, - Evolution of the team, Team homogeneity, Scientific excellence. |
| Wright et al., 2004 in Rothaermel et al. (2007) | Investors - Informational gap, Availability, Relationship, JVC arrangement. |
| Johansson et al., 2005 in Rothaermel et al. (2007) | Networks - Strength of ties, Formality of ties/collaboration. |
| Powers and McDougall 2005b in Rothaermel et al. (2007) | External conditions - Industry R&D funding, Federal resource fund, Market opportunity, Industry attractiveness. |
| Zhou and Peng (2008) | Entrepreneurial university as a university which influences on regional development and economic growth. |
| Gibb et al. (2009) | Looking for solutions for development of entrepreneurship in higher education institutions. |
| Nelles and Vorley (2010) | Elements of an Entrepreneurial university (structures, systems, strategies, leadership, and Culture) |
| Guerrero and Urbano (2010) | Relations between environmental factors (formal and informal) and internal factors (Resources and capabilities) involved in the transition processes of universities. |
| Salamzadeh et al. (2011) | Entrepreneurial university is a dynamic system |

In addition to the above, there is also, an important stream of work that has focused on the environment in which universities operate. From this perspective, universities' effectiveness in promoting entrepreneurial growth and development is to a significant degree determined by the extent to which local conditions favour this type of development. In a study of economic change in 22 different regions in six countries, MIT's Local Innovation Systems Project, led by Richard Lester (2005: 22-23), found that "*In every case, the outcome of the transition hinged on the ability of firms in their region to identify new technological and market opportunities, and*

*to develop or absorb and then apply new technological and market knowledge…the innovation performance of these firms depended on more than their own internal capabilities and strategies. It was also affected by the behavior and performance of local supplier and customer firms, producers of complementary goods and services and financial intermediaries, as well as local and regional education and training institutions, universities and other public research institutions and foundations, and government agencies and programs concerned with innovation….less tangible attributes were also important, such as attitudes toward innovation and entrepreneurship and the quality of local leadership. All of these elements comprise the local innovation system".*

Sean Safford of the University of Chicago (and a member of Lester's team at MIT) has highlighted how a more open and diverse economic, social, institutional and cultural environment helped the region around Allentown, Pennsylvania to overcome the precipitous decline of the local steel industry, while the Youngstown, Ohio area – where the major steel companies dominated virtually every aspect of the life of the region – was unable to respond effectively to a similarly wrenching change (Stafford, 2009).

**Ireland: The practical problem**

Just like Allentown, Pennsylvania and Youngstown, Ohio, Ireland is looking to respond to sweeping economic challenges. The actual impact of the current Irish recession has been captured by Kinsella (2011: 3-4)

i) The Irish economy experienced the largest compound decline in gross national product (GNP) of any industrialised economy over the 2007-2010 period. Bank bailouts alone accounted for 14.5% of nominal GDP in 2009 and 32% of nominal GDP in 2010 (Kinsella and Lyons, 2011).
ii) In the most optimistic scenario, Ireland's general government debt is projected to Stabilize at 108% of GDP by 2014.
iii) Unemployment has grown from 4.6% in 2007 to 14.2% in June 2011. Over 55% of those unemployed are long term unemployed (greater than 12 months).
iv) Domestic price levels have fallen for 9 successive quarters, especially in the private sector. There has been a collapse of private credit into the economy. Banks are deleveraging, suddenly unable to access interbank funding, and dependent on liquidity from the ECB to remain nominally solvent. Private savings rates have increased from 1.6% of disposable income in 2007 to 14.6% in 2010 as households pay down debt and move to cope with increased uncertainty.

Considine and Dukelow (2012:181) aptly observe that Ireland represents one of the more extreme cases of economic damage in the global economic crisis with the situation imposing near impossible challenges and severe economic and social hardship. Much like New Orleans, Ireland desperately needs to find ways to rebuild its economy. Driven by an economic shock and a desire to reinvigorate its economy, the Irish government is calling for a reconfiguration of the Higher Education sector to help create a more entrepreneurial environment to drive a programme of renewed economic growth through the establishment of a technology university. It is clear from the work of Lester, Safford and others who suggests that major changes in external conditions can significantly affect how and to what extent a university can contribute to the vitality of the local economy. This may especially be the case where the region [Ireland] in which a university is located has experienced a severe economic shock –Large-scale economic dislocation can create an increased need for innovation and entrepreneurship – and at the same time open up space within which bottom-up entrepreneurial development can occur.

The reconceptualisation of the Institute of Technology education system into a technology university structure presents an opportunity to reconfigure a formidable and important pillar of economic recovery for Ireland. The HEA have set out to create a technology university with the following aims (HEA 2011: 9-13):

i) 'Stronger engagement[s] with individual students, communities, societies, and enterprises'
ii) "It will also be the engine for new ideas through research, and many of these ideas will translate into the sustaining innovative enterprises of the future."
iii) "projected widening and growth in participation"
iv) "A high-quality student experience" with "specific improvements in the teaching and learning environment in respect of the breadth of curriculum and skills assessed as well as in the quality of teaching itself."
v) "The structure and design of PhD programmes should incorporate generic skills and be formulated with direct engagement with employers and enterprise

where appropriate. Critical mass in PhD programmes is of the highest importance if quality is to be maintained."

vi) "developing a cadre of highly trained PhD students, producing new knowledge to address national and international problems, enhancing international competitiveness, and informing public opinion."

vii) "Higher education research will need to connect to enterprise and society in new and imaginative ways to harness its potential for economic and social well-being, including a more effective approach to knowledge transfer and commercialisation."

viii) "Higher education institutions should have open engagement with their community and wider society and this should infuse every aspect of their mission."

Many of these aims are linked to both Clarke's interpretation of an entrepreneurial university and the characteristics outlined by Rothaermel et al (2007). This research focuses on entrepreneurial universities but acknowledges this concept is not mutually exclusive to academic entrepreneurship. With a relatively large body of literature on university and academic entrepreneurship and how university spinoff companies account for wealth creation (Shane, 2004), this paper views academic entrepreneurship as a node of the entrepreneurial university, but not the only engine of economic growth or wealth creation. The next section review the methodology applied to the case study of Tulane University.

## III. METHODOLOGY

Our research on Tulane University included both quantitative and qualitative elements. The quantitative dimension included collection of detailed information on the operations of the University as a major enterprise in its own right (for example, its role as the city's largest employer); and on the direct, indirect and induced impact of University spending in the city. The authors also conducted extensive quantitative research on the New Orleans economy, how it was affected by Hurricane Katrina, and how it has recovered during the past six years. Qualitative research included review of the extensive literature on New Orleans post-Katrina, and interviews with University administrators and faculty members, and representatives of other local institutions, city agencies and business community organizations. The quantitative data presented in this paper were produced using an Impact Analysis for Planning (IMPLAN) software database which supports regional economic impact analysis of changes in industry activity, income, household spending, or employment for any area of the United States (MIG., Inc. 2009). Originally created by the USDA Forest Service, IMPLAN estimates the economic multiplier or "spinoff" effects arising due to linkages in the supply chain (indirect effects) and employee household spending (induced effects), in addition to the direct changes in output, employment, or spending.

The research methodology uses both positivist (quantitative) and interpretivist (qualitative) approaches which are combined together to exploit the strength of each (Denzin, 1978) in the form of a case study. A summary of the main differences of the two research approaches are outlined in the table below:

| | **Quantitative** | **Qualitative** |
|---|---|---|
| **Purpose** | To study relationships, cause and effect | To examine a phenomenon as it is, in rich detail |
| **Design** | Developed prior to study | Flexible, evolves during study |
| **Approach** | Deductive: test theory | Inductive: many generate theory |
| **Tools** | Uses preselected instruments | The researcher is primary data collection tool |
| **Sample** | Uses large samples | Uses small samples |
| **Analysis** | Statistical analysis of numeric data | Narrative description and Interpretation |

**Table 2: Comparison of Quantitative and Qualitative Research**

Goldrick-Rab and Shaw (2007:81) feel due to the conflicts of positivism and interpretist approaches in education, we are left without a methodological approach to constructing a study that will provide enough detail about either policy outcomes, or the implementation process that lead to them. They further note that combining the collection of quantitative and qualitative data within a single study is both an enormous challenge and an opportunity. *A real sense of policy enactment "on the ground" as it affects people's lives will only be obtained by entry into the field, but quantitative data is also needed in order to examine how widespread and effective the policy outcomes are (ibid, 93).*

The value of a case study is that as a holistic approach it exists in its real-life context and tends to be pragmatic facilitating evidence-based policy making (Johnson and Christensen, 2012). To further reinforce the value of the approach to the research methodology applied here, Goldrick-Rab and Shaw (2007: 4) note that both case studies and elite interviewing, two of the methods

applied, have emerged in the disciplines as important strategies for conducting comparative [state] research on policies and the policy behaviour of governments (King, Keohane, & Verba, 1994).

Despite the vanguard of the acceptance of qualitative method in the second half of the twentieth century (Atkinson et al, 1993), Hammersley (2008) points out that the traditional positivist versus interpretivist debate is still present, especially in education. This opinion is based on the focus of debate which typically surrounds the primary objective of education; that is to educate. However, this study looks at education from a social science perspective and looks to provide evidence-based policy making for the mechanism of education through the third objective of education; the Triple Helix.

## IV. CASE STUDY: TULANE UNIVERSITY

### *A. Context*

New Orleans was a declining (and in many respects seriously troubled) city long before the levees broke in August 2005. Between 1990 and 2005, the city's population had fallen from 497,000 to 455,000 – a decline of 8.5 percent. As of 2000, 28 percent of the city's residents lived in households with incomes below the federally-defined poverty level ($17,463 for a family of four), and New Orleans had long been plagued by crime rates that were among the highest for any major U.S. city.

In 2006 Tulane historian Douglas Brinkley noted that while New Orleans before Katrina still had strengths in shipping, tourism and energy, its economy had become static. *New Orleans simply didn't draw business investment the way other American cities did, and it didn't spawn entrepreneurs, either. The city – the anti-Seattle – missed the high-tech boom of the 1980's and 1990's entirely (Brinkley, 2006: 27).* On many levels, New Orleans was thus ill-equipped to deal with the disaster that engulfed the city on that August morning.

Even now, the magnitude of that disaster is hard to grasp. In February 2006, FEMA reported that nearly 79,000 housing units – about 56 percent of the city's housing stock – had been destroyed or severely damaged (U.S. Department of Housing and Urban Development, 2006). Energy and telecommunications systems were crippled – some parts of the region remained without electric power for weeks after the flood waters had receded. Roads, bridges, schools, hospitals and other public facilities were severely damaged. The hurricane and its aftermath left several parts of New Orleans nearly uninhabitable. Between mid-2005 and mid-2006, the city's population fell from 455,000 to 210,000 – a loss of 54 percent.

The city's economy was severely disrupted. Between 2004 and 2006, payroll employment in New Orleans fell by 39 percent – a loss of 95,000 jobs. As table 3 show, several of the largest sectors of the New Orleans economy – hotels and restaurants, retailing, education, economy – hotels and restaurants, retailing, education, and health and social services – were hit especially hard, collectively losing 59,000 jobs.

| | Payroll employment, 2004 | Payroll employment, 2006 | Decline in employment, 2004-2006 | Percentage decline, 2004-2006 |
|---|---|---|---|---|
| Hotels and restaurants | 35,328 | 19,166 | 16,162 | 45.8% |
| Educational services | 30,808 | 16,241 | 14,567 | 47.3% |
| Retail | 19,103 | 9,611 | 9,492 | 49.7% |
| Health and social services | 34,565 | 14,276 | 20,289 | 58.7% |

**Table 3: Decline in average annual employment in selected industries, Orleans Parish, 2004-2006**

In the aftermath of the hurricane and the flooding that followed, New Orleans desperately needed to find ways to rebuild its economy. Getting tourists to come back was an obvious target; so was increasing the use of New Orleans as site for film and television production. But early planning showed little understanding of the need to reach beyond familiar industries and ways of doing business.

The remaining discussion in this section presents the impact of Tulane University on the New Orleans economy from the perspective as a major regional enterprise and as an institution with active entrepreneurial engagement with its region. The observations are presented through a review of the Tulane's role in the City's recovery, its renewal plan, the role of technology transfer and

incubation, the promotion of entrepreneurship and finally the transitional road to recovery.

### *B.* ***Tulane's role in the City's recovery***

While Tulane's campus sustained serious damage in the flooding that followed the hurricane – with total costs later estimated at more than $650 million – the University was still standing and still functioning, and was able to begin operating again in January 2006. This in itself was a significant contribution to the recovery – Tulane was the city's largest private employer, and getting thousands of people back to work within a few months was seen as a vote of confidence in its future.

Tulane's response to the crisis went far beyond its role as a major employer, however – and it did so in a way that highlights how an entrepreneurial university can contribute to the process of recovery from a severe shock to the local community and the local economy. As a major regional enterprise, in the fall of 2008, Tulane had 5,173 employees (excluding students) 52 percent of whom live in New Orleans making it the single largest private employer in the city, and one of the largest in the Greater New Orleans area. The average salary for full-time, full year employees at Tulane in fiscal year 2008 was $60,600 – 22 percent greater than the average for all full-time, full year workers in New Orleans, and 38 percent greater than the average for Greater New Orleans. In addition to those who are directly employed by the University, Tulane Medical Centre in 2009 employed 1,764; the Medical Centre is also one of the city's largest private employers.

Tulane University spent $75.8 million during fiscal year 2008 on the purchase of goods and services from Louisiana companies, including $49.8 million paid to companies located in New Orleans. This spending directly supported more than 800 full-time-equivalent (FTE) jobs with companies throughout Louisiana, including more than 350 FTE jobs in New Orleans. Between fiscal years 2004 and 2008, Tulane invested a total of $390.5 million in construction and renovation of University facilities – including $200 million spent restoring the campus after Hurricane Katrina. During fiscal year 2008, Tulane's investments in construction and renovation directly supported 450 FTE jobs with Louisiana contractors. In 2008, Tulane's payroll of $262 million generated $9.9 million in Louisiana state income taxes. The University also paid more than $9 million in fees (for water and sewer services, building permits, etc.) to state and local governments. Appleseed estimate that off-campus spending by students who came to Tulane from outside of the City of New Orleans totalled $84.2 million during the 2008 academic year; and that this spending directly supported approximately 916 FTE jobs throughout New Orleans. Off-campus spending by visitors to Tulane from outside of New Orleans is estimated to total approximately $68.8 million; and that this spending directly supported about 700 full-time equivalent jobs within the city. Combining the impact of spending by the University, its students and visitors, and taking into account the multiplier effect of this combined spending, Appleseed estimated that in fiscal year 2008, Tulane accounted for approximately *$694.6 million in economic activity and more than 8,300 FTE jobs in New Orleans; and Approximately $920 million in economic activity and nearly 10,600 FTE jobs throughout Louisiana (including New Orleans*) (Appleseed, 2008: pg).

However, Tulane's response to the crisis went far beyond its role as a major employer and contributor to economic activity. It did so in a way that highlights how an entrepreneurial university can contribute to the process of recovery from a severe shock to the local community and the local economy. The next section looks at how Tulane formulated and executed a renewal plan for New Orleans.

### *C.* ***Tulane's renewal plan***

In December 2005, Tulane's administration and board of trustees approved a Plan for Renewal that defined both the university's strategy for its own recovery and how it would participate in the rebuilding of the city. The plan asserted that; *Tulane University and its faculty and students will play an important role in the rebuilding of the City of New Orleans* (Tulane University, 2005:51).

The plan identified several key areas in which the University would be involved in the rebuilding the city. But did not spell out in detail what was to be done. In retrospect, this may have been one of its greatest strengths. Rather than setting the agenda from the top down, Tulane's leaders called on the entire University community – administrators, faculty members, students and others – to develop and launch their own initiatives aimed at advancing the City's recovery, and helped provide the resources they needed to do so. This case study discusses the University initiatives used to create an entrepreneurship ecosystem through active engagement in public services in addition to the promotion of an expansive entrepreneurship programme.

*D.* ***Promoting renewal***

The University engaged in two key strategies to help create a successful entrepreneurship ecosystem post Hurricane Katrina. As mentioned above, a bottom up approach was used to help in the recovery of New Orleans. This was used to address key public service issues that existed as a result of the hurricane or were already present when the hurricane struck. Secondly a comprehensive and expansive entrepreneurship promotion campaign was undertaken.

*E.* ***Public service engagement***

In relation to public service issues, the following are several examples of initiatives used to address specific areas of public service deficits:

i) *Infractructure.* In January 2006 the Tulane School of Architecture established the Tulane City Center as a focal point for its engagement in the rebuilding of New Orleans. The Center has used teams of Tulane students to design and build several prototypes of sustainable, low-cost homes in some of the city's worst-hit neighborhoods, and has also designed a variety of new community facilities.

ii) *Education.* In the aftermath of Hurricane Katrina, the State of Louisiana launched a sweeping reconstruction of the New Orleans public school system – probably the most radical overhaul of public education yet undertaken in any American city. Since the fall of 2005 Tulane has been deeply involved in this effort. Early on, University faculty and staff helped incubate and launch several new schools; and the Cowen Institute for Public Education Initiatives, established in 2007, has provided research support in areas such as measurement of school performance.

iii) *Healthcare.* Faculty and students at the School of Medicine have played key roles in planning and implementing new models for the delivery of health care, including new neighborhood health centers in Mid-City and in the predominantly Vietnamese New Orleans East community.

*F.* ***Promoting entrepreneurship***

Prior to Hurricane Katrina, New Orleans (as noted above) was not seen as an attractive place to start a business. Yet in just a few short years, a new entrepreneurial economy has begun to emerge in New Orleans. New businesses are being started – and young companies started elsewhere are moving to New Orleans. In August 2009 the Wall Street Journal noted that "*Four years after Hurricane Katrina's devastation, New Orleans is experiencing a rebirth of entrepreneurship. Small-business owners who left are coming back…Young professionals have moved to the Big Easy to help with its recovery, enjoy its cultural offerings and start businesses* (Flanderz, 2009)".

A cover story in Entrepreneur magazine also highlighted the trend:

> *In the midst of one of the worst national economies in decades, New Orleans is recreating itself as a hive of entrepreneurial initiative, and demonstrating to other cities how to recover from even the worst disaster (Meyers, 2009).*

Etzkowitz (1998, 2000, 2003, 2005) has commitment significant research to what is known as the 'Triple Helix' where education has evolved from its original role as a pure educator to its second evolution of where commercial engagement of private and public entities looking to the knowledge being generated by universities to full engagement of university-industry-government interactions. According to Etzkowitz (2008:8) the 'triple helix' is a platform for "institution formation", the creation of new organisational formats to promote innovation. A triple helix regime typically begins as university, industry, and government enter into a reciprocal relationship of the other (ibid). Universities cannot by themselves create the kind of entrepreneurial spirit that is helping to revitalize New Orleans – but they can nurture it, and can help to create an environment in which that spirit can flourish. Tulane already had several programs in place prior to 2005 that supported entrepreneurial development, and these programs have since been expanded.

The university engaged in partnership expansion and social entrepreneurship as a platform to encourage technology transfer, entrepreneurship education and enterprise creation, which are discussed below.

*Research, patents and licensing: Technology transfer*

After lagging behind other U.S. research universities for many years on measures of technology transfer (patents awarded, licensing agreements, etc.), Tulane has stepped up its activity in this area. Since 2010, five new businesses have been launched in New Orleans for the purpose of commercializing technologies licensed from Tulane. These companies are notable for their diversity; their work spans

medical devices, industrial process monitoring technology, groundwater purification and dental care. This is particularly important in a city whose economic had for decades failed to evolve beyond its traditional strengths in tourism, shipping and energy production.

Friedman and Silberman (2003) looked at the factors enhancing university technology transfer (TT) and the greater rewards for faculty involvement in Technology Transfer (Rothaermel et al, 2007, 715). For Tulane, between 2003 and 2008 67 patent applications were filed with 24 awarded. The university collected $43.9 million in licensing revenue from companies that had licensed technology from Tulane. On a relative basis (say to MIT and other Universities), a report published by the Milken Institute in 2006, for example, ranked Tulane seventh among U.S. and Canadian research universities when measured by licensing income per patent awarded (DeVol and Bedroussian, 2006: 11).

One part of the incentive for faculty is that part of the income the University receives is plowed back into research thus creating continuity of research for faulty, thereby creating a partnership between the University and faculty. However, it should be noted as Lester (2005: 12) and his colleagues have shown formal technology transfer is ultimately less significant than the other ways in which universities contribute a region's entrepreneurial ecosystem. Below we highlight several examples of additional initiatives.

*Entrepreneurship Education*

i) The focal point for entrepreneurship education at Tulane is the A. B. Freeman School of Business's **Levy-Rosenblum Institute.** Undergraduates in the Freeman School can choose a major in "strategy and entrepreneurship," with courses on topics such as management of technology and innovation, new venture creation and venture capital financing. MBA students may also choose a concentration in entrepreneurship. The quality of Tulane's program has been recognized the Princeton Review, which in 2009 ranked the Freeman School fourth among all graduate business schools in the U.S. in entrepreneurship education.

ii) The **Tulane Entrepreneurs Association (TEA)** is a student-run organization whose mission is "to promote entrepreneurship within Tulane and throughout the greater New Orleans community." TEA sponsors workshops and a speaker series aimed at helping prepare students to succeed as entrepreneurs, and helps connect them with entrepreneurial networks in the New Orleans area. In 2009, 65 Tulane students were members of TEA.

iii) TEA and the Levy-Rosenblum Institute sponsor the annual **Tulane Business Plan Competition**, which draws aspiring entrepreneurs not only from Tulane but from universities across the country and overseas. The program was started in 2000, and in 2007 was expanded to include a separate track for social entrepreneurship. The 2008-09 competition drew a record 76 entries from 50 universities in five countries.

*Alumni and Faculty Enterprise Creation*

Alumni and faculty members are also encouraged to create new enterprise and these ventures include both for-profit businesses and non-profit organizations that are helping to rebuild New Orleans, and reinvent its economy. From the Alumni, these companies range from real estate development (Brian Gibbs Development LLC) involved in the rebuilding of New Orleans, to a law firm focusing on intellectual property law (Couhig Partners), to a solar energy company (South Coast Solar), a non-profit community organization (Phoenix of New Orleans (PNOLA)), a medical informatics company (Elympus Wireless Medicine). For faculty members, the School of Architecture has produced two companies, one specializes in the sustainable design and construction of new homes (Green Coast Enterprises) while the other provides architectural and design services on a wide range of residential projects (BILD Design).

*Partnerships*

Tulane was also a key partner in the development of an organization that perhaps more than any other has been emblematic of the effort to turn New Orleans from the "anti-Seattle" into a hive of entrepreneurial activity.

The University has partnered with the State of Louisiana and other institutions in the development of the New Orleans BioInnovation Center, a life sciences incubator, and the New Orleans BioDistrict, a "knowledge district" that the city and the State of Louisiana are seeking to develop in the area around Tulane Medical Center.

The Idea Village was founded in 2000 by its president, Tim Williamson (a Tulane graduate), and several colleagues. Its mission is "to build a

vibrant entrepreneurial ecosystem that feeds economic development through entrepreneurship….to identify, support and retain entrepreneurial talent in New Orleans by supporting the start-up of new entrepreneurial ventures." Tulane's Levy-Rosenblum Institute provided early financial support at the beginning, and has worked closely with the organization since.

*Social Entrepreneurship*

In the spring of 2006, the Idea Village collaborated with the Institute in a graduate course on "rebuilding New Orleans," in which 25 MBA students worked with local businesses to address specific problems they faced in the wake of the hurricane. The course has since evolved into one of The Idea Village's signature programs, which each spring brings MBA students to New Orleans from leading universities all over the U.S. to work with local entrepreneurs. As of 2011, The Idea Village estimates that it has worked with more than 1,100 New Orleans start-ups (Williamson, 2010).

Not widely adopted by Entrepreneurial University researchers, social entrepreneurship represents a major pillar of Tulane University's relationship with New Orleans. In September 2009 the University unveiled a new University-wide initiative on **Social Entrepreneurship** – the use of entrepreneurial thinking, methods and resources to develop innovative solutions to societal problems such as poverty, illness, lack of education and environmental degradation. 'No matter what their career aspirations,' Tulane President Scott Cowen said in announcing the initiative, 'we want every Tulane student to embrace and become engaged in social entrepreneurship.'

Elements of the new initiative include creation of several new faculty positions in social entrepreneurship, social entrepreneurship fellowships for students, and assistance to students in developing and launching new social ventures. In addition, students have played an important part in Tulane's engagement in the city's recovery. As part of its Plan for Renewal, the University in 2006 began to require that all undergraduates take at least two "service learning" courses, combining classroom work with community service projects. Tulane also established a Center for Public Service to oversee this requirement, to help faculty members develop service learning courses and projects, and to connect students with community service opportunities. The Center reports that in 2009-2010, 7,900 Tulane students, faculty and staff contributed nearly 142,000 hours of work in areas such as park restoration, tutoring public school students, providing consulting services to community-based organizations and building affordable housing (Tulane 2009).

The above case study presents some of the initiatives undertaken by Tulane University as an entrepreneurial university post Hurricane Katrina (2005). Following this event, by reopening in January 2006, Tulane put thousands of people back to work, and brought thousands of students back to New Orleans. The next section represents the discussion of these initiatives in the context of how they could help Ireland

## V. DISCUSSION

Viewing Ireland as a region that is currently experiencing economic dislocation, the authors believe the experience of Tulane University can help inform Irish policy making. Prior to Hurricane Katrina, New Orleans did not have a reputation as a place of innovation and entrepreneurship. In August 2009 the Wall Street Journal noted that: 'Four years after Hurricane Katrina's devastation, New Orleans is experiencing a rebirth of entrepreneurship. Small-business owners who left are coming back. Young professionals have moved to the Big Easy to help with its recovery, enjoy its cultural offerings and start businesses'. Between 2006 and 2008, the city gained back 20,000 of the 95,000 jobs it had lost in the wake the hurricane. Employment declined once again in 2009. But the New Orleans economy held up better during the recession than that of other American cities or the U.S. as a whole, and by the summer of 2011 the city had more than gained back all of the jobs it lost during the recession (Louisiana Workforce Commission).

Perhaps most notably for this analysis, New Orleans has improved significantly on measures of entrepreneurial activity. The rate of new business creation in the New Orleans area is now 40 percent above the national average (Good, 2011). Based in part on the vitality of the entrepreneurial activity in the New Orleans area, Louisiana rated fourth among the fifty states on the Kauffmann Foundation's Index of Entrepreneurial Activity for 2010 (Fairlie, 2011). And in the fall of 2011, a readers' poll conducted by *Under 30 CEO*, a new York City-based on-line publication, rated New Orleans as the best city in the U.S. for young entrepreneurs (O'Toole, 2011).

Tulane University engaged in two key strategies of renewal and entrepreneurship to help create a

successful entrepreneurship ecosystem post Hurricane Katrina. A bottom up approach was used to help address key public service issues that existed as a result of the hurricane or were already present when the hurricane struck. Secondly a comprehensive and expansive entrepreneurship promotion campaign was undertaken to stimulate economic growth post the hurricane. The next section reviews if this approach can be used to help Ireland emerge from its economic dislocation.

### *A.* ***Context***

Ireland was the first EU country to be officially designated as 'in recession' in August 2008. Since then the deepening crisis has been reflected in the dramatic downturn in the Irish economy from a period of high employment growth, paralleled by high GDP growth, to one of extremely high levels of unemployment, a very significant contraction in employment and GDP levels and an acute crisis in public finances. Irish macro-economic policy over the last year has been dominated by just one objective i.e. stabilising public finances (Barry, 2011: 3).

### *B.* ***Promoting renewal: Ireland***

The Irish economy is facing current and future issues in the area of infrastructure, education and healthcare (public service engagement). This paper calls for policy makers to look to the academic community to help create partners and apply civic engagement to the following issues:

i) *Infractructure.* Unlike New Orleans, where housing was scarce, Ireland's building boom has left many residential and commercial buildings empty and unused. Webb (2012) reports that Ireland has so many empty houses that it would take up to 43 years to fill them. Webb (2012: 1) suggests a study claims 'over 200,000 houses would need to be demolished in order for the housing supply to fall to three years of current population growth'. Tulane's School of Architecture got to work building houses, can the Architecture shools of Ireland respond?

ii) *Education* When it comes to education, Ireland can learn from Tulane's civic engagement and the work done in addressing education infrastructure issues. According to Telford (2012) there is a baby boom in Ireland. The Central Statistic Office (CSO) has reported that there were 75,554 births in Ireland: the highest number recorded since 118 years ago when 76,877 children were born. A publicly funded education system to Terniary level will therefore come under increasing budgetary pressure in the next few years. In addition, a patronage reconfiguration is expected to take place immentely, moving away from the traditional catholic controlled school system to a more multi-dimentional approach. All of these changes represent huge challenges for policy makers.

iii) *Healthcare.* Ireland is facing issues surrounding resource allocation and sustainabilty of a healthcare system which struggles to operate in a hybrid of a social and market based system. Projecting the impact of demographic change on the demand for and delivery of health care in Ireland, the ESRI (2009: XXVI) believe that 'even if national finances improve substantially, the current way in which care is delivered will be unsustainable within any reasonable budget given the nature of demographic change'.

### *C.* ***Promoting entrepreneurship: Ireland***

Irish policy makers are facing challenges in promotiong entrepreneurship in Ireland. Although the technology transfer system in Ireland is relatively young, *research, patents and licensing activity* appears to be robust according to the following:

| | **2007** | **2008** | **2009** | **2010** | **Total 2007-2010** |
|---|---|---|---|---|---|
| **Licence/Option/Assignments** | 56 | 67 | 100 | 93 | 316 |
| **Spin-outs** | 13 | 7 | 35 | 31 | 86 |
| **Invention Disclosures** | 271 | 407 | 457 | 431 | 1566 |
| **Patent Applications** | 124 | 202 | 148 | 101 | 575 |

**Table 4: Technology Transfer Strengthening Initiative (Enterprise Ireland, 2011)**

However, no information is available as to whether any resources are reinvested or returned to the original researcher to further their studies as adopted by Tulane University. In relation to *Alumni and faculty enterprise creations*, according to Enterprise Ireland (2011), 32 percent of the 316 licence, option or assignment agreements (2007-2010) were transferred to academic spin outs. However, the numbers do not separate out these achievements between the University and Institute of Technology sector. There is some evidence to suggest that the Institute of Technology sector struggles with academic spin out activity. In 2009 Frontline were asked to review the impact of incubation activity within 14 Institutes of Technology centres and 3 University centers. Frontline found that the 'vast majority of businesses are spin-ins' (2009: 30). Additional the '*top down approach (to incubation) is driven by the Irish Government's education and economic aims. It is embraced at senior levels within the universities, and Institutes of Technology and the existence of the campus incubation centres underpins this strategy in a practical way. Commitment from an operational level is less apparent, with feedback from companies indicating that this strategic drive was not always backed up with hands-on support at a departmental level*'. (ibid). The report also found instances of University/Institute of Technology staff being given sabbaticals to support campus companies, or start their own businesses on a 'trial basis' (2009: 31). However, starting your own business is an all consuming endeavour and therefore probably requires more commitment that 'trial and error'.

When it comes to *Entrepreneurship education*, in 2009, the management committee of the ACE (Accelerated Campus Entrepreneurship) initiative found 'no national framework nor an articulated strategic policy for entrepreneurship education institutionally' (2009: 11). Irish policy makers are only now (2012) working on a document to outline the establishment of guidelines and key criteria for the review of Enterprise and Entrepreneurship Education. This is despite a call by the European Commission to ensure entrepreneurship education is made available to all students at all levels across all countries following the Lisbon Agenda in 2000. This is a classic example of the reticent struggle between policy discussion and practical initiatives. This consultation document supports the concept of 'learning by doing' as illustrated by Tulane University and is being formulated in conjunction with the Institutes.

*Partnerships*

The Irish government has set up a collaborative structure for industry partnership and academic institutions. However, Ryan (2011: 1) suggests "an increasing policy concern of government has been to promote effective cross-sectoral research collaboration. Policy responses have been to establish collaborative research, programs to fund industry-directed research, and on-campus facilities to foster interactions. The experience suggests that increasing overall R&D funding does not result in more technology for industry, nor in more academic interest in collaboration".

The results of active engagement by the Triple Helix might be overestimated in the Irish context. Jordan and O'Leary (2007: 1) specifically reviewed Irish innovation policy and the effects of HEIs, in the context of interaction with other interaction agents, on the innovation output of Irish high-technology businesses. They found a negative HEI effect in existence in Ireland, noting that the greater the frequency of direct interaction with HEIs the lower the probability of both product and process innovation in 184 businesses in the Chemical and Pharmaceutical, Information and Communications Technology and Engineering and Electronic Devices sectors. The management committee of the ACE initiative also observed: 'Industry engagement within HE is neither widespread nor intensive despite initiatives to mainstream such collaboration. While private funding and active engagement with entrepreneurs in the teaching process is common within the entrepreneurial University culture of the US, this is a challenge for the HEIs in Ireland'. (2009: 17)

*Social Entrepreneurship*

And finally, although some evidence of social entrepreneurship exists in the form of social enterprises, the Irish education system experiences barriers to civic engagement. According to Lyons and McIlrath (2011), who conducted a survey of civic engagement activities in Higher Education in Ireland, 'resources (n=16) and time (n=12) are the two most commonly reported barriers in establishing civic engagement activities. Resources are both 'fiscal and human'. The current economic climate and employment framework and their concomitant effects on staff-student ratios are identified as significant, as are the lack of appropriate and adequate funding mechanisms. (2011: 38). Tulane University created many faculty positions in social entrepreneurship in order to help bridge their relationship with the community and economy of

New Orleans. This helped facilitate student social engagement which also contributed to increased economic activity.

## VI. Conclusions and Recommendations

### A. *Implications for research on entrepreneurial universities*

This paper explored the role that Tulane University played in promoting renewal and recovery in the aftermath of a major economic shock to New Orleans in 2005. Tulane University engaged in a bottom up approach of renewal (addressing key public service issues before and after the economic shock) and entrepreneurship (encouraging growth) to help New Orleans recover from its economic dislocation. As an example of an entrepreneurial university, this case contributes to entrepreneurship theory building by helping to bridge the gap between academics who call on policy makers to encourage high quality policy initiatives but are reticent about "actual initiatives that policy-makers should implement" (Mason, 2011). From a literature perspective, Tulane adopted a bottom up approach to embraced Clarke's (1998) observations of a strengthening steering core, an integrated entrepreneurial culture (social embeddeness), a diversified funding base (research revenues), an expanded periphery impacting Louisiana, and have achieved a stimulated academic heartland. In addition their approach to economic renewal and entrepreneurships helps validate many of the literature findings, presented by Rothaermel et al's (2007: 737) in the definition of what represents an entrepreneurial university.

### B. *Implications for other regions that have suffered severe economic dislocation*

In the case of Tulane University, the initiative of promoting renewal and entrepreneurship through an in-depth commitment to social engagement and partnership shows policy makers how initiatives can work in practice. Rather than being an independent node of economic activity, Tulane University became embedded within the community as a dynamic source of renewal and economic activity. Perhaps the most important message is to make a call for the new technology university to be flexible and capable of multiple measures (Antonic and Hisrich, 2001) to respond to the renewal and entrepreneurship challenges facing Ireland. Such an approach would demand institutionalising agility within the HEA in the application of the concept of a technology university. Additionally, a bottom up approach demands a transformation in not just the aims and strategies of the (technology) university but also its climate and culture (Arroyo-Vazquez, et al., (2010: 26) to help create an entrepreneurial ecosystem. Cooney and Murray (2008: 68) provided sage advice when they noted: 'entrepreneurship suffers from the myth that it only deals with the creation of a new venture. However, entrepreneurship is much broader than that as it is not just about establishing a new business but instead about a way of thinking and behaving.'

Despite the above upbeat observations of the contribution of an entrepreneurial university, some limitations should be acknowledged. New Orleans is still a city plagued by serious problems; nevertheless, its progress during the past six years has by some measures been dramatic. Between the summer of 2006 and the spring of 2010 the city's population grew by more than 100,000 – gaining back nearly half the population it had lost after Hurricane Katrina.

The question remains as to whether a 'technology university', like that set out by the HEA, can replicate the successes of Tulane University contribution to New Orleans. Entrepreneurial activity is currently been touted as the panacea for many modern economic ills. However, evidence of the contribution of entrepreneurship to GDP and productivity growth is harder to come by (Gibb and Hannon, 2006: 13). The GEM report 2005 (London Business School, 2005) makes the bold statement that 'several studies as well as the 2004 GEM Global reports show the existence of a systematic relationship between per capita GDP, its growth and entrepreneurial activity'. In addition, the results of active engagement by the Triple Helix might be overestimated as observed by Jordan and O'Leary (2007).

However, acknowledging the above limitations and others not presented here, the evidence of the economic contribution of the enterprise of Tulane University is compelling. Through an agile entrepreneurial approach, Tulane, as an entrepreneurial university, significantly contributed to the promotion of economic development following the economic shock created by Hurricane Katrina.

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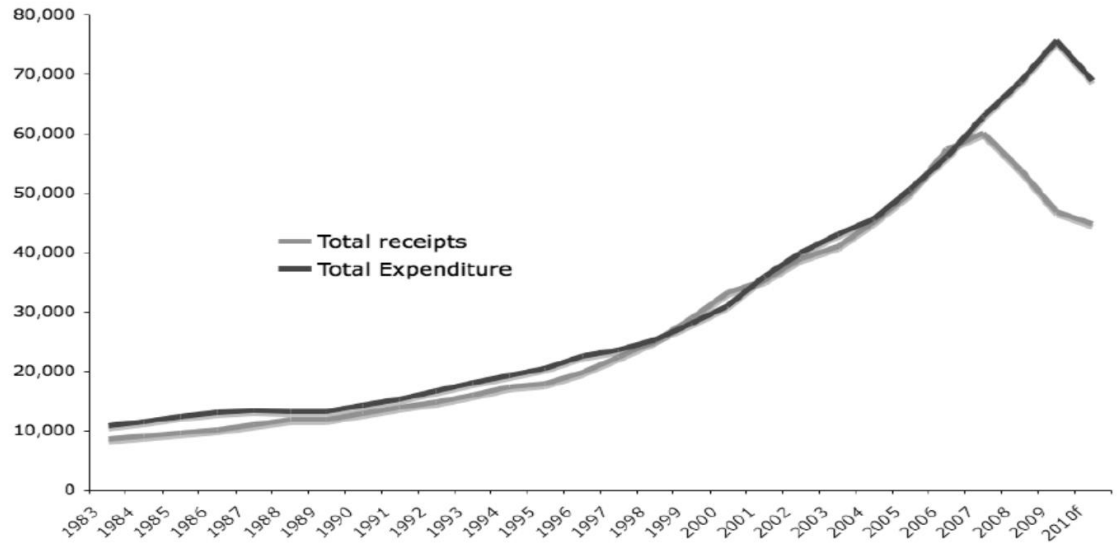
**Appendix 1:**

Government Receipts and Expenditures: 1983-2010f




*Source: Irish Department of Finance as presented by Kinsella (2011:11).*

# UNI:PRISE – UNIVERSITIES AS ENTERPRISES: IDENTIFYING UNIVERSITIES' VALUE POTENTIAL FOR ENTREPRENEURIAL VENTURES

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**Abstract: The paper presents a joint research project of the Universities of Dortmund, Frankfurt and Magdeburg called Uni:prise – Universities as Enterprises, funded by the German BMBF (2011-2014). The project deals with the identification of universities' value-creating potentials, and it investigates future issues of the university system, in particular the institutions and actors involved in developing research and higher-education capacities in the course of an entrepreneurial process. The research is based on theoretical as well as on empirical economic and social-science approaches and methods. In detail, the project concentrates on the following key questions: What exactly are the underlying innovation and investment processes in science? What are the goals and means, costs and benefits of science for researchers, students, and the economy? How can improvements in the field of opportunity research be identified and designed for use? What kind of opportunities can be recognized for advanced academic autonomy by using performance related distribution systems? And finally, efforts are made to create business models for the core potentials of the entrepreneurial university in research, teaching and technology transfer. The project design aims at addressing three levels of investigation, divided into three phases. The first phase includes the model level, institution level and player level. The second phase contains the evaluation of the empirical and theoretical research. The third phase covers the documentation of the results of all three levels followed by feedback towards universities in the interaction. Finally, the relationships between the addressed research questions and the employed research methods are discussed.**

Keywords: Value-creating potential, entrepreneurial opportunities, business model.

## I. INTRODUCTION

At the beginning of the new millennium the discussion on the development and arrangement of the knowledge society has increasingly focused on the economic utilization of scientific knowledge. A central issue in this context is the university as an engine for the development of innovations. At an international level, considerations of universities as potential cores of value chains, ranging from the finding of ideas to the utilization of innovative potentials have, therefore, taken knowledge and technology transfer as a means for process creation into account. While institution research (university research) since the 70s of the last century has focussed especially on the system analysis of a reform-driven construct named "Higher Education", in the course of the 90s, „New Public Management", a concept from business administration, was applied to the question of how to make universities more effective as well as efficient in research, teaching, and administration. This development also featured a disciplinary shift from sociology to economics. The purpose now was to implement efficiency-raising methods in research, teaching, and (self) management of universities, such as expenditure accounting and achievement calculation, purpose arrangements, identification number development, incentive systems, optimization in the use of resources, and how to introduce and internally launch new governance structures.

All these considerations have in common the promotion of the institutional autonomy of universities, which enables them to continuously improve the quality of their research and teaching under quickly changing conditions, such as declining developments of the universities' global budgets. At the same time third-party funds must rise to meet excellency criteria as well as to comply with the competitiveness of a developing international university market. For university managements this induces the sociopolitical desideratum to make the outcomes of research excellency and education quality available to their economic environment. A necessary condition for the establishment of this process lies in the successful implementation of knowledge transfer.

## II. THE CREATION OF VALUE-ADDED SUPPORT

With the creation of a value chain within the transfer process, the university is confronted with new challenges in its cooperation with the economy. As an entrepreneurial university, it is not forced to finance itself exclusively from public funds, but it can also act as a market participant equipped with the competence to produce innovative Spin Offs. Thereby, the university would even assume the role of a public-private entrepreneur.

The first developments in this direction are recognizable in Germany, in particular in such universities, which have visibly marked their profile as "entrepreneural universities." As a prominent example, the University of Technology in Munich (TUM), one of the first three universities within the scope of the federal excellency initiative in the funding program "Zukunftskonzept" (future draft), strives to realize the consolidation between research excellency and entrepreneurship. For a science oriented economy, to build on such transformation scenarios requires as a first step the development of a suitable organizational model. For research in this direction, there are central issues that need to be addressed.

An economically relevant issue, in general, is the role as well as the function of universities as public and publicly funded institutions, because their requirement to make offers for higher education publicly available is linked with their market presence and, thus, their role as social enterprises. Taking into account that declining public financing of the educational sector cannot be substituted completely, the question to be answered by economic research is how value generating structures for a transfer-supported utilization of science can be created in order to generate (re)financing options for the university (Weisbrod 1998). Particular attention must be paid to the analysis of economic potentials of usable knowledge basins that integrate applied research (patenting/licensing, spin-offs/start-ups, public-private-partnerships, contract research, extended workbenches, intrapreneurship, profit centers), as well as special formats of teaching in higher education (continuing education, coaching, tuition-based study programs, international management, lifelong learning, train-the-trainer-concepts). For the creation, development and utilization of these potentials a transfer concept must be developed at the micro-theoretical level, which is compatible with given structures and offers incentives for actors within and outside universities to participate.

In a parallel investigation the aspect of market failure must also be discussed; specifically, to what extent resources cannot efficiently be made available by the market. If market failure prevails, state interventions appear justified, or even necessary. For instance, it is assumed that universities make new knowledge as well as new technologies available as public goods which are characterized by non-exclusivity concerning their utilization. Distributing the research results by publication or market launch also benefits those economic subjects that are not included in the price and profit system of utilization. Given that research and development are financed privately, these so-called spill-over effects lead to a lower investment in research and development (Arrow 1962). In the analysis of the university and the market the traditional causes for market failure in the neoclassical model (public goods, asymmetric information, external effects, monopolies/cartels) have to be re-examined. Therefore, it is important to check first the relevance of individual causes for market failure in the context of modern universities. In addition, the present public financial policy must be analyzed with respect to its adequacy and, if necessary, modifications for its optimization should be discussed.

To make universities capable of entrepreneurial acting and sensitive for creating incentives for co-operations with actors in- and outside the institution, both described research topics should be flanked by economic research on business models. These will be used at a later stage to recognize potentials for value creation from research and teaching and to prepare as well as to transform them for the market (Osterwalder and Pigneur, 2010). The particular challenge consists in developing commercial business models for knowledge-based projects, to provide these with as much transfer potential as possible. With the help of core business-model elements such as the value proposition (which value is generated for customers and enterprises?), value creation (how is value provided?), and the profit model (how is money earned?) the objective is to find business models that share a broad range of common characteristics, in order to minimize the share of business cases that need to be worked out individually. Moreover, for knowledge-based business models, which are developed for projects with an expectable high innovation degree, the analysis of the options for high growth is especially interesting.

Universities meet these challenges through institutional adjustments: On the one hand, there is the objective to optimize given organizational processes by an improved management, while, on the other hand, new problems are addressed by further institutionalization. This development strategy has led to a multitude of institutions and service centers, which are often regarded as "island solutions" within the university, because they are inadequately cross-linked and typically filled with "third-sphere professionals." Examples are computer centers, libraries, transfer agencies, institutes for scientific continuing education, university didactics, multimedia information centers, career services, Alumni organizations, or even "houses of competence," in which general and special skills are tied together to new qualification profiles. All previous attempts for a systematic integration have led to further institutional solutions, e.g., the establishment of more functional jobs in support of already existing leading positions. Disregarded, however, are the necessary exchanges between these institutions and the systematic requirements of a university and its value-creating divisions. At this institutional (meso-) level one needs appropriate business models to make services transparent, quantifiable, accountable and controllable in an objective-oriented manner, so that they can be strategically and effectively implemented within an autonomously operating university.

The research perspective would remain limited and hardly connectable with the model level, if the identified actors (key players on the micro-level) were not included in the examination of the institutional processes. The methodological framework of empirical social research should be employed in both, qualitative and quantitative studies, in order to be able to identify the strengths and weaknesses as well as opportunities and threats that actors within their institutions are able to recognize (SWOT analysis). The perspectives of this investigation will be directed mainly towards business-related issues, investigating entrepreneurial attitudes of the interviewees while searching for potentials in research and development.

Actors at universities, e.g., scientists and administrators, consider entrepreneurship to be risky. As a consequence, entrepreneurial opportunities are often not realized. This phenomenon has both, rational and irrational components. In economic science the subject is highly relevant because it has a significant impact on the entrepreneurial involvement of actors within and outside of science. With methods of neuroeconomics a framework for special research studies has recently been developed in laboratory tests, in order to analyze the rationalization of irrational and emotional aversions. These tests can possibly deliver the basis of a training program for the recognition of entrepreneurial opportunities. After identifying those actors at the micro-level, who are able to perceive their universities' facilities and services from a business perspective, one can confront them with a selection of the mentioned examination settings. The results provide important feedback on how the actors' behavior and preferences influence a university's business model.

## III. Project Design, Key Questions and Interdisciplinary State of Research

Research on the model, as the macro-level of investigation within the whole topic of „Universities as Social Enterprises", is based on the determining conditions of market-failure theory, taking into consideration the objectives of social entrepreneurship. How a university may be conceived as a social enterprise is related to current research on business models in this context.

The project level concerned with identifying and interviewing key players in the process of institutionalization, using qualitative and quantitative social research methods (micro-level), focuses on issues of knowledge management and self management, with a special interest in control processes in universities (meso-level), management changes and the introduction of innovations in higher education. What is new is the possibility of including behavioral economic research methods in the consideration of attraction and aversion when dealing with the implementation of innovations in the university system.

This empirical economic research, in close cooperation with the neurosciences, promotes the topic of incentive structures and how they induce risk-bearing entrepreneurial action. With regard to the implementation of intrinsically motivated initiatives and actors' responsibility in change management processes, institutional conditions strongly influence the quality and the degree of modernization (such as job security and limits in personal advancement development). Therefore, the interdependence between the anticipatory actor and the changing institution plays a significant role for the question of how much entrepreneurial spirit does an institution allow, and what effect is to be expected by an institution

which neither creates nor offers incentives for its actors.

In its current state international research reveals desiderata for the discussion of what research, teaching and development will look like in a globalized world which depends more than ever on courageous and energetic entrepreneurial universities. The topics merged and scientific disciplines employed in the Uni:prise project focus on the importance of business models for knowledge-based institutions. The architecture developed for this research project corresponds to specific key concepts and their characterization in international research. In order to study the „entrepreneurial university," one must begin with a central prerequisite, which is due to the theory of market failure and its possible implications for economic policy (Fritsch et al. 2007). It is important to focus the discussion on potential reasons for market failure, pointing out the importance of external effects (Maskin 1994). As early as the 70s of the last century, institutions of the state, such as universities, have been understood as transmitters of externalities (McKean 1975). Nevertheless, the paradigm for growth processes remained with the private sector. However, if incentives as they arise, e.g., by external effects, can be transmitted to the public sector, it would make sense to analyze research in the private sector and its effects on endogenous growth (Corriveau 1998). Related to this is the question of what effects subsidization of education with public funds has on competition among students, teachers and institutions. On the one hand, people at the university are provided with public money and who, in turn, make their created values available to the private sector. On the other hand, public educational institutions are subsidized, although they are primarily oriented towards institutional parameters, i.e., targeting institutional growth in the first instance. This is part of a discussion on approaches to a reform of higher education subsidies (Barbaro 2003). How far public institutions such as universities are meant to take over the role of an initiator of supporting science-based entrepreneurial start-ups leads the discussion into the field of possible interactions between science and the economy and their respective interfaces between their primary interests and markets (Mayer-Krahmer, Kulicke 2002). However, it turns out that institutions, instead of relying on entrepreneurial activities, rather tend to take money or fees, as the example of tuition fees demonstrates. Finally, the normative question has to be answered how much of a market in higher education is appropriate and how much tuition appears to be justifiable (Schmidtchen 2005). This goes back to the question of just what kind of an entrepreneur a public university should be allowed to be. This question of appropriateness is discussed from an entrepreneurial point of view (Bok 2003) as well as from standpoints of law and sociology (Weingart 2008). At this point the idea of a university as a social entrepreneur comes into play more and more, starting with a general discussion on universities as social entrepreneurs, but already stressing the aspects of commercialization of education and research (Powell, Owen-Smith 1998). At the same time researchers in the USA already had started to analyze the competitive edge of universities based on their strengths and weaknesses in comparison with industrial suppliers (Rosenberg, Nelson 1994). In order to make education and R&D attractive for more private companies, the idea emerged to transmit single elements of the idea of social entrepreneurship to private companies by highlighting their corporate social responsibility (Kotler, Lee 2005).

## IV. CONCLUSIONS AND RECOMMENDATIONS

All these approaches towards entrepreneurial universities are fundamentally dependent on the development, design and implementation of business models raising economic growth. This marks a major research desideratum which, at the same time, is one of the most important challenges in economy of science and all cooperating academic disciplines (Gaus, Raith 2012). The term "business model" has become popular during the dot-com boom in the late nineties. After the concept had been defined and its inherited elements discussed (Osterwalder et al. 2005; Pateli, Giaglis 2004) different perspectives were established (Morris et al. 2005, George & Bock 2010). The survey and mapping of internal processes resulted in enterprise models useful for applications in existing companies. The view towards the environment and network of a company allows one to create business models for the analysis and synthesis of start-up projects. The benefits of the "business model" as a concept have been discussed controversially (Porter 2001, Magretta 2002). Concerning the perspective of research in entrepreneurship, the subsequent adaptation to changing environmental conditions are of interest (Amit, Zott, 2001; Günzel, Wilker 2010).

Finally, it is highly interesting to contrast these views with the sociological perspective in Higher Education and Institutional Research. In the sociological literature universities are understood as systemic knowledge networks which initiate

continuing processes. These are influenced by individual and institutional actors (Bender 2001). The contextual precondition for the creation of new scientific knowledge is not so much the temporarily existent network of different actors is, but rather the institutional form (Callon et al. 1986). For the organization of research and teaching in faculties and departments this is associated with multi-divisional organizational forms (North 2002). This means that institutions, including universities, are able to generate value in going through these processes.

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# LEARNING RISK-TAKING IN ENTREPRENEURSHIP EDUCATION, AN ACTION LEARNING APPROACH

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**Abstract: Risk and further insecurity are part and parcel of entrepreneurship and entrepreneurial learning. Risk has been seen as an essential part of entrepreneurial behaviour and action since the very early days of entrepreneurship research (e.g. Palich and Bagby, 1995; Goel, 1998; Leskinen, 1999). The ability to tolerate risk has been identified as the primary challenge of entrepreneurs (Knight, 1921, Schumpeter, 1926) and the risk construct has an important role in the literature on entrepreneurship. However, when looking at the historical background of risk research, risk has most often been associated with the control of different uncertainty factors in the field of entrepreneurship. Innovation, the creation of something new, invariably entails risk. However, the dynamics of risk-taking from the perspective of learning and teaching has not attracted scientists very much in the field of entrepreneurship education. Although risk-taking is an essential part of entrepreneurial action, so far it has not been a very important part of learning theories (Kyrö and Tapani, 2007).**

**This paper aims to explore, how risk-taking has been seen in the past and today and what is known about learning risk-taking and action learning as a way of learning entrepreneurship as the basis of my dissertation research. Based on the thinking that learning risk-taking is action oriented, related to both insecurity and uncertainty, learning risk-taking competencies will be studied in an action learning context. In my research the dynamics of risk-taking will be studied and analysed using the insecurity oriented model of learning risk-taking (Kyrö, 2006) and the three- construct taxonomy of personality and intelligence (Koiranen and Ruohotie, 2001). The research setting is comparative and longitudinal. There are only few examples of such settings in entrepreneurship education research. Two such dissertations can be identified, one in France and one in Finland (Pihkala 2008). In my research I try to understand how students experience insecurity and risk-taking during their action learning entrepreneurship education process and whether their conceptions change and develop in the course of their education. My initial assumption of this research phenomenon is that risk-taking competences can be learnt and taught (Leskinen, 1999; Kyrö and Tapani 2007). In the light of this research I will endeavour to present new entrepreneurship education practices to enhance risk-taking competences.**

**Keywords** : risk-taking, learning risk-taking, entrepreneurship education, action learning.

## I. INTRODUCTION: RISK - THE CORE OF ENTREPRENEURIAL EDUCATION

The word "risk" has its origin in the ancient Italian word "risicare", which means "dare", writes Peter L. Bernstein, the Wall Street economist, in his book *Against the Gods: The remarkable story of risk* (Bernstein, 1996). Historically, the concept of risk-taking has not been easy to define unambiguously (Palich and Baby, 1995). Kuusela and Ollikainen point out that in this sense risk can be seen to include both alternatives or choices and losses or death. When looking at the different dimensions of risk, we are concerned the freedom of human beings and enterprises to make choices and the courage to make decisions and act. (Kuusela and Ollikainen, 2005). Ristimäki (2004) reviewed the concept of risk in a broader sense with respect to economic, psychological and social dimensions and points out that risks connected to entrepreneurship can be seen to be mostly psychological and social in nature, although economic risks do exist.

The *Survey of Entrepreneurship in Higher Education in Europe* (Niras Consultants et al., 2008) points out that entrepreneurship is to a large extent a matter of learning-by-doing. Therefore a practical perspective on learning is crucial. The survey report also contains thirty-nine cases describing the unique features of entrepreneurship education in various European universities. Nine of these cases stress the importance of an action learning approach. Also according to Taatila (2010; also Rae, 2007)), learning in authentic business environments is the key to success in entrepreneurial education. However, research on these action learning processes has only very recently attracted researchers.

I argue that risk-taking competences can be learnt and taught (Leskinen,1999; Kyrö and Tapani 2007). In my dissertation research I try to understand how students experience insecurity and risk-taking during their action learning entrepreneurship education process and whether their conceptions change and develop in the

course of their education. In the light of this research I endeavour to present new entrepreneurship education practices to enhance risk-taking competences. This paper aims to explore, how risk-taking has been seen in the past and today and what is known about learning risk-taking and action learning as a way of learning entrepreneurship.

## II. DIFFERENT PERSPECTIVES ON RISK-TAKING

There are different ways of defining the risk-taking concept. In her theoretical examination of risk research Kyrö (2008) identified three different perspectives on risk taking: the first viewpoint – uncertainty in risk taking- is represented by Richard Cantillon (1680-1734), to whom risk meant uncertainty of knowledge between purchasing and selling prices (Goel, 1998). This is identified as the *perspective of uncertainty in risk-taking* (Kyrö, 2008). The second viewpoint is based on the thinking of Nicolas Baudeau (1736-1792) (Barreto 1989, Herbert and Link 1988). According to him economic actions are divided into actions that a person can control and actions that he cannot control. Baudeau connected risk to actions that one cannot control. The success of a person controlling these actions was dependent on his skills and abilities (e.g. Kyrö 1997, Lumpkin and Dess 1996). This is identified as *a perspective of propensities and control premises* (Kyrö 2008). The third viewpoint on risk-taking comes from Ludwig von Mises (1966) and his epistemological writing (Buchanan 1982). According to this methodological apriorism entrepreneurship always involves human action and interaction (Cunning, 1996). This is identified as *the perspective of action oriented insecurity in risk-taking* (Kyrö, 2008).

Kahneman and Tversky (1979) developed prospect theory, a subjective utility theory, to describe general situations not necessarily centred on financial benefit. Prospect theory suggests that situations, carrying a risk of loss, tend to produce risk-averse choices, whereas situations, involving a prospect of gain, tend to increase risk-inclined choices (Tversky and Kahneman 1981). This viewpoint – *uncertainty in risk taking*, presumes that acquiring more knowledge will enhance the acquisition of risk- taking competencies (Kyrö 2008).

The research on risk behaviour in entrepreneurship studies, based on Baudeau's thinking and identified here as *perspective of propensities and control premises* (Kyrö 2008), is on the one hand based on motivation theories and on the other hand on recognizing and utilizing opportunities. The ability for risk-taking has been identified as the primary challenge of entrepreneurs (Knight, 1921). The personality trait approach has been the major approach to study risk in entrepreneurship until 1980s. As entrepreneurship is a "unique occupation characterised by risk-taking" (Cromie, 1994, 64), a large number of studies have been conducted to measure the risk-taking attributes of entrepreneurs (Palmer, 1971; Brockhaus, 1980; McGrath, MacMillan & Scheinberg 1992; Ray, 1993). In their studies Elliott and Thrash (2004) also point out that the fear of failure is, on the one hand, transferred from generation to generation, and on the other hand, is highly deleterious in the perspective of learning situations and outcomes.

These differing examples of studies in risk-taking show the main features of the personality trait approach and the importance of the cognitive processes of risk-taking. This approach stresses insecurity and regarding learning risk-taking it concerns a positive attitude to risk and insecurity. Thus this means that experiences are important in learning risk-taking and through cognitive processes the competencies of risk-taking can be affected.

In recent years there has been more research stressing the perspective of action-based insecurity. The studies by Janney and Dess (2006), Segal, Brogia and Schoenfeld (2005) and McMullen and Shepherd (2006) share the notion of action based insecurity.

Janney and Dess (2006) stress the relativity of the risk concept. It is a matter of an entrepreneur's perception of risk, which depends on and varies according to the knowledge the entrepreneur has or has acquired of it. When acquiring new knowledge about a matter earlier unknown to him, he reduces the risk.

The process models of entrepreneurial motivation are the starting point of Segal, Borgia and Schoenfeld (2005). They present a rational three-part model of entrepreneurial motivation, which is driven by the difference between the desirability of self-employment and the desirability of working for others. The results indicate that these factors significantly predict self-employment intentions.

The entrepreneurship presupposes action is the basic tenet of the study by McMullen and Shepherd (2006). To become an entrepreneur an individual has to act on the possibility that he has identified an opportunity worth pursuing; this

means that an individual has to have knowledge and motivation. The researchers present two research streams, each inspired by alternative conceptualizations of uncertainty.

These three studies demonstrate one of the essential elements of action-based insecurity in learning risk-taking: the willingness to bear uncertainty, which is one of the key questions of my dissertation.

## III. LEARNING ENTREPRENEURSHIP

Many kinds of learning theories can be identified each of them emphasizing different aspects of learning, therefore each is useful for different purposes (Wenger, 1998). There is, nevertheless, a gap between tacit knowledge and the theory and between "subjective" knowledge (learning from experience) and "objective"

knowledge (Gibb, 1997). Bringing knowledge, skills, values and attitudes together to interact in the learning process means learning from experience and, according to Revans (1983), it therefore fundamentally demands an action learning approach. Experience is the main consideration in all learning. Learning builds on and emanates from experience – so learning can only take place if the experience of the learning is engaged (Boud, Cohen & Walker 1993). The question of whether entrepreneurship can or cannot be taught is today irrelevant, since it has been proved that it can indeed be taught (Henry, Hill & Leithch 2005; Kuratko, 2005), the challenge is more to choose the right teaching methods. Learning theories offer several understandings of the role of learning in entrepreneurship: Kolb's (1984) definition of learning as an experiential process, the widely supported experiential view (Gibb, 1987; Deakins and Freel, 1998), Bandura's (1986) theory of social cognition, Young and Sexton's (1997) problem solving process. Taatila (2010) presented four successful learning environments in entrepreneurship education, where he summarizes that learning within a real business environment is the key success factor in entrepreneurial education.

The basic tenet of my dissertation is that entrepreneurship is to a large extent a matter of learning-by-doing, and therefore I see it as crucial to have a practical aspect of learning and try to learn more about it.

### *A. How to learn risk-taking competencies*

Seen from the perspective of learning, the three differing views on risk-taking presented in the chapter two, can be observed to lead to different ways of learning risk-taking. The first of these stresses the concept of uncertainty and know-how in rational reasoning. The second and the third stress insecurity. The second one concerns positive attitude to risk and insecurity. The third is interested in the learner's will and ability to act profitably in insecurity. Considered from the viewpoint of learning, the latter two are more versatile than the perspective of uncertainty in risk-taking (Kyrö, 2008). There is still conceptual confusion or a lack of consensus about how entrepreneurship education should be on the one hand integrated into curricula and education systems and on the other hand taught in learning interventions. There is a pedagogical challenge to create such learning environments which are able to provide good learning opportunities to practise and develop entrepreneurial behaviours and skills (Gibb, 2002a). This would need a holistic and pluralistic approach in the paradigms of entrepreneurial education (Kyrö, 2000).

The perspective of action-based insecurity in learning of risk-taking extends the concept of risk from a cognitive view to conative readiness: motivation and desire and even for affective readiness in the case of beliefs and feelings (Kyrö, 2008, 172-185). Research findings indicate that affect – the feelings and emotions individuals experience –has major implications for cognition and behaviour (e.g. Forgas, 1998, 2000). Affect is relevant in entrepreneurship, as in contexts involving high uncertainty and unpredictability, affect can readily tip the balance regarding specific actions or decisions (e.g. Forgas, 1998, 2000).

In my study I try to present new entrepreneurship education practices including these elements to enhance risk-taking competences.

### *B. Studies in the learning of risk-taking competencies*

Although risk-taking is essential to entrepreneurs, few studies have been published thereon in the context of education. So far, in most risk studies, uncertainty relates to knowledge.

In studies on how to teach risk-taking, students are very often exposed to situations involving financial risk. This was also basic study setting in Leskinen's (1999) dissertation on students on entrepreneurship courses. However, the results indicated that the psychological risk increased during the courses and finally led to negative attitudes towards entrepreneurship. Leskinen suggests that learning risk-taking is an essential element in entrepreneurial education. She developed a concept of risk-field, a framework,

which includes four context bound dimensions: vision – action and autonomy – interaction.

Kyrö and Tapani (2007) (also Kyrö, 2006) conducted research on learning interventions in two different experiential courses for learning and teaching risk-taking in Jönköping International Business School in 2001 and at the University of Tampere in 2003-2004. On both of these courses the students were obliged to face risk and controlling unknown, inexperienced situations was supported according to the orientation selected. Kyrö and Tapani found that in all cases students learned risk-taking competences to some extent, so their conclusion is that risk-taking competences can be learned and also taught. According to Kyrö and Tapani (2007) the idea of learning risk-taking could be approached by sharing experiences of insecurity in a collaborative way of learning, which is a new aspect in entrepreneurial learning.

## IV. Action learning as a way of learning

Action learning is known as learning from experience and reflecting it to that experience that may be group discussion, trial and error or discovery. People can also learn from and with each other. In action learning issues or problems are set in actual work places by the learners. The learners develop themselves as experts on their own problems or learning tasks and learn how to solve or conduct them. In action learning the learners can generate knowledge actively rather than absorbing it passively. It provides a method which is flexible and systematic to conceptualise learning from experience (Zuber-Skerrit, 2002). According to the original architect of action learning, Revans (1982), action learning is a method to generate learning from human interaction, which occurs when learners engage together in real-time work problems.

The most common elements of action learning are: learning by doing, experiential learning, reflecting on practice, being open, sharing ideas, collaborating, synergy, learning to learn, life-long learning and learning at the workplace (Zuber-Skerrit, 2002).

Action learning differs from conventional study. The personal, situational and emergent process focuses on the individual. Participants work together in action groups; in the group they jointly develop a critical approach to problem solving. The participants are encouraged to better manage their own learning by embedding learning in practice (Howell, 2000, in Boles, 2005, 268).

## V. Theoretical framework for conducting risk-taking learning interventions

According to Kyrö (2006), too, the ways to learn risk-taking are connected to action and it imparts, instead of cognitive readiness, even more affective and conative readiness. To consider these three aspects in action based learning interventions Kyrö created a model of the learning process of risk-taking**.** The model describes the phases of the learning process of risk-taking and these phases are linked to the planning, implementation and assessments of teaching considering the principles of entrepreneurial learning and teaching.

According to Ruohotie (2000) the key processes of entrepreneurial education belong to conative e.g. motivation and volition processes. Dewey also interprets emotions as an essential factor in learning (Dewey, 1951). Koiranen and Ruohotie (2001) (also Ruohotie, 2000) presented the three-construct taxonomy of Individual Difference Constructs originally introduced by Snow, Corno and Jackson (1996) concerning personality and intelligence. This taxonomy explicates the entity present in every learning process. The dynamics of the entrepreneurial learning process is an interplay of affective, conative and cognitive constructs. Koiranen and Ruohotie (2001) conclude that in addition to cognitive readiness in entrepreneurial learning and education, conative and affective readiness should also be considered much more than is common today. They also point out that learning by experience combines the learning concepts of empiricism and constructivism in a way in which the experiences of everyday life and conceptual thinking support to each other, thereby offering a good basis for reflective learning (Koiranen and Ruohotie, 2001).

## VI. The objectives of my study, the research setting, context and methodological choices

As action is significant in the learning process of risk-taking, my goal is to better understand how to learn risk-taking competencies in the action learning context. I am especially interested in how students experience insecurity and risk-taking during their action learning entrepreneurial education process. I also try to find answers to how better to develop education to enhance risk-taking competences.

I study and analyse the dynamics of learning risk-taking in the action learning approach by using and adapting Kyrö's (2006) model of the learning process of risk-taking and the three-construct taxonomy of Individual Difference Constructs created by Snow, Corno and Jackson (1996), presented by Koiranen and Ruohotie (2001). My research setting is comparative and longitudinal. I have studied two groups of entrepreneurship students in an action learning context in the Polytechnic of Namibia and in TAMK University of Applied Sciences in Tampere, Finland in 2009-2011 and conducted semi-structured interviews with the students and their coaches to ascertain their conceptions, experiences, feelings and opinions of learning in the insecurity of a new learning method, action learning at the beginning, in the middle and at the end of their studies to find out about the dynamics and development of their risk-taking competences. The interviews are now under the process of transcribing and analysing.

There are differences between these two societies, which might afford some insights into how to consider cultural differences in risk-learning contexts. Kyrö and Tapani (2007) found no differences between students in different cultures when the education took place in Scandinavia. However, the situation may be quite different when education takes place in different continents, in very different cultures.

As I am interested in the different conceptions, students' experiences of risk-taking and insecurity, I will use the methodology of phenomenography. In my study I shall try to understand and describe how these students actually conceptualize and experience the phenomenon of insecurity and risk-taking in different phases of their studies. In phenomenography the interest is focused on what people learn and how they understand the phenomenon of interest (Grön,1989; Marton,1988).

### *A. Entrepreneurship education in Finland and Namibia*

Finland has a fairly long tradition of entrepreneurship education in its education system. The 2007 assessment of the current situation regarding compliance with the entrepreneurship education objective indicated that entrepreneurship is a recognised objective of the education systems and is embedded explicitly in the national framework curricula of six countries: Cyprus, Finland, Ireland, Poland, Spain and the United Kingdom. Additionally six countries planned or had partially implemented it (Czech Republic, Estonia, Germany, Latvia, Slovenia and Sweden) (Commission of the European Communities, 2007). In this respect the objectives of entrepreneurship education vary between countries. For example, Austria and Norway have a strong business focus, Finland a strong non-business focus while, for example, Ireland and the UK seem to have a mixed approach (Hytti, 2002).

In the Namibian state's 10-year' development program, the country has set a target to improve entrepreneurship and innovativeness, to encourage self-employment, especially among young people. The purpose of the new entrepreneurial program at the Polytechnic of Namibia has been to establish a modern, working model for promoting entrepreneurship via team companies, self-employment and growth. The benefits of the programme in the long run will be to reduce unemployment rates, increase student initiative and activity and introduce to Namibia a new way to think about teaching and learning.

## VII. CONCLUSIONS

As risk-taking is one of the core competencies of entrepreneurs, and as there are very few studies on learning risk-taking in an action learning context, it is important to learn more about it. In my dissertation, I explore the process of learning risk-taking in action oriented context of learning, where the roles of student team reflection and dialogue are the core of learning. In this action learning context in my study, an important tool for reflecting on experiences, developing new ideas and concepts, and sharing insights, is dialogue in students' team sessions.

In the light of this research I endeavour to present new entrepreneurship education practices to enhance risk-taking competences knowledge and a better understanding of action based learning of risk-taking competencies.

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# EXPERIENCES OF CROWDSOURCING FOR CONCEPT GENERATION AND SCREENING

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**Abstract: Crowdsourcing is a rather new addition to the toolbox of innovation management. Our paper starts by comparing crowdsourcing to related concepts such as brainstorming, networking, open innovation, and outsourcing. Next, to set the scene, a sample of commercial applications of crowdsourcing is presented. These "apps" have been filtered and condensed from numerous cases found in literature. The descriptions establish a baseline for state-of-the art crowdsourcing applications in real-life business.**

**Bearing in mind the target group of this seminar, the paper puts its main focus on the use of crowdsourcing in an academic environment. It highlights the experiences of the writers, as case workers at Arcada University. Some crowdsourcing applications discovered at other universities are also mentioned. We trust that the "apps" will be useful for teachers, researchers and students alike. Hopefully some of them will find their way into the toolbox of entrepreneurial practitioners.**

**On the basis of the numerous cases studied, the authors discuss some of the tricky economic and ethical issues raised by the use of crowdsourcing. In closing, some operative recommendations are given in a focused format of six commandments. As their final verdict, the authors feel that crowdsourcing is one of several useful methods, to be applied with thought and precision, to further the innovative process.**

Keywords: Crowdsourcing, innovation, networking, entrepreneurship, product development.

## I. 1. INTRODUCTION

Crowdsourcing starts with decentralization, by sourcing tasks traditionally performed by specific individuals to a group of people or community (crowd) through an open call (Wikipedia, 2012). Crowdsourcing has grown to become a key component in creative thinking and problem-solving. Crowdsourcing delivers a lot of results and develops innovations and ideas. This method can be used by start-up businesses, universities and organizations. The term was first presented by Jeff Howe in his article "The Rise of Crowdsourcing" in Wired 2006.

Crowdsourcing is the combination of two words: 'outsourcing' and 'crowd'. Outsourcing specifically meaning sourcing a task to a group of people outside the borders of a company or university. Outsourcing is done by a small group of professionals. The graph below provides a visual explanation of the word 'crowd':

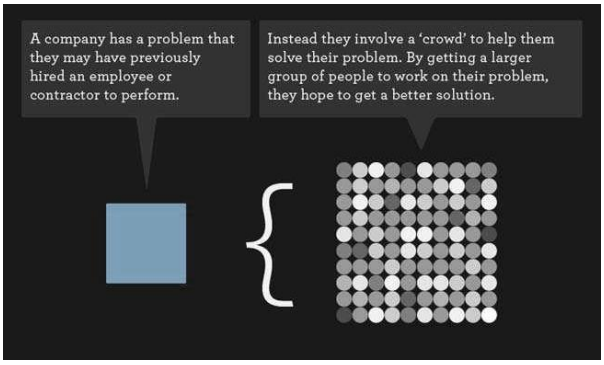


**Figure 1 Crowdsourcing graphically explained**

Crowdsourcing is related to many terms. **Crowdcasting** is an intersection of crowdsourcing and broadcasting. This combination of push and pull strategies creates a network of passionate participants and then harness for new insights, these are used to create broadcast programming. The insights and concepts gathered from the network can then be used to new brands, products or even scientific breakthroughs.

**Brainstorming** is a method done in groups, but it's very restricted, often done by a small group of people throwing out spontaneous ideas to solve a problem. The method is often a temporary solution to problems and rather expensive. Concerning the participants, this is the opposite of crowdsourcing, which is in most cases open for everyone. Brainstorming and Outsourcing are similar ways of problem solving, which are done by highly trained professionals in small groups. The same facts apply to focus groups, which are very small and carefully chosen.

**Networking** is a widely known concept of sharing thoughts and ideas with close friends and

people you know. This method is commonly used when working on projects, solving problems and getting to know an area of expertise. The method has its limits within the amount of people you are able to contact, which can result in a lack of resources and information.

All these methods have their roots in the idea of **open innovation.** The term was brought up by Henry Chesbrough in his book Open Innovation: The new imperative for creating and profiting from technology. Open innovation claims that firms and companies should use external ideas as well as internal. This is based on the fact that companies cannot rely only on their own research.

Crowdsourcing is cheap compared to the other activities; many cases of crowdsourcing involve a reward to the best concept. There are a handful of things that are very important to successfully 'crowd source', due to the fact that it reaches out to massive amount of people. The platform needs to be structured and very well moderated to handle and sort the information that is gathered. Without specific boundaries and rules a lot of the information can be lost, which is avoidable if following the incentive.

In order for the reader to better understand the concept of crowdsourcing, the authors provide examples of the use of this tool in business (both start-ups and already established enterprises) and academia (Arcada and other educational institutions).

## II. BUSINESS EXAMPLES OF CROWD-SOURCING

### *A. Audiodraft - crowdsourced sound design*

Audiodraft offers a crowdsourced sound design service. The company was founded in May 2010 by three Finnish entrepreneurs and is now funded by a group of venture capitalists. The company's web platform brings enthusiastic sound designers and customers seeking for sound compositions together in one place. It creates a link between the buyer and the seller, connecting demand and supply. In order for the customer to get the desired composition, it is advised to follow several steps: to buy a license; to set the prize; to describe what kind of sound production they are looking for and for what purpose; to listen to the entries submitted by random people; to pick the winner; to get the license for the sound product. Thus, Audiodraft acts as an intermediary in this case and receives a contribution for the service.

### *B. Microtask – a crowdsourcing word-processing service*

Microtask is a startup established by four Finnish entrepreneurs in Tampere, Finland in 2009. The company offers word-processing services. Microtask Platform App receives the hand-written documents faxed by companies, splits them into pieces of task and delivers them to computers and humans in a game format. Each task is performed by two people separately to ensure the quality of work. A typical task can be typing a word or a number from the provided picture. The price of one task is 0,0005$ and represents two seconds of work, equaling one dollar an hour. Microtask has 12 employees and has already received two million dollars of venture capital. DigiTalkoot, a subsidiary of Microtask, is a game-based document correction service performed by volunteers for National Library of Finland. The idea behind the game is to correct mistakes done by OCR software when transforming the old hardcopy newspapers into online format. This operation is one of the 100 most innovative digital solutions in 2012, according to the Netexplo Global Observatory on Digital Society.

### *C. Threadless- Crowdsourced T-shirt!*

Threadless is considered a pioneer among corporate users of crowdsourcing. The company maintains a sizable community of designers and artists. Weekly, Threadless managers call for open designs from the community. Creative people respond by doing designs and posting them on the community website. The call is usually open for a week. On closing, the designs are subject to review by Threadless staff and voting by other community members. Based on the final judgments, 10 designs are then selected and printed on clothes produced by Threadless and sold in its brick-and-mortar store in Chicago and online store as well. Threadless reserves the copyright of the designs to them. In exchange, a winning designer gets a lump sum payment for his approved design, and a royalty on subsequent sales of clothes bearing his design.

### *D. Crowdspring – a crowdsourced graphics studio*

Crowdspring, a Chicago based web marketplace launched in 2008 is considered as one of the most recognized and well-known "cloud sweatshops". In Crowdspring, designers from almost 200 countries help entrepreneurs, startups, small businesses, big brands and agencies with logo design, web design, illustration and other types of graphic design, industrial design and copywriting. Companies who need a certain kind of designing task to be done can post what they need, when

they need it and how much they are willing to pay. Once posted, people from all around the world can take part and submit work that fits the need. Buyers choose from among actual work (which is currently an average of more than 110 entries per project) and pay the offered price.

## III. CROWDSOURCING AT ARCADA

### *A. Crowdsourcing University challenges*

Colleges and universities may face challenges for improvement from time to time. Traditional solutions include forming committees, organizing employee group meetings, and hiring external consultants. However, universities can solve these challenges via crowdsourcing: using the workforce of the students. For example, one of Arcada's Plastics Students Jonas Eklöf produced a pink cup made of plastics in Arcada's laboratory during the summer 2011. The cup needed a name and neither the manufacturing group nor the marketing employees could come up with anything creative. Therefore, Arcada's marketing team posted a contest on Arcada's Facebook Page asking the students of the university to write their suggestions of the name for the cup for the winning reward – an iPad. In about a couple of days or less, more than 130 suggestions were made by students and the final name 'CorCup' was selected. This is just a small example, but it can be applied for solving more complicated challenges.

### *B. Facebook group for a specific course*

Creating a Facebook group by the teacher for the students of a particular course can be very beneficial for the learning experience. By bringing the students of the same course in one place, it allows them not only to get to know each other, but generate and exchange ideas. For example, Henry Ericsson, a teacher of Product Development course, created a Facebook group for the students and invited them to participate. There were approximately 50 students on the course divided in the groups of 5 people each, making it 10 groups. Each group had its own space on Facebook group. The course was a real-life case project for the new building area called Skaftkärr which is intended to be one of the greenest villages in the world. The students had to come up with green ideas which can be used by the project planners. Some students were lacking ideas, while others had so many good ideas that needed to be shared and Facebook offered a platform for sharing the ideas. The pages were visible outside Arcada, attracting ideas internationally from Facebook "friends of friends". Valuable tips were received on electric bicycles, small-scale wind turbines, LED street lighting and many more applications.

### *C. Forums – the power of the crowd with the same interest*

A web forum is a gathering place for a group of experts on a specific topic. These are typically volunteer professionals, willingly sharing their knowledge for the common good. This type of crowdsourcing can be quite useful for students when doing assignments. Some information is not easily accessible on the websites; therefore, forums can be really helpful in bridging this information gap. Arcada's students involved in the project dealing with orthopedic implants needed to find out the prices currently charged by manufacturers for this kind of products. However, this is not a publicly available information. Therefore, the students used the help of the professionals gathered on the orthopedic implant forum by creating the new topic, managing the discussion, and thus providing the required information, for various countries.

## IV. OTHER USES OF CROWDSOURCING IN EDUCATION AND SCIENCE

### *A. Innocentive*

InnoCentive is a Massachusetts-based website that enables scientists to receive professional recognition and financial award for solving R&D challenges, while it simultaneously enables companies to tap into the talents of a global scientific community for innovative solutions to tough R&D problems (About InnoCentive, n.d.: 2, 3). In InnoCentive, companies who have certain problems or questions they need answers for, can post these under various distinctive categories. That way they call for an open solution from the huge numbers of members (read the crowd) using InnoCentive who are professionals, researchers and scientists working in numerous fields. The crowd of solvers can then submit solutions through the web, which go under review by the seeker, which remains anonymous at least during the open phase. If solution meets the technical requirements for the challenge, which about half of the time only requires written theoretical and methodological proposals, the seeker company awards a cash prize that they determine up front. Awards range from US$10,000 to $100,000 per challenge. Even certain complex challenges can bear prize money up to a million. The novelty and concept behind

InnoCentive is strictly crowdsourcing at its core. InnoCentive 'broadcasts scientific challenges to over 80,000 independent scientists from over 150 countries'. So the companies who are seeking solution are reaching a wide experienced community of experts which they wouldn't have gotten if it were done in house.

### *B. Crowdforge*

CrowdForge is a framework for crowdsourcing which breaks down complex tasks into simple, independent micro-tasks or segments that can be completed rapidly and cheaply through crowdsourcing. The great part about this is that here dozens of writers and contributor can collaborate on the very same article and work together to shape it into a complete article or paper just like it would have been written by a single person. The overall crowdsourcing process is done online and in most cases the writers don't even know each other but they have the same project and goal to work on and the end result has so far been commendable. Each person in the experiments completed just a sliver of the work of preparing an article. This included preparing an outline, gathering facts and writing simple prose. The best use of Crowdforge is in scientific and academic research.

### *C. Wikipedia – the free encyclopedia*

Maybe the best-known example of crowdsourcing is Wikipedia. People from all over the world contribute their knowledge freely to the online encyclopedia. From the time of its creation by philosopher Larry Sanger and entrepreneur Jimmy Wales in USA in 2001 till nowadays there has been created over 20 million articles in 283 languages written by 31 million registered users and countless anonymous contributors worldwide. The quality assurance done on a peer review basis may also be considered a form of crowdsourcing.

## V. ECONOMIC ISSUES OF CROWDSOURCING

The many examples above have shown that crowdsourcing has its advantages and drawbacks. A clear advantage is the wide reach of net-based platforms such as Facebook or Linked-In. It enables the "sourcerer" (new term, coined by us) to obtain a large variety of responses, on a regional or global scale. Another advantage is speed. It takes minutes only to type out a call for assistance, on a commonly used Web 2.0 application. Making an on-line survey is quick work on a pre-built survey tool such as Kwiksurvey.

Saving time usually means saving money. Is crowdsourcing a low-cost operation? Picking the brains of unpaid volunteers certainly has lower out-of-pocket costs than the hiring of pin-stripe consultants or Madison Avenue advertising agencies. That this hurts the pros right in the pocketbook can already be seen as sour reactions on the 66design site. If crowdsourcing grows to a permanent phenomenon, it could be seen to take the bread from the mouth of budding experts, trying to break into the labor market. Large corporations using massive external brainpower for zero compensation have already been accused of running "virtual sweatshops". But the internal back-office costs should not be discounted. It takes more time to wade through 999 silly proposals, than to listen to a presentation by a proven, selected professional agency. To be a pro-active moderator on a serious crowdsourcing site is a full-time job for the duration of the project. Just checking up nightly from home is not good enough.

## VI. 6. ISSUES OF INTELLECTUAL PROPERTY RIGHTS

Successful crowdsourcing sites such as Audiodraft, Crowdspring and Threadless deal with artistic expressions. Clearly, each end product has been designed by a person. But who owns the rights to the creation? Winning 99 $ for a snappy ad slogan in response to a crowdsourced Procter & Gamble campaign may feel sufficient at the time, but hearing your slogan broadcast on national TV may find you looking for the phone number to your lawyer. Clearly, the rules of the game must be spelled out clearly at an early stage. This is well done by Linden Labs, the proprietor of the Second Life fantasy site, by requiring each entrant to approve a standard licensing contract as a condition of accessing the site. In this fashion, Linden Labs keep all proprietary patents and copyrights safe and sound, as explained by Llewellyn.

## VII. 7. BEST PRACTICE FOR CROWDSOURCING

Based on our own experience, supplemented by our readings, we wish to state the following 6 rules for best practice.

i) Plan your sourcing campaign well. Be precise and focused. Formulate the relevant questions. (Pilot testing is recommended, especially for language versions). Tap the right crowd, i.e. define your market segment for the campaign. Nominate an expert moderator, and brief him well on the campaign.

ii) Establish your campaign on a readily available, well-structured platform, familiar to the intended respondents. For students,

we recommend student association web portals, school learning platforms (Blackboard et.al.) and social media (Facebook, MySpace). For professionals, we recommend university web portals, alumni portals, technical discussion sites (such as Heatonresearch) and social media (Linked-In).

iii) Promote the existence of your campaign by alternative media, such as WOM (word-of-mouth), info screens, flyers and posters.

iv) Moderate your campaign on a daily basis. Monitor the traffic on the site, answer questions, add explanations, and contribute to the discussions. For a global campaign over many time zones, relief moderators may be needed.

v) Run the operation to a tight schedule, start it with a bang, close it exactly at the agreed day and hour, and dismantle it expediently. The time span may be from 1 day to 2 weeks, depending on the nature of the project. Not more, the net grows cold quickly.

vi) Document the results immediately, while they are fresh in your mind. Also describe the nature of the respondents (age, gender, location). Distribute the results to all members of the client team. Evaluate the findings critically. Could they be biased or manipulated? When satisfied, act quickly on the findings.

The authors hope that this introduction to crowdsourcing has whetted the appetite of the audience to try out a crowdsourcing campaign of their own. We look forward to receiving your comments.

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## IX. ONLINE SOURCES


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# BUSINESS OF SCIENCE: THE BUSINESS MODEL OF THE ENTREPRENEURIAL UNIVERSITY

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**Abstract: The advancement of science and technology is regarded as the driving force behind economic growth and social welfare in knowledge intensive societies. While the responsibility for the creation and dissemination of new knowledge typically lies with leading research institutions, such as universities, the translation of this knowledge into economic value is typically performed outside of universities. How-ever, since universities increasingly depend on additional funds for new and expen-sive research, there is an increasing interest in the so-called "entrepreneurial university." In this paper, we acknowledge this orientation by revealing the logic of value creation within the university through its business model. We develop a general business model of the university as a research and teaching institution. Within this framework we contrast the private with the public university, and we are able to point out differences in their incentive structures, which are important for the fulfilment of their missions.**

**Keywords:** Business Model, Value Creation, Entrepreneurial University

## I. 1. INTRODUCTION

The advancement of science and technology has long been identified as the driving force behind economic growth and social welfare in knowledge intensive societies. While the responsibility for the creation and dissemination of new knowledge typically lies with leading research institutions, such as universities, the translation of this knowledge into economic value is typically performed outside of universities. As a consequence, society's main creators of valuable knowledge cannot reap the accruing economic rent. Moreover, the transfer of knowledge and technology into society must overcome the frequently encountered frictions between its creators and its users.

For the self-understanding of the university according to Humboldt a sceptical attitude towards any profit motive is comprehensible. However, since universities increasingly depend on additional funds for new and expensive research, there is an increasing interest in the so-called "entrepreneurial university."

The reference to the "entrepreneurial university" is meant to emphasize a specific, more focused, perspective. Indeed, the chosen vocabulary is intended to foster an economic understanding of the university as a firm or enterprise. It is important to stress, however, that this view of the university does not automatically imply a general acceptance of the capitalization of knowledge. More important is the notion of the firm (i.e., the university) as an economic institution designed specifically for the creation and delivery of economic value. In which way the benefits of value creation can be reaped is a further important question, but which should be addressed separately.

In this paper, we acknowledge this economic orientation by revealing the logic of value creation by the university through its business model. We develop a general business model of the university as a research and teaching institution. Within this framework we contrast the private with the public university, and we are able to point out important differences in their incentive structure for the fulfilment of their missions.

The rest of the paper is structured as follows. In Section 2, we introduce the business-model framework that we employ in our analysis. In Section 3, we develop the general modular structure of a university's business model, which we then use in Section 4 to contrast the private with the public university. In Section 5, draw conclusions from our analysis and point out the main implications.

## II. THE BUSINESS-MODEL FRAMEWORK

For a firm, the opportunity for value creation arises whenever a problem can be solved, a specific demand can be met, or a need satisfied with a product or service. The created economic value can be measured by the difference between the value perceived by consumers and the firm's unit cost of providing the good or service. If both the perceived value as well as the unit cost can be measured in monetary units, then so can the created value, although monetary value is not a prerequisite for value creation. For the firm, the

crucial questions are with what, for whom, and how this value creation can be realized. The answers to these questions are given by what is commonly referred to as the firm's "business model." Despite the fact that the term itself is often used today in publications, business presentations and conversations, and there is also a vast amount of research and popular literature pointing out the importance of business models, it is, nevertheless, difficult to pin down a precise definition. In this paper, we adopt the definition of Osterwalder & Pigneur 2010, according to whom "a business model describes the rationale of how an organization creates, delivers, and captures value." However, they go one important step further than other authors by identifying nine interacting key components of a business model, which they graphically organize in a "business model canvas," as depicted in Figure 1.

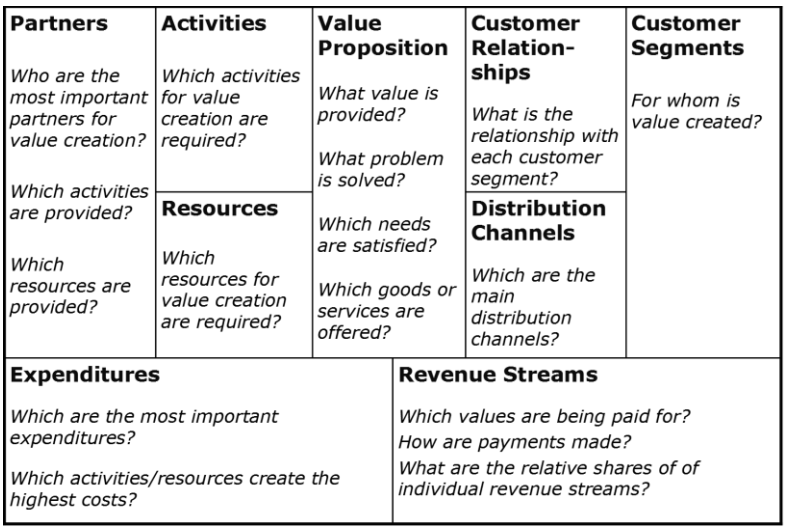


**Figure 1: Osterwalder & Pigneur's nine key components of a business model**

Central to the business model is the firm's *value proposition*, stating what form of value is provided. The economic relevance of this value depends on whom this value is created for, i.e., the *customer segments*. Their willingness to pay then generates the *revenue streams* for the firm. How well value is delivered depends on the firm's choice of *distribution channels* and the quality of its *customer relationships*. While the right-hand side of the canvas focuses on value distribution, the left-hand side is concerned with value creation. Most important for sustainable value creation are the *resources* of the firm, which include its key competencies. Putting these resources to work appropriately enables the firm its value proposition. Hence, value creation requires key *activities* (cf. Porter 1980) and typically also the support of *partners* outside the firm. The accruing *expenditures* must then be weighed against revenues in order to determine whether or not the business model is profitable.

The nine key components themselves do not yet constitute the business model. It is rather their specific interaction which characterizes the rationale of value creation. If these nine components are simple in nature, then the logic of their relationship is self-evident. However, the firm's value proposition is more sophisticated, if it is multidimensional, i.e, if the firm creates more than only one value. Moreover, the firm may have multiple customer segments, in which case the individual values must be related to the individual customer segments, each of which may require specific distribution channels or consumer relationships. Furthermore, selected consumer segments may also play a crucial role as a resource or partner for the value creation of other consumer segments. The business model then features a more complex structure. In order to understand the general logic and the process of value creation, it is helpful to first break down the business model into separate modules, i.e., partial business models, in order to identify the different forms and modes of value creation, and then to analyze how these modules interact with one another.

In the following sections we will investigate the multidimensional value-creation process of the university using a modular approach. The individual modules will be identified with the help of the business-model canvas described above. The logic of business model will be illustrated by augmenting the business model canvases with a causal map (cf. Eden & Ackerman 1998), in which arrows between business-model components and modules

characterize the direction of argumentation, thus illustrating the rationale of value creation.

## III. The Modular Structure of the University's Business Model

In order to understand the university's business model, we first disaggregate its value proposition by distinguishing between its core missions, research and teaching. More recently, universities are also expected to claim a third mission, viz. technology transfer, which we will discuss afterward. For the separate modules of the business model we will employ the component model of Figure 1.

### *A. Module RV: Research output as a value proposition*

As a research institution, the university's foremost value proposition is the output of its research, ranging from publications to patents. Its key resources for providing these products are its senior and junior scientists, whose key activity is research. In addition, there is also the complete research infrastructure together with the supporting administration. The relevant customers are mainly within the research community and can be segmented into individual peers, peer groups, research institutions, and research funds. Aside from acquired grants, the revenues that accrue from these customers are mainly non-monetary, taking the form of publications and editorships of varying value or university rankings. On the expenditure side, however, are the scientists' salaries and the costs of infrastructure and administration. Figure 2 illustrates the key components of module RV.

Since the monetary expenditures of the university cannot be covered by research grants alone, it is clear that this module by itself does not establish a closed business model for sustainable value creation.

### *B. Module SR: Students as resources*

We next turn to the university's second mission, teaching. Again, we have senior and junior scientists as key resources, but now in role of teachers, their key activity being teaching. If one considers the quality of a university's education to be dependent on the quality of its research, then there is an evident causal relationship between the value proposition of module RV and the activities of the teaching module.

More sophisticated, though, is the role of the students. Viewed as a production process, the value proposition of university education is the transformation of students (resources/inputs) into graduates (products), who are then hired (bought) by the greater research community, private firms, and the government (as an employer). Figure 3 illustrates the components of this module SR.

As in the previous module, the university is confronted with customers from whom it does not receive any monetary revenues to cover the high expenses of the complete educational infrastructure. Although these customers do have a willingness to pay, their payments go only as salaries to the graduates that they hire. For the university, the main benefits are reputational (i.e., non-monetary).

### *C. Module SC: Students as customers*

Alternatively, one can view the students themselves as customers of the university, who receive state-of-the-art specialized knowledge and a job-qualifying degree. This perspective is given by module SC, illustrated in Figure 4.

Interestingly, the value that students associate with the acquired knowledge and degree is generated by the value that future employers associate with the graduates that they hire. There is, thus, a direct causal relationship between the value proposition of module SR and that of module SC.

The crucial question of this module is: Are the students of the university customers with a willingness to pay, and, if yes, are the generated revenues sufficient to close (all modules of) the business model? In the answer to this question lies the main difference between the private and the public university.

| Partners | Activities | Value Proposition | Customer Relation-ships | Customer Segments |
|---|---|---|---|---|
| *Researchers in other fields*<br>*Researchers at other universities* | *Research*<br>**Resources**<br>*Scientists*<br>*Research Infrastructure* | *Research Results*<br>•*Publications*<br>•*Patents* | *Conferences*<br>**Distribution Channels**<br>*Journals*<br>*Publishers*<br>*Calls for Proposals* | *Research Community*<br>•*Peers*<br>•*Research Institutions*<br>•*Research Funds* |
| **Expenditures**<br>*Expenditures for personell*<br>*Costs of infrastructure and administration* | | **Revenue Streams**<br>***Non-monetary revenues***<br>•*Journal publications/editorships*<br>•*University rankings*<br>***Monetary Revenues***<br>•*Research Grants* | | |

**Figure 2: Module RV**

| Partners | Activities | Value Proposition | Customer Relation-ships | Customer Segments |
|---|---|---|---|---|
| *Adjunct professors*<br>*Firms* | *Teaching*<br>**Resources**<br>*Students*<br>*Professors*<br>*Teaching infrastructure* | *Graduates* | *Internships*<br>*External theses*<br>**Distribution Channels**<br>*Job platforms* | *Research institutions*<br>*Firms*<br>*Government (as employer)* |
| **Expenditures**<br>*Expenditures for personell*<br>*Costs of teaching infrastructure* | | **Revenue Streams**<br>***Non-monetary revenues:***<br>*Reputation of the university* | | |

**Figure 3: Module SR**

| Partners | Activities | Value Proposition | Customer Relation-ships | Customer Segments |
|---|---|---|---|---|
| *Adjunct professors*<br>*Firms* | *Teaching*<br>**Resources**<br>*Professors*<br>*Teaching infrastructure* | *State-of-the-art knowledge*<br>*Job-qualifying degree* | *Mentoring*<br>*Student organisations*<br>**Distribution Channels**<br>*Courses*<br>*Seminars* | *Students* |
| **Expenditures**<br>*Expenditures for personell*<br>*Costs of teaching infrastructure* | | **Revenue Streams**<br>***Monetary revenues:***<br>*Tuition* | | |

**Figure 4: Module SC**

## IV. The Private vs. the Public University

If students are paying customers, then the university receives revenues in the form of tuition fees. These revenues close the business model, if tuition not only covers teaching expenditures, i.e., closes modules SR and SC, but also research expenditures, thus closing module RV as well. The interaction between the three modules is shown in Figure 5, thus illustrating the business model of the private university.

Students as customers enter the education production process as resources to become graduates and be hired by prospective future employers. Their willingness to pay for this opportunity (i.e., entry qualification) is determined by their expected future income. The higher this is, the higher the university can set the price for education and reap higher revenues to finance not only the teaching modules, but also the research module as well. Hence, the business model of the private university is driven by the interaction between the two teaching modules SR and SC. The research module supports the quality of the teaching modules, but it is subsidized by module SC.

With this structure of the business model, it appears logical that private universities, e.g., in the US, are organized as "schools" supported by research departments as subdivisions of the individual schools. Research is financed mainly by the school, but this requires teaching to be of sufficiently high quality. The incentive structure of the business model with its clear customer orientation is simple and intuitive.

However, the model of the private university depends not only on students' willingness to pay but also their capability to pay the tuition. The general criticism of this model is that not all potential students have access to the necessary funds. The private university may confront this deficit by means of price discrimination, i.e., by letting poorer students pay less than wealthier students. Although, rather than actually charging different prices, the university will typically fix the tuition, and instead grant (promising) poorer students scholarships, which are subsidized by (less promising) wealthier students.

Nevertheless, society may wish to remain in charge of the educational system and, thus retain the right to provide access to universities. As a consequence, tuition must be low enough for all eligible to afford. For convenience, let us assume that tuition is free. In Figure 5 one can see that this opens the business model, again. In order to close the model, the public university relies on financial support of the government.

Within our business-model framework, we treat the government that finances the complete university as a new customer segment. Accordingly, the value proposition offered by the university must be broad enough to encompass all its missions, i.e., all the other modules. Figure 6 illustrates the business model of the public university, where we have added the module GC for the government as a customer.

As Figure 6 reveals, the business model of the public university induces an incentive structure which is quite different than that of the private university. There is no driving module associated with the university's core missions. Instead, it is the government that politically weights the university's missions and distributes funds accordingly. In particular, the university itself has no incentive of its own to regard students as customers, unless the government as its customer demands this explicitly. Relevant for the flow of funds is, therefore, not students' perception of the university's value proposition, but rather the government's view of the quality of education. Unfortunately, governments have limited possibilities to measure student satisfaction, therefore often relying only on the number of enrolled students. Moreover, the government's view is influenced by stakeholders outside the university, which further complicates the incentive structure within the university.

## V. Conclusions and Recommendations

The notion of the entrepreneurial university suggests a view of a research institution as a business. As we have argued in this paper, the main motivation should be a deeper economic understanding of the process of value creation and distribution. As we showed, the business model, precisely defined, is a useful tool for this exercise. By disassembling the business model into separate modules, we were able to illustrate the different forms of value creation within the university and identify for whom these values are created. Since the driving force behind sustainable value creation is given by the customer segment(s) responsible for financing the university, there is a structural difference between the business models of the private and the public universities, which induces differing incentive structures.

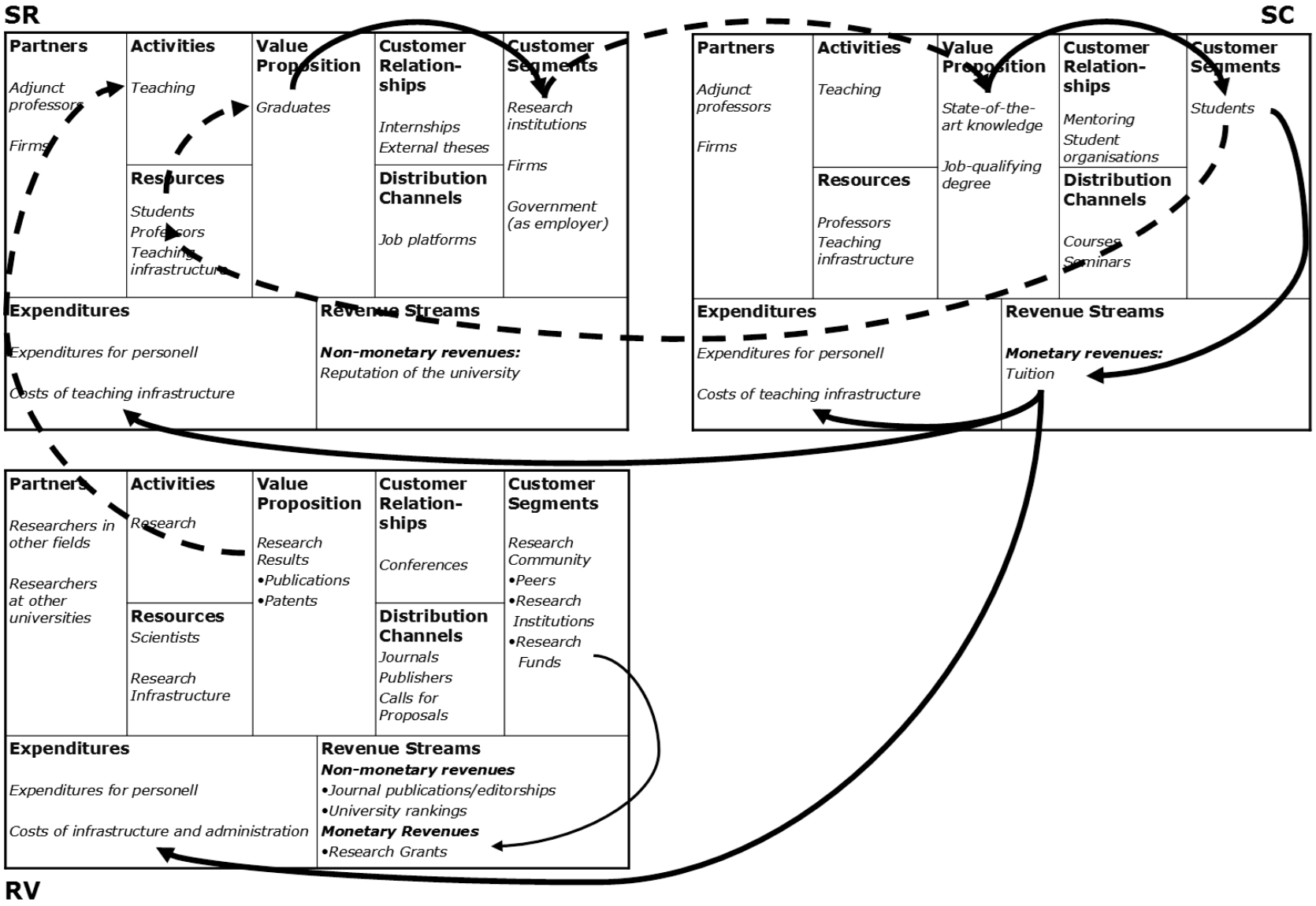


**Figure 5: The business model of the private university**

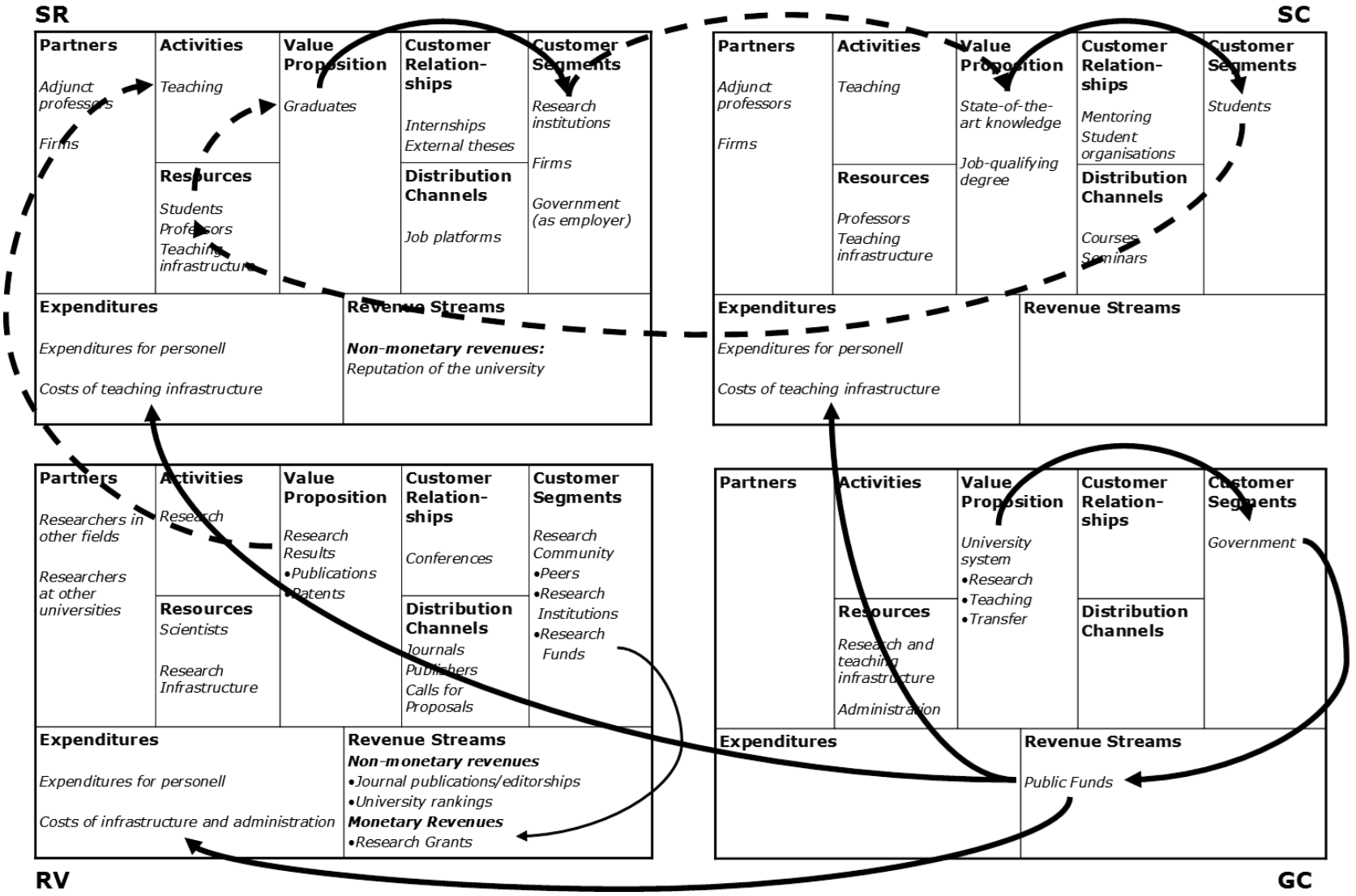


**Figure 6: The business model of the public university**

An important aspect for future research is to investigate empirically/experimentally at the micro level how actors within the university actually perceive these different incentive structures and how this view affects the quality of value creation. This task, however, requires a much finer structure of the individual modules, which reveals the activities of the relevant actors.

A further aspect to consider is technology transfer as the "third mission" of the university. Within our model structure, transfer primarily affects the research module RV. In addition to the research community, private firms enter as a new customer segment that is capable of generating monetary revenues. On the one hand, these new funds enable the university to expand its scope of value creation, in particular with regard to its mission of advanced research. On the other hand, technology transfer via the sale of research output inevitably implies a capitalization of knowledge. Hence, both, the incentive structures of the private as well as the public university, may be affected by these transfer revenues, depending on their size, as the university becomes less dependent on its traditional financial sources. How this change of the business model will affect the university of the future is an important issue that deserves to be investigated.

## VI. ACKNOWLEDGEMENTS

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# FOSTERING ENTREPRENEURIAL BEHAVIOURS: THE EXPERIENCE OF STUDENT ENTERPRISE INTERNSHIPS

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**Abstract: Much has been written about the employability of university graduates and equipping students with an enterprising skills set. Such researches have proved beneficial in informing enterprise educators on pedagogical and andragogical issues. Most universities now provide opportunities for some of their graduates to study enterprise. In this paper, the authors question if tutor-directed initiatives alone adequately provide for today's learner. Whilst the authors recognise there are many components within the entrepreneurial ecosystem that are essential to fostering an entrepreneurial spirit, of particular interest in this paper is the advantages of peer-led enterprise activity.**

**The objective of this paper is to outline an approach that encourages all students, regardless of discipline, to engage in enterprising activities. The approach is novel in that the activities are student-led, by the campus enterprise interns and such activities are often non-credit bearing. In this paper, the success of a Student Enterprise Internship (SEI) Programme is explored. Through random sampling of students on campus via face-to-face surveys, the SEI Programme is evaluated by the customer, the students.**

**The findings illustrate that year on year awareness of student-led activities has increased; more students from various disciplines are engaging in enterprising activities which has in turn led to new opportunities to practice entrepreneurial behaviours and therein increased demand for tutor-led initiatives.**

**The SEI Programme has succeeded in hooking in students where tutor influence has failed. The SEI programme has provided a bridge for staff to link into new pools of student talent. It is recommended that all entrepreneurial universities need to apply peer-led influencers when building a supportive infrastructure for campus entrepreneurship.**

**Keywords**: Student enterprise internship; peer-entrepreneurship

## I. INTRODUCTION

There is global acceptance of the need for entrepreneurship education and the role of Higher Education in fostering entrepreneurship and innovation. In fact, some researches indicate that graduates that have studied entrepreneurship are likely to be in a better position to create wealth (See Charney and Libecap 1999). More recently, Rae (2010) and Watts et al., (2010) arrive at the same conclusion by hinting at the growing perception that enterprising graduates are more employable. Approaches to entrepreneurship education have varied from single course offerings to integrated curricula that explore either the theoretical or practical underpinnings, or both, of the entrepreneurship process. For instance Galloway et al. (2005) note that entrepreneurship education *'...requires a blend of knowledge, skills and attitudes, which recognises the synergistic links between management theory and entrepreneurial practice...'* It appears that classroom activities alone cannot provide a holistic replication of the dynamism and complexity associated with the real business world (D'Abate et al., 2009; Beenen and Rousseau, 2010). But rather being involved in real tangible enterprise activities is a more realistic experience (See Oosterbeek et al., 2010). In this paper we argue that much research in the field of entrepreneurship education is concerned with the pre-occupation of the worthiness of entrepreneurship as a university subject and the *'Teachability'* conundrum which might contribute to the dearth of research specifically addressing peer-led enterprise activity and the non-credit bearing programmes offered in Higher Education. In this paper, we shift the argument onto examining other components of the entrepreneurial ecosystem within Higher Education. Moving towards a personalised pedagogy of enterprise education as presented in Blenker et al. (2011) moves somewhat towards this notion and is largely based upon effectuation principles (Sarasvathy 2008). Bridge (2010) argues that policies to increase entrepreneurship have been less than successful and should pay more attention to social norms and influences. The social system to which Higher Education

students belong is critical; college life is not just about getting the university degree but it is invaluable in developing essential life skills, hence determining the need for peer-led activity and student internships.

In the past, credit-bearing apprenticeships and internships (which originated in the USA) have provided a structured means to introducing students to work-based learning and to creating connectivity between what the student learns and what skills employers want. Internships are perceived to bridge the gap between the classroom knowledge received and first-hand skills development, insights and know-how (D'Abate et al., 2009) because Internships are 'fundamentally developmental in nature, they provide an opportunity to engage in meaningful activities, which build skills and knowledge, as well as work in a context that assists in making the transition from the classroom to the workplace. The authors argue that student enterprise internships are 'doubly beneficial' both for the intern and for the student body since campus enterprise activities have a role to play in broadening the mindset of students thus facilitating them to act as entrepreneurial graduates.

## II. AIMS

In this paper, we outline an approach that encourages all college students to engage in enterprising activities (often non-credit bearing). The approach originates with a three-year initiative to **A**ccelerate **C**ampus **E**ntrepreneurship (ACE) which sought to migrate entrepreneurship out of its traditional homestead (Business school) to various departments where entrepreneurship and intrapreneurship naturally flourishes such as science, informatics, engineering and incubation hubs. The programme discussed in this paper is led by undergraduates enrolled on the incubator's Student Enterprise Internship Programme which is a peer-to-peer programme for students of all disciplines.

In this paper, the authors seek to find answers to the following questions:-

i) How can engaging in enterprise activities enhance a student's college experience and their individual competency?
ii) If staff working in the incubation space that are not typical involved in curriculum-based entrepreneurship should play a role (what role) in student enterprise?
iii) If peer-led enterprise activity has a greater influence on entrepreneurial behaviour than tutor derived initiatives?

Note in this paper, entrepreneurship is referred to as a dynamic process of vision, change, and creation. It follows that an "entrepreneurial perspective" can be developed in individuals. This perspective can be exhibited inside or outside of an organisation, in profit or not-for-profit enterprises, and in business or non-business activities for the purpose of bringing forth creative ideas.

## III. BACKGROUND

The Student Enterprise Internship (SEI) Programme at Dundalk Institute of Technology began in 2007 and was initially modelled upon the Scottish Institute for Enterprise (SIE) programme which itself began in 2003 in Scotland's 13 Universities. This programme adopts an approach that uses peer Interns to encourage participation in entrepreneurship through peer to peer marketing which enables the student population to explore their enterprising abilities in a 'safe environment'. The aim of the SEI Programme is to support and to enhance the delivery of enterprise. In 2006, it was only Business school students who had access to enterprise, hence the SEI Programme sought to redefine enterprise to the student body by affording all students the opportunity to discover and practice their enterprising skills within a social setting. The SEI Programme is a two-year programme which has an overlapping year between the first and second year intern to enable knowledge transfer, that is, to strengthen the learning curve, this effectively means the new Enterprise Intern has a peer mentor throughout their first year in office and in their second year they in turn will be expected to work in a team with a new Intern. This approach has been advocated in the literature, for instance Lord et al. (2011) suggest Internship Programmes should encourage and support the development of professional relationships between interns and co-workers.

The linchpin of the SEI Programme is the Student Enterprise Intern, who is tasked with creating a 'safe discovery environment' on campus to support enterprising individuals. The SEI also receives a scholarship to study part-time for a Masters degree. In Appendix 1, a sample job description for the two-year programme for the SEI is shown [See Appendix 1]. To date, eleven Student Enterprise Internships have been completed through the Accelerating Campus Entrepreneurship Initiative at five partner Higher Education institutions. A residential two-day training programme is offered to the successful Interns prior to commencement of the programme

which involves the graduating Interns thereby offering a structured means of exchange of ideas across campuses. The training covers a number of how-to sessions such as how to market enterprise societies, how to engage students in enterprise, how to develop an elevator pitch, and how to develop sales and presentation skills. The workshops offered as part of the training focus on team building, motivation and leadership. More recently, the college has embraced the need to fund cross-campus and School-specific SEIs since there was a growing demand for campus entrepreneurship.

## IV. METHODS

The Student Enterprise Internship Programme has been in existence for a five-year period at the college. Following the success of the initial two-year pilot, the Programme was embedded at a further four Higher Education colleges in Ireland which were also involved in the Accelerating Campus Entrepreneurship (ACE) Initiative. As part of this Initiative the Interns submit monthly and quarterly reports relating to campus activity. In addition, the Interns survey customer satisfaction through on-the-spot evaluations at events etc. At Dundalk Institute of Technology, the campus Interns in the academic year 2010/11 conducted brand awareness surveys across a random sample of first to final year students, the survey was then repeated in 2011/12. Note that final year students would have been first year students during the first year of the SEI Programme at the college. The short survey contained a number of dichotomous questions relating to their awareness of the Enterprise Interns and the activities associated with the SEI Programme. The survey also served to exact the requirements of the student population, for instance if any were entrepreneur-ready and needed further support beyond the events and activities organised by the Interns.

## V. DISCUSSING THE FINDINGS

From 2007-2012 the SEI Programme has concentrated on wide-ranging activities including cross-campus enterprise events, competitive challenges and competitions and student exchange visits as illustrated in Table 1 [See Table 1]. As well as providing soft supports to students the SEI Programme has also grown to provide hard supports, in particular Dundalk Credit Union's Student Innovation Fund and more recently the Ideas Lab and the Bright Ideas Programme. Table 2 provides a concise overview of core supports and enterprise activities on campus. Whilst there is a range of awareness raising events, there is equal or more opportunity for entrepreneurial application for those students requiring further support with concrete ideas.

## VI. LIMITATIONS OF TUTOR-LED CAMPUS ENTREPRENEURSHIP ACTIVITY

Under the Accelerating Campus Entrepreneurship (ACE) Initiative a number of core and elective modules were developed and delivered in conjunction with non-business schools e.g. engineering and health sciences. And more recently, as a result of further staff training and recruitment the first non-Business school Honours Programme was developed, that is a BSc with Honours (Subject Specialism) Engineering Entrepreneurship. So where does curriculum activity fit with the SEI Programme? Over the years, The SEI Programme has acquired buy-in from academic staff members. By 2011, approximately 46 academic staff members across all schools embraced the aims of the Programme and offered their time and support encouraging participation in events and acting as champions for some of the enterprise activities e.g. judging panel for competitions. Whilst it is true there are a number of academic staff whose role is partly or wholly defined by teaching enterprise and entrepreneurship, the SEI Programme has attracted interest from additional champions that have had limited involvement in such initiatives in the past. These champions tend to emerge naturally since they possess a genuine interest in peer-led influencers and they recognise the value of exposing their students to entrepreneurship. Staff were keen to point out that "there is only ever going to be a dedicated amount of space within the scheduled timetable for critical thinking to take place" and "we need to encourage our students to become more involved in "open learning" which is where the SEI Programme fits in. The events and other activities organised by the campus Interns are ideally placed to "cement classroom learning" and sometimes they assist in "creating new learning opportunities because they bring the subject matter to life" and the student is "forced to question what we teach them, which can only be a good thing…if it ensures they have assimilated the content appropriately". Some staff felt …the Interns can provide a range of different options to add relevant practical value to what we are teaching". Some staff also admitted that the fun element associated with peer-led activity could positively influence student attitude in the classroom (it fast-tracks student buy-in) and thus influenced demand for other tutor-led initiatives, which in turn has led to more cross-departmental working between staff and students. Feedback

**Table 1. Objectives and Outputs of Student Enterprise Intern Programme**

| ***Event Description*** | ***Objective*** | ***Benefit to students*** | ***Output Metrics*** |
|---|---|---|---|
| Competitions<br><br>***Sample activities*** | "Learn by Doing" | Selling & Presentation skills, Problem Solving, Networking, planning a project, leadership<br>Skills | Participation rates,<br>Potential new businesses,<br>Student Innovation Fund applications<br>Regional winners to Newstalk Competition |
| Rookie Challenge | Four- day, cross faculty team competition running annually since 2007/08 | Enterprise into action, idea generation to implementation. | Approximately 120 students per year |
| €10 Challenge | One day Challenge | Students uncover their enterprise skills – idea generation, selling, negotiating, presenting, etc. | Largest winner made €140 in one day |
| Seminars | "Warts and All" stories from industry with particular focus on local, successful entrepreneurial graduates (of college) | Networking, Assessing risk, Motivation, Stimulation<br>Enterprise Education | Participation Rates<br>Student Innovation Fund applications |
| Enterprise Club/Society | Recruiting students | Students can network with like-minded individuals, form collaborations or discuss their ideas | DkIT's Innovators' Club a student-led society ran alongside the SEI programme for a couple of years - Closed in 2008/9 |
| Fresher's Fayre | Awareness Building | Students introduced to like-minded individuals | Participation rates, Connections via Social Media |
| Student Enterprise Conference | Awareness Building | Awareness of wider enterprise community (Enterprise boards, Enterprise Ireland, Not for profit organisations) | 50 attendees |
| Enterprise Week | Awareness Building | Awareness of wider enterprise community (Enterprise boards, Enterprise Ireland, Not for profit organisations) | Over 250 students in attendance |
| Lecture Shouts | Awareness Building of the SEI programme, student interns and upcoming events | Getting to know interns, can request specific interventions or supports and awareness of upcoming events. | 1500 per year |

**Table 2. Core supports of the Student Enterprise Intern Programme**

| *Enterprise Support* | *Objective & funding* | *Benefit to students* | *Output (success story)* |
|---|---|---|---|
| Access to Advisors | Provision of professional advice to students funded through Regional Development Centre | Professional Start-Up advice i.e. from practical, expert and experienced advisors (as opposed to lecturing staff with no or limited entrepreneurial experience). | One company Mara Surf benefited of a wide range of advice and supports; and has recently taken full incubation facilities and has begun trading. |
| Student Ideas Lab | Funded by Dundalk Credit Union this is "an incubator within an incubator" for students to build their businesses. | Dedicated space for students only with goal to concentrate on building their business. Liaising with like-minded people | Approximately 12 per semester |
| Bright Ideas Programme (Non-credit bearing) | Funded by Dundalk Credit Union and the Regional Development Centre the programme aims to provide students with tools to develop and evaluate robust business ideas. | Significant commercial focus on students' business ideas.<br>Provided with business tools, and access to expertise and networks and funding sources. | 20 students undertook the Summer 2010 Programme and<br>16 students undertook the Summer 2011. The 2011 programme was opened to graduates of any Higher Education Institution in Ireland – 2 external students attended. |
| Student Innovation Fund (SIF) | Sponsored by Dundalk Credit Union the SIF provides students with access to seed funding for prototyping, market research, etc, for their business. | Access to early stage seed capital. | Since 2009, 35 applications for the Student Innovation Fund were made. 24 have been approved (70% approval rate), for approximately €17,000 in cash funding. |

also indicates there is still room for improvement in better linking peer-led with tutor-led initiatives. It is critical that this 'bottom up' approach is met with a 'top down' initiative so that the updated curriculum reflects the needs of many students to have an 'enterprise experience' whilst at college .

## VII. Student Benefits of Peer-Led Campus Entrepreneurship Activity

If we look at how the SEI Programme has grown over the years, the brand awareness surveys conducted in academic years 2010/11 and 2011/12 show that year on year more students are becoming aware of SEI-led enterprise activity. The 2011/12 data shows 84.6% of students were aware of the brand 'Student Enterprise at DkIT' whilst this had been as low as 49.5% in the 2010/11 survey. The 2010/11 survey showed awareness increased over the student lifecycle (from year 1 to postgraduate study). Note that awareness did not necessarily translate into numbers attending events or engaging in activities, therefore whilst there was greater awareness in 2011/12 this did not translate into increased demand which illustrates the need for an inclusive (wide-ranging) approach for campus entrepreneurship. Only 11 out of 118 (9.3%) respondents' required extensive help with a current business idea in the 2011/12 survey; 5.9% had been involved in more than five of the enterprise activities organised through the SEI Programme.

In the 2010/11 survey only 22% revealed they would know how to access support on campus for entrepreneurship whilst in 2011/12 another two-thirds (60.3%) were aware of campus supports for entrepreneurship, perhaps this is indicative of the growing need for entrepreneurship supports as students move through the learner lifecycle and as a supportive campus culture for entrepreneurship develops. An evaluation carried out at the Freshers Fayre (induction week for first year students) in March 2008 showed that 12.5% of first year students expressed a tendency for entrepreneurship which may also contribute to the increased awareness among third year students in 2011 – early identification of entrepreneurial tendencies within the student population enables the Interns to nurture entrepreneurial attitudes. In both surveys, the respondents tended to have a broad view of the benefits of entrepreneurship to them as illustrated in their own words, in the following two quotations:-

*"Being enterprising is much more than a grasp of good business know how and experience; it is a way of thinking and is active in every part of our day to day lives."*

*"Our entrepreneurial instinct is what helps us to stand out from the crowd. … we should never underestimate the power it has when combined with an outgoing, and dynamic outlook on things".*

When we compare the uptake of core enterprise activities offered through the SEI Programme across the academic years 2010/11 and 2011/12 as shown in Table 3 [See Table 3], we observe the need for enterprise activities to be an enjoyable and exciting experience for students with the Rookie Challenge, being the major highlight of the calendar year, closely followed by the €10 Challenge. Participants said:

*"...It was a well worth experience that I used as a talking point in interviews."*

*"...Being questioned on all aspects of the business was challenging but rewarding"*

*"...events were fun and great for developing teamwork and presenting skills."*

*"... experience that involved me putting my academic learning to practice in a real life situation."*

| **YEAR** | **2010/11 (n=324)** | | | **2011/12 (n=118)** | | |
|---|---|---|---|---|---|---|
| **SEI ACTIVITY** | **STUDENT RESPONSE** | | | **STUDENT RESPONSE** | | |
| | ***Yes*** | ***No*** | ***Not sure*** | ***Yes*** | ***No*** | ***Not sure*** |
| **The Rookie Challenge** | 76 | 248 | - | 72 | 45 | 1 |
| **The €10 Challenge*** | - | - | - | 66 | 49 | 3 |
| **The Student Innovation Fund** | 41 | 283 | - | 36 | 76 | 6 |
| **The Bright Ideas Lab** | 17 | 307 | - | 16 | 99 | 3 |
| **Molly Malone Student Mobile Shop**** | - | - | - | 47 | 67 | 4 |

*Not offered in 2010 ** Not introduced until 2011/12

**Table 3. Awareness of the Activity of the Student Enterprise Intern Programme**

The surveys reveal a growing awareness of on-campus supports with low levels of awareness of the Student Innovation Fund at 12.7% in 2010/2011 has been improved to 30.5% in 2011/12. Similarly the awareness of the Bright Ideas Lab has been improved from a low of 5.2% in 2010/2011 increased to 13.6% in 2011/12. It is not surprising that fewer students avail of the Student Innovation Fund since the majority of students will not be in a position to develop their own ideas at this stage and therefore have a need for funding. By the same token, the Ideas Lab might be commonly used by students working in teams or as individuals to develop their ideas – nevertheless the Interns would be keen to increase the usage of the lab since it gives students a valid reason for visiting and spending time in the incubation space.

Over the period of the SEI Programme, the number of students that have sought advice from incubator staff has steadily increased from zero in 2007 to in excess of 10 serious propositions to date, academic year 2011/12. The Mobile shop provides a means of bringing enterprise goods and services to the wider student population; awareness of this SEI activity is promising [See Table 3] since it was introduced in semester two of the year 2010/11.

## VIII. Benefits for the Student Enterprise Intern

In addition to the activities of the programme mentioned above, the Student Enterprise Interns are required to manage various internal aspects of the programme [as mentioned in Appendix 1]. These include:-

i) Generate an overall marketing plan and event strategies (and evaluate the effectiveness of the marketing strategy) appropriate to budgets includes liaising with graphic and web designers as part of the on-going branding of 'Student Enterprise' on campus e.g. submissions to college newsletter.
ii) Generate and maintain database of students interested in the varied aspects of entrepreneurship on campus in order to tailor future supports.
iii) Create and maintain a physical and online presence for student enterprise on campus e.g. own brand website, facebook events etc.
iv) Engage with students at Secondary School level during Open day.
v) Liaise with programme co-sponsors and Local Development agencies.
vi) Engage with SEIs in the ACE partner institutions.
vii) Undertake a management role in networks and clubs to promote campus entrepreneurship among the student population.

Graduating Interns of the SEI Programme provide an in depth review of their SEI experience. The SEI programme appears to have afforded the Intern the opportunity to hone various skills especially:-

i) creativity
ii) (self-) presentation and other communication skills
iii) leadership and networking skills
iv) negotiation, fundraising and sales skills
v) project management skills

The SEI Programme has proved to be invaluable in affording the Intern the opportunity to capitalise on intellectual and social capital. Being awarded a scholarship (funded by the college President) for the Masters study was a significant factor in attracting the Intern to the Programme. The graduate Interns had a "sense of achievement in working with their peers".

## IX. Conclusions and Recommendations

In this paper we posed the three questions:

i) How can engaging in enterprise activities enhance a student's college experience and their individual competency?
ii) If staff working in the incubation space that are not typical involved in curriculum-based entrepreneurship should play a role (what role) in student enterprise?
iii) If peer-led enterprise activity has a greater influence on entrepreneurial behaviour than tutor derived initiatives?

In answering the first question, the SEI Programme strives to instil empathy with entrepreneurial values among the student population on campus given its peer-driven focus. The SEI Programme is conducive to breeding a culture for both intrapreneurship and entrepreneurship within the Higher Education ecosystem. The value of peer-led learning and influence has been a major factor in the success of the project to date. The Interns are role models as well as champions of entrepreneurial behaviour and attitudes. The second question related to if we should involve staff working in the incubation space that are not typical involved in curriculum-based entrepreneurship in student enterprise. The findings imply that 'Incubators' may have been too narrowly defined as the premises or

environments in which the 'business incubation' process is inculcated, since we know the process starts much earlier with idea germination and self-reflection. Incubator staff have a role to play in bringing enterprise to life and thus encouraging students on campus to discover more about entrepreneurship, after all discovery is at the heart of entrepreneurial action (Shane and Venkataraman, 2000; Shane 2000). It is also worth noting that the range of activities associated with the SEI Programme closely mirrors the nature of supports given to graduate entrepreneurs by incubators. In both instances, supporting potential entrepreneurs involves (1) training, advice and mentoring, (2) networking opportunities and peer support, (3) financial supports, and (4) physical resources and access to the Institution's facilities

In answering the third question assessing if peer-led enterprise activity has a greater influence on entrepreneurial behaviour than tutor derived initiatives, students on campus seem to vote with their feet, there is a greater awareness of enterprise activity which has a positive impact upon the starting-base for building knowledge in the classroom. It is recommended that all entrepreneurial universities need to apply peer-led influencers when building a supportive infrastructure for campus entrepreneurship in order to foster entrepreneurial behaviour among its students. In particular the authors recommend that Higher Education Institutions should address the following:-

i) Campus enterprise should be based on a fun element to encourage wider participation; activity should primarily focus on encouraging learning by doing. The SEI Programme activity is perceived as low risk since it is non-credit bearing and there was scope for promoting curiosity and experimentation.
ii) Student Enterprise Interns should promote amongst their peers curiosity, creativity, collaboration, networking, coping with uncertainty, resourcefulness, and calculated risk taking and working against (unreasonable) deadlines.
iii) Campus enterprise activity should be supported by a range of complimentary pro-enterprise initiatives and measures e.g. student hatchery, national and international links with other groups which foster and support campus entrepreneurship.
iv) Consider providing a compulsory peer-to-peer promotion of Enterprise within the Higher Education ecosystem.
v) Actively seek to cluster activity and engage with other Higher Education Institutions to share experiences, training and best practices in relation to peer-led campus supports for enterprise.

## X. ACKNOWLEDGEMENTS

The authors wish to acknowledge sponsors of the SEI Programme who include: Dundalk Credit Union Provision of Student Enterprise Fund, sponsorship of Ideas Lab and Bright Ideas Programme; Louth County Enterprise Board – Provided Funding from 2007 – 2009; the President of Dundalk Institute of Technology for providing Masters Scholarships for the Interns and the Scottish Institute for Enterprise who piloted the Programme prior to Dundalk Institute of Technology.

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**Appendix 1: Sample Job Description for the Student Enterprise Intern**

**I. JOB DESCRIPTION**

Reporting to a Manager, the Student Enterprise Intern (SEI) will promote, develop and support entrepreneurship at Dundalk Institute of Technology, and will encourage a spirit of entrepreneurship amongst all students based on campus. The SEI will be based in the Regional Development Centre and will be provided with administrations support.

**II. TERMS AND CONDITIONS**

The successful candidate will be contracted from the 1st of September 2007 until 31st May 2008 subject to satisfactory performance. Employment is subject to 3 monthly reviews. It is envisaged that the SEI will be appointed for a second year from the 1st September 2008 until 31st May 2009.

The role demands a minimum of 18 hours per week and the SEI will also be expected to study for a Masters Degree focused on Campus Entrepreneurship. This will be by way of a scholarship awarded by Dundalk Institute of Technology.

Payment will be €160.00 per week.

**III. KEY DUTIES**

The successful candidate will be expected to:-

- Take a proactive role in the management of the Innovators Club and Enterprise Network.
- Develop a marketing strategy and plan to promote student entrepreneurship.
- Develop, plan and implement monthly cross faculty student networking events.
- Communicate events across the (full time and part time) student population.
- Create and maintain the Student Enterprise Website and to evaluate the utilisation of e-promotional tools, e-zine, blogging, to reach target audience.
- Financial control of marketing budget (circa €2000)
- Attend intern training sessions - the successful candidate must also be free to travel within the EU.
- Promote and actively recruit students for participation on enterprise development programmes in the Institute.
- Carry out other duties as requested by management.

# INNOVATION PEDAGOGY - PRODUCING QUALIFICATIONS NEEDED BY HIGHER EDUCATION STUDENTS

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**Abstract: According to European Parliament and Commission's definition 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. The innovation pedagogy developed in Turku University of Applied Sciences (TUAS) is defined to be a learning approach, which defines in a new way how knowledge is assimilated, produced and used in a manner that can create innovations. Being able to act as an entrepreneur seems to include some of the capabilities innovation pedagogy is trying to achieve.**

**The work done in TUAS has been targeted to define the innovation competencies taken as a goal for innovation pedagogy. In entrepreneurship education there is an existing detailed list of competencies which might to a large extent be overlapping with innovation competencies. The role of entrepreneurship education is an elementary part of the higher education process and thus it should be any university's strategic choice.**

**The aim of this paper is first to give rationale to the new concept of innovation pedagogy and to study the overlapping elements with entrepreneurship education. We aim to contribute to the ongoing development process of defining innovation competencies for the use in university education and in the European wide AHELO process.**

**Keywords:** innovation pedagogy, learning, universities of applied sciences, entrepreneurship education

## I. INTRODUCTION

Universities of applied sciences in Finland were established at the beginning of the 1990s to support regional development, unlike the traditional research universities which create new universal knowledge in basic research and serve the whole society and mankind. The pedagogical approaches of traditional research universities were not suitable for the universities of applied sciences. Therefore, Turku University of Applied Sciences (TUAS) developed innovation pedagogy to promote innovations and regional development (Kettunen, 2009, 2011).

Smart, sustainable and inclusive growth is set as the targets in the communication from the European Commission "Europe 2020". In Finland the activities needed to boost this development are defined in the innovation strategy given by the Finnish government. Organizations wanting to be involved in producing successful innovations need employees who have the qualifications, which are essential for participating in the different innovation processes of their organization. These individual qualities can be called innovation competencies. (Kairisto-Mertanen, 2011; Kairisto-Mertanen, Kanerva-Lehto & Penttilä, 2009; Nuotio, Kairisto-Mertanen & Penttilä, 2010; Penttilä, Kairisto-Mertanen & Putkonen, 2011.)

The green book of EU makes a suggestion that in higher education the curricula should systematically include entrepreneurship and management studies in non-economic curricula. It also proposes that science students should be made to work together with business students. (Report 2003) A recent research done in USA context also proves that the greatest need for entrepreneurship courses and curricula exists within academic disciplines outside of the business school (Levenburg et al. 2006). It seems quite obvious that educational institutions should take means to assure that every student gets a possibility to familiarize him/herself with entrepreneurship during his/her studies. Entrepreneurship education taught on and learned on the basis of an interdisciplinary approach will introduce new forms of knowledge and teaching methods as well as new problem-solving skills for students. The key point in this education is that one becomes an entrepreneur not by birth but by education as well as by experience. (Volkman 2004)

Entrepreneurship studies in higher education are traditionally mainly offered to business students. However many non-business students also might have characteristics indicating them to be well suited to entrepreneurs and intentions about wanting to set up an enterprise of their own.

According to the GEM Monitor Finland was placed in the low average entrepreneurial group of countries (Reynolds et al. 2003). To foster entrepreneurship finish government created a special entrepreneurship policy program. This program emphasizes the importance of enterprises

and entrepreneurs as creators in economic growth and employment (KTM 2006). It is great challenge to introduce new attitudes about entrepreneurship to our students and to further foster the positive attitudes some of the incoming students might have. Creating new entrepreneurs to set up new growth businesses can be considered as one the most important tasks of a university of applied sciences in Finland.

It seems quite obvious that the competencies needed for entrepreneurial and innovative behavior are overlapping to some extent. The aim of this paper is first to give rationale to the new concept of innovation pedagogy and to study the overlapping elements with entrepreneurship education. We aim to contribute to the ongoing development process of defining innovation competencies for the use in university education and in the European wide AHELO process.

## II. INNOVATION PEDAGOGY IN TURKU UNIVERSITY OF APPLIED SCIENCES

Traditionally, the role of education has been to give knowledge-based readiness, which later would be applied in practice to various innovation processes in working life. Innovation pedagogy introduces how the development of students' innovation skills from the very beginning of their studies can become possible. (Kairisto-Mertanen, Kanerva-Lehto, Penttilä 2009.) Innovation pedagogy contributes to the development of new generation of professionals whose conceptions of producing, adopting and utilizing knowledge make innovative thinking and creating added value possible. (Putkonen, Kairisto-Mertanen, Penttilä, 2010; Kairisto-Mertanen, 2011.)

The core of innovation pedagogy can be described as Figure 1 presents. The ultimate aim is to reach the final learning outcomes which are related to the competencies possessed by the students when entering working life once having completed their degrees. The aim of the whole educational process is to equip students with the core competencies of their own subject matter and in addition to that also prepare them to become active contributors in the different innovation processes they are facing when working as entrepreneurs or employees. (Penttilä, Kairisto-Mertanen & Putkonen, 2011.) To reach this goal it becomes essential to define the desired goals, knowledge, skills and attitudes, which refer to the learning outcomes related with the capability of being able to act innovatively. These learning outcomes are called innovation competencies. One of the important tasks of any educational institution is to define, develop and implement the correct methods to be used in education. To succeed in this development work requires joint effort with the faculty members, students and working life.

An innovative individual forms the base for any innovation activities to take place. Innovativeness

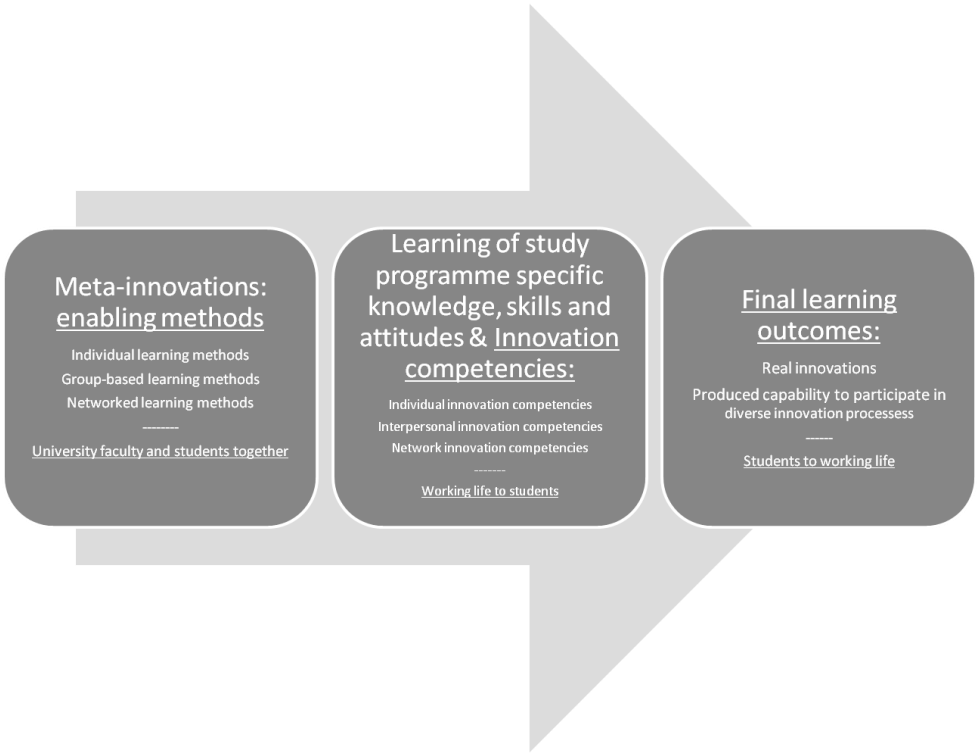


**Figure 1. The final learning outcomes according to innovation pedagogy**

at individual level usually demonstrates itself as creativeness. But in many cases this is not enough, instead the idea needs to be examined by other creative individuals who get the chance to contribute and develop it further. In this phase the further development of future innovations calls for interpersonal competences in the participating individuals. After interpersonal examination the next level is to connect to the existing networks of the individuals involved. In order to reach successful results a well working network and competencies to operate in the network are needed. Only flowing information and knowledge can create learning in the organization and organizational learning in many cases is an antecedent of innovational behavior.

Learning outcomes are statements which are used to describe specifically what is expected from a learner in form of understanding, knowledge and know-how at the end of a certain period of learning. They are broad statements of what is achieved and assessed at the end of the course of study (Harden 2002; Buss 2008). They represent an approach to education in which decisions about the curriculum are driven by the outcomes the students should display by the end of the course. In outcome-based education, product defines process. The curriculum is being developed from the outcomes the students are wanted to demonstrate rather than writing objectives for the curriculum which already exists. A learning outcome is a written statement of intended and /or desired outcome to be manifested by student performance. (Spady 1988; Harden, Crosby, Davis 1999; Proitz 2010.) Guidelines for defining learning outcomes recommend that they should be clearly observable and measurable (Buss 2008).

The outcomes cover both cognitive and practical skills (Davies 2002). The learning outcome is divided into components consisting of the cognitive, psychomotor and affective domains of an outcome. They can be called knowledge or understanding, skills and attitudes, feelings and motivation accordingly. As Spitzberg (1983) points out the distinction among knowledge, skills and motivation is important because performance can be enhanced or inhibited by any one or all of these components. Learning outcomes are also guaranteed achievements which can be institutionalized and incorporated into practice. The ownership of the outcomes represents a more student-centered approach. Students take responsibility for their own learning. (Harden 2002.) As it is argued that learning outcome might not be suitable for every discipline of education literature also speaks of emerging learning outcomes and thus leaves room for emergent ones which differ from the predetermined intended ones and make unexpected occasionally occurring learning possible. (Hussey & Smith 2008; Buss 2008, Brady 1996.)

Innovation competencies are the learning outcomes which refer to knowledge, skills and attitudes needed for the innovation activities to be successful. The methods applied and the way how teachers and students interact constitute a base for learning and thus enable the forming of innovation competencies. The methods used also facilitate intuitive and unexpected learning during the learning process and make transmitting of tacit knowledge possible when dealing with working life. In innovation pedagogy this kind of learning outcomes can manifest them in the form of intuitive and tacit learning which takes place in the learning situation. They can be f.ex. experiences about cultural differences, about working at customer surface etc. The core idea in innovation pedagogy is to bridge the gap between the educational context and working life. Learning and teaching processes are developed so that they provide improved competences for the students and enable personal and professional growth. Learning is deeper when the previously gained knowledge is continuously applied in practical contexts. (Penttilä, Kairisto-Mertanen, Putkonen, 2011.)

Innovation competencies are learned gradually as new information is added to our knowledge structures. Knowledge acquisition and application are critical components in this process. Thus, creating new services, products and organizational or social innovations – new added value – requires both knowledge and skills, which are applied in an innovation process. (Gibbons et al., 1994; Kairisto-Mertanen, Penttilä, & Putkonen, 2010; Nonaka & Takeuchi, 1995; Nowotny et al., 2001, 2003.) Innovation pedagogy is defined as a learning approach that defines in a new way how knowledge is assimilated, produced and used in a manner that can create innovations. (Kairisto-Mertanen, Kanerva-Lehto & Penttilä, 2009; Kairisto-Mertanen, Penttilä & Putkonen, 2010; Nuotio et al., 2010.)

Innovation can be defined in many ways. For example, Schumpeter (2003) speaks about innovative entrepreneurship. It is an Idea, practice or object which is considered new by the people (Rogers, 2006) or a solution which brings economical benefits (SITRA, 2006). In Finland's

national innovation strategy (2008), innovation is understood as competitive advantage based on knowledge. Innovations are best born in a special culture which includes freedom to think, equality and brotherhood. In the context of innovation pedagogy innovation is understood as the process of constantly improving knowledge, which leads to new ideas, further knowledge or other practices applicable in working life. (Kairisto-Mertanen, Penttilä & Nuotio, 2011.)

Innovation pedagogy contributes to the development of new generation of professionals whose conceptions of producing; adopting and utilizing knowledge make innovative thinking and creating added value possible. (Kairisto-Mertanen, 2011; Putkonen, Kairisto-Mertanen & Penttilä, 2010.) This is an important target mentioned in the Finnish National Innovation Strategy (2008), which integrates applied research and development, entrepreneurship and flexible curricula to meet the multi-field customer needs in regional and international networks (Kettunen, 2011). The core idea in the application of innovation pedagogy is to bridge the gap between the educational context and working life. Learning and teaching processes are developed so that they provide improved competences for the students and enable personal and professional growth. Learning is deeper when the previously gained knowledge is continuously applied in practical contexts. (Penttilä, Kairisto-Mertanen & Putkonen, 2011.)

## III. ENTREPRENEURSHIP EDUCATION IN TUAS

According to Gibb (2005) entrepreneurship is defined "in terms of sets of behaviors, attributes and skills that allow individuals and groups to create change and innovation, and cope with, and even enjoy, higher levels of uncertainty and complexity in all aspects of their life". He continues that entrepreneurship is "not seen as being synonymous with being "business-like" in the formal administrative sense". This means that entrepreneurship is a wide concept and an attitude to living and more like a mindset which will become essential for every citizen in the future economy characterized by uncertainly, mobility and individual choice. Gibb presents three sets of nine items each and names them entrepreneurial behaviors, entrepreneurial attributes and entrepreneurial skills.

Another way of defining entrepreneurial competences is to use a competence based approach to developing a curriculum by analyzing different working life based activities. Westerholm (2007) used this approach when exploring the knowledge needed by small and medium sized entrepreneurs. She presented the competences dividing them into cognitive, affective and psycho-motoric components or into a combination of them. Westerholm found in her theses a list of most important core competences for the Finnish SMEs. These are eagerness to be an entrepreneur, company management, self-management, product design and development skills, marketing products and services, financial management, leadership, company development skills, organizing skills, communication skills and knowledge management.

Training preparing for entrepreneurship in Turku University of Applied Sciences can be examined with the help of the following Figure 2 (Saurio 2004). There are different levels and methods used corresponding the readiness and earlier knowledge of the student. There are also great variations in the awareness concerning entrepreneurship in different study programs. The methods used have to be chosen so that best possible results can be reached.

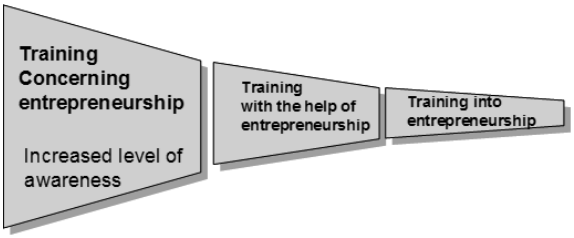


**Figure 2. Training preparing for entrepreneurship in universities of applied science: Different levels and methods (Saurio 2004)**

The first box in the figure 2: training concerning entrepreneurship concept means training which aims at increasing awareness of entrepreneurial activities and entrepreneurship as an important economic development factor and working attitude. Different first year introductory study units on entrepreneurship belong to this category and they are offered for the purpose of increasing the level of awareness of new students. During these courses the students get real life examples about running a business, the intention being to arouse an attitude of internal entrepreneurship in the students and familiarize them with the idea of running a business of one's own.

Training with the help of entrepreneurship means a pedagogical process that incorporates enterprise-like situations or actual enterprises. In TUAS these enterprise-like situations take the form of an enterprise game, cooperation projects, practice enterprise concept and real life company assignments. This face can also be considered as a

pre-incubation face where new ideas in multidisciplinary teams are born and lead to the next face where the students set up an enterprise of their own.

Training into entrepreneurship concept means training and instruction which have an aim of setting up one's own enterprise and working as an entrepreneur. Our last example where students set up a co-operative and work in it as real entrepreneurs belongs to this group. After finishing their studies the students can continue working in this co-operative or turn to local incubator center and set up another enterprise.

## IV. CONCLUSION: ENTREPRENEURSHIP EDUCATION AND INNOVATION PEDAGOGY

When examining the definition of entrepreneurship given by Gibb (2005) or the list of entrepreneurial competencies developed by Westerholm (2007) it seems obvious that innovation competencies include many of the competencies needed when becoming an entrepreneur.

When considering individual innovation competencies it seems that also entrepreneurs need to learn how to tolerate insecurity and how to take calculated risks. Presenting skills and communication skills are also essential in entrepreneurial work. A certain kind of pattern recognition skill is undoubtedly beneficial if one wants to succeed as entrepreneur.

Interpersonal innovation competencies needed by entrepreneurs are essential and include adaptive capability when sensing other people. Work at customer surface requires ability to actively communicate using real dialogue.

Running a business successfully usually requires good networks. An entrepreneur must beable to actively build networks, operate in them and develop them further. This means that entrepreneurs must possess the networking competences defined by innovation pedagogy.

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# ENTREPRENEURSHIP IN UNIVERSITIES: AN ANATOMY OF THE PROGRAMS IN ENTREPRENEURSHIP OF THE EUROPEAN BUSINESS SCHOOLS

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**Abstract: Education in entrepreneurship poses a major challenge in EU today, as it is closely related to creativity, innovation and the launch of new business ventures. Although regarded as a key instrument for mobilizing economic and social advancement, education and training in entrepreneurship still suffer from inadequacies in the methods and practices followed and the lack of comprehensive educational models. Here, we present the findings of an empirical survey on the educational programs in entrepreneurship in the "top" European Business Schools (EBSs), according to the FT 2011 ranking list. We adobe a content analysis approach in order to examine the objectives and the structure of such programs, reveal their characteristics and further analyze their educational approaches. The findings reveal the attitude of European Business Schools towards entrepreneurship education. Today, there is already a large number of the (top) European Business Schools provide educational programs in entrepreneurship which are usually developed at the postgraduate level or as independent training programs. The analysis of the structure and the curriculum content of those programs reveal the most important topics of interest and at the same time help us to highlight best practices for the education of future entrepreneurs.**

**Keywords:** entrepreneurship education, european business schools, content analysis

## I. INTRODUCTION

Entrepreneurship has become the engine of economic and social development throughout the world. The role of entrepreneurship has changed dramatically between the traditional and new economies. At the same time, education in entrepreneurship poses a major challenge in EU today, as it is closely related to creativity, innovation and the launch of new business ventures. it is Although regarded as a key instrument for mobilizing economic and social advancement, education and training in entrepreneurship still suffer from inadequacies in the methods and practices followed and the lack of comprehensive educational models. Here, we present the findings of an empirical survey on the educational programs in entrepreneurship in the "top" European Business Schools (EBSs), according to the FT 2011 ranking list. We adobe a content analysis approach in order to examine the objectives and the structure of such programs, reveal their characteristics and further analyze their educational approaches.

The findings of our study reveal the attitude of European Business Schools towards entrepreneurship education. Today, there is already a large number of the (top) European Business Schools provide educational programs in entrepreneurship which are usually developed at the postgraduate level or as independent training programs. The analysis of the structure and the curriculum content of those programs reveal the most important topics of interest and at the same time help us to highlight best practices for the education of future entrepreneurs. The paper is structured as follows: in the first part we review the literature in relevance to the role of entrepreneurship in education. In the second part we present the methodological approach of our study and in the third part we briefly present our findings. The paper concludes with a summary of our results and some ideas for future research.

## II. THE ROLE OF ENTREPRENEURSHIP IN EDUCATION

### A. *The Role and the Importance of Entrepreneurship Education*

Entrepreneurial education emphasizes imagination, creativity, and risk taking in business whereas traditional business schools tend to over-emphasize quantitative and corporate techniques at the expense of more creative skills (Porter, 1994). Traditional business school programs emphasize the large established corporation over the small or start-up venture and nurture the follower and steward over the leader, creator and

risk taker (Chia, 1996). However, entrepreneurial education has firmly established a beachhead in academia as a result of a shift in academic thinking about the value of this field. It is now recognized that entrepreneurship is an important educational innovation that provides the impetus to learning about learning (Charney and Libecap, 2003) Interest in entrepreneurship as a field of research and teaching has been fuelled by the growing demand for entrepreneurs that produces innovations and advance the society as a whole.

There are various reasons for national governments trying to promote entrepreneurship education. First of all is the major role that small businesses play in a country's economic growth. Also, acquiring proper entrepreneurial skills may lead to a decrease in the failure rate new start ups. Critical considerations related to governmental interest in the stimulation of entrepreneurship are the fact that small firms are "net creators of jobs" whereas large companies are "net shedders of jobs" (Hynes, 1996 p. 10) and that small enterprises exert a hugely disproportionate positive effect on increases in total national employment (Gibb, 1987; Morris et al., 2001; Formica, 2002; Colette et al., 2004).

The fact that entrepreneurship attracted the attention of researchers and practitioners is considered to be more than a vogue. Venkatraman (1996), states that this attention accurately reflects an "emerging economic environment created by the confluence of changes in the corporate world, new technology and emerging world markets"..

One of the key success factors for entrepreneurship education is effective development of the entrepreneurial ecosystem, in which multiple stakeholders play a role in facilitating entrepreneurship. It is a system of mutually beneficial and self-sustaining relationships involving institutions, people and processes that work together with the goal of creating entrepreneurial ventures. It includes business (large and small firms, as well as entrepreneurs), policymakers (at international, national, regional and local levels), and formal (primary, secondary and higher education) and informal educational institutions. The different stakeholders are involved in a series of symbiotic actions which include awareness and outreach, the development of human capital and critical talent, public - private partnerships, multiple sources of innovation, intellectual property and funding. In a dynamic and growth-generating entrepreneurial ecosystem, there is a high degree of interaction and coordination among these key elements.

The role of government is crucial in creating the proper regulatory framework and incentives to catalyze the involvement of the private sector, education institutions, individuals and intermediaries within an entrepreneurial ecosystem. However, in many developing countries, each of these groups of actors may be at an early stage of development in terms of entrepreneurship, or perhaps not yet focused on it due to other priorities and the allocation of scarce resources. Each stakeholder in the ecosystem needs to recognize entrepreneurship as a key element of its strategy, thereby creating win-win networks of entrepreneurial relationships. In this regard, links between the private sector and academia should be encouraged, as should the development of networks between various potential actors in the ecosystem. "Social networks" and trust provide the essential glue in such ecosystems.

### *B.* ***Defining Entepreneurship Education***

The entrepreneurship education definition is, as well as the entrepreneurship phenomenon itself, rather complex and vague. The lack of consensus in defining entrepreneurship contributes to the confusion about entrepreneurship education program definition. For the purpose of this study, entrepreneurship education program is defined as the process of providing individuals with the ability to recognize commercial opportunities and the knowledge, skills and attitudes to act on them (Jones and English, 2004. p.416.). Therefore, entrepreneurship education program is a complex process with wide array of objectives such as:

i) to give individuals more and better knowledge for entrepreneurial ventures creation, management and growth,
ii) to provide more awareness about entrepreneurship,
iii) to enhance individuals capability to act entrepreneurially in all walks of life (by providing them with the set of attitudes and values for embracing changes and self-reliance.

While the third objective can be triggered early in the educational process (primary and secondary education), the first and the second objective are more likely to be influenced during the postsecondary education. The academic institutions and their programs have been called upon to provide more substantial impact on developing and stimulating entrepreneurial skills, knowledge and attitudes. Entrepreneurship courses and programs started to appear during the early 1960s, predominantly in the U.S. One survey (Katz, 2003) reports that 1600 HEI's offer

2200 courses in entrepreneurship worldwide. The assessment of entrepreneurship programs and courses started after 1980s (Kao and Stevenson, 1984; Vesper and Gartner, 1997).

The assessment of the programs turned out to be one of the intriguing tracks on the entrepreneurship research due to the complexity of entrepreneurship education programs' definition, aims, processes, activities and outcomes. The short review of the major recent surveys of the entrepreneurship education programs illustrates the scope of the conceptual and methodological challenges in designing and monitoring of the entrepreneurship education programs. The basic objectives of entrepreneurship education are to create enterprising people and embody the characteristic of self-reliance through proper learning processes. It aims to the stimulation of entrepreneurship as either independent small business ownerships or opportunity seeking managers within enterprises. Entrepreneurship education must provide student some generic and horizontal skills, aiming to make students:

i) more creative/innovative, highly motivated, pro-active, self-aware, self-confident,
ii) willing to challenge
iii) better communicators, decision-makers, leaders, negotiators, networkers, problem
iv) solvers, team players, systematic thinkers
v) less dependent, less risk averse, able to live with uncertainty, capable of recognizing
vi) opportunities.

According to Jamieson (1984) there is a framework consisting of three categories by entrepreneurship education which can be set up. These are education about enterprise, education for enterprise and education in enterprise. Education about enterprise is mostly concerned about awareness creation and attempts to provide the fundamentals of setting up and running a business mostly from a theoretical perspective. Garavan and O'Cinne (1994) present another categorization of entrepreneurship education of two fields. The first one is entrepreneurship education and the next is education and training for small business owners. In the first field entrepreneurial education has the purpose to provide an opportunity to be educated concerning the factors surrounding a new start-up and the types of characteristics needed for successful entrepreneurship.

## III. ENTREPRENEURIAL EDUCATION IN HIGHER EDUCATION INSTITUTIONS

The teaching of entrepreneurship can be considered quite complicated as it includes the transmission of rules, information and guides across a wide range of topics. As mentioned in the first section of the research entrepreneurship includes the running of an entire business. It requires perspicacity and the possession of certain attitudes and plausibility. Lastly, specific financial, organizational and marketing knowledge are required. A plethora of knowledge exists concerning the disciplines organizational behavior and accountancy and marketing, which include accepted definitions, benchmarks and professional norms. This does not goes for entrepreneurship, where various options arise vis-a-vis the way the subject is taught and where there are multiple opportunities for teaching methods to be influenced by an individual's background.

Entrepreneurship is already established in business schools and now the next challenge for the entrepreneurship education movement is into non-business schools and against an even more formidable opposition. Business schools effectively rear entrepreneurship education (Hynes, 1996) but wanting to actually promote economic development means that the non-business school sector, particularly engineering and other science-based disciplines, must also integrate entrepreneurial education. The latter disciplines face the problem of developing ideas that even though they do not lack of value, they are often not commercialized due to lack of process awareness

Until now entrepreneurial education can be delivered divided under two different schemes. Students in both business and non-business studies must take into consideration these two schemes The first one focuses on the practical small business management skills, and the second one on the development of certain attributes within the participant (Gibb, 1987; Curran and Stanworth, 1989; Garavan and O'Cinneide, 1994; Ladzani and van Vuuren, 2002; Peterman and Kennedy, 2003; Walton, 2003).

Though skills-based entrepreneurial education method students are guided concerning matters of running their own businesses. It is a "highly structured, consensus-orientated and unstressful" method (Sexton and Bowman, 1984) and often includes involve instruction on finance, selection of premises, taxation, employment and other legal regulations, elementary book-keeping, marketing

problems, and so on. Also, students learn about functional business interrelationships, they build self-confidence and develop analytical skills. This method implies that entrepreneurship education must mostly be focused on studying management, marketing, finance, budgetary control, employee recruitment and other aspects of personnel administration (Hambrick and D'Aveni, 1988; Jansen and van Wees, 1994; Davies et al., 2002; Ibrahim and Soufani, 2002; Peterman and Kennedy, 2003; Keogh and Galloway, 2004), because presumably lacking knowledge in these fields will lead to failure of a new business.

On the other hand, through the method of development of certain attributes entrepreneurial education targets to "inculcate the necessary attitudes, values and psychological sets" of the successful entrepreneur (Curran and Stanworth, 1989), and develop appropriate personal attributes such as innovativeness, the willingness to take risks, to fail and start afresh, creativity, determination and self-direction (Garavan and O'Cinneide, 1994; Jansen and van Wees, 1994; Hynes, 1996; Engelen, 2002; Gibb, 2002; Deamer and Earle, 2004). This method implies that the most common reason for a new business to fail is the lack of innovation, imagination and self-confidence of its owner. So, students must acquire a wide perception of the entrepreneurial process and become capable of reacting to events that were not planned or predicted. They must enrich their abilities for innovative behavior, creativity, flexibility, self-direction and their ability to respond to different situations. There is generally an argument about whether entrepreneurial education in students of business management should be different from the non-business ones. In order to motivate students for nonbusiness studies to handle economic subjects and entrepreneurship examples from their technical area can be used. The focus should be on the essential connections and practical aspects, having regard to the particular target group of students.

Non-business students are strong in technical matters and very often they tend to have very strong product ideas. At the same time they tend to be weaker in the field of commercialization and marketing. They must attend courses on Intellectual Property, Commercialisation Process, Marketing and Venture Capital in order to acquire an entrepreneurial aspect beside their technical abilities. They must learn to analyze the market and conduct market oriented programs, rather than product oriented ones, where in most cases lead to product failures, according the "marketing myopia" theory. They must be capable of creating not just excellent in quality and innovative products but products that the market demands.

At the same time, entrepreneurship for business students must highlight the start-up phase of the business and the growth of an SME. Fields like marketing, management, accounting etc are offered as separate studies so entrepreneurship must have a most focalized landscape. Students must be offered entrepreneurial and enterprising experiences and opportunities in order to advance and promote entrepreneurial behaviors. Lastly, they should learn to work with students from different fields (engineering, scientific studies, etc).

### *A. Entrepreneurial Education in Europe and European Business Schools*

Traditionally, entrepreneurship education has been linked to the fields of management and business, but the growing recognition of entrepreneurship education as a broader concept has initiated a focus on the need for entrepreneurship policies to embed entrepreneurship throughout all levels of the EBSs and throughout all faculties in multidisciplinary HEIs (Grilo and Thurik, 2005). Wilson (2008) argued that innovative entrepreneurs come in all shapes and forms. They start companies; they spin out companies from universities or corporations; they restructure companies in need of refocusing; they innovate within larger organisations. Hence, entrepreneurship should not be only considered in the field of management but also in other disciplines. To achieve that EBSs should aim at fuelling entrepreneurial mindsets and have an institutional action plan for how to achieve this.

The EU Commission Communication "Fostering Entrepreneurial Mindsets through Education and Learning" from 2006 states clearly: "Universities and technical institutes should integrate entrepreneurship as an important part of the curriculum, spread across different subjects, and require or encourage students to take entrepreneurship courses. Combining entrepreneurial mindsets and competence with excellence in scientific and technical studies should enable students and re-searchers to better commercialise their ideas and new technologies developed. (Commission Communication "Fostering Entrepreneurial Mindsets through Education and Learning" COM (2006) 33 final).

In Europe, students are more likely to obtain access to entrepreneurial education if they attend either a business school or a multidisciplinary institution with a business school department.

Many "entrepreneurship" programs are actually SME training programs that focus on functional management skills for small business (Zahra, 2007) rather than skills for building, financing and nurturing high-growth companies (Wilson, 2008). Entrepreneurial education can be viewed broadly in terms of the skills that can be taught and the characteristics that can be engendered in individuals that will enable them to develop new and innovative plans (Jones and English, 2004).

A survey commissioned for the European Union revealed that particularly specialised Higher Education Institutions - HEIs (except specialised institutions within the technical area) are lagging behind when it comes to entrepreneurial education. The survey also points to a difference in access to entrepreneurial education according to the students' country of residence. In general, students in the EU15 have better access to entrepreneurial education than students in the EU>15, i.e. countries that have recently joined the EU. This survey also highlighted that the most common goal among the institutions that offer entrepreneurial education is to foster entrepreneurial behaviours, skills and mindsets among the students. It therefore seems that the institutions have embraced the broader concept of entrepreneurship at the strategic level and the task at hand is related to having entrepreneurial activities and courses that to a greater extent also focus on the mindsets of students and not primarily on the skills needed as an entrepreneur. The main results of this survey are presented below:

i) About 51% of the institutions reported no programs or indicated that entrepreneurship was covered in a limited fashion within courses
ii) Only a minority of institutions (48%) had courses where entrepreneurship accounted for 25% or more of the course content
iii) Entrepreneurship courses appear to be concentrated on undergraduate students in independent business schools and institutions with business studies units while entrepreneurship degree programs are primarily oriented to master's students in business. However, most schools have cross-disciplinary course structures that allow students from across the university to take entrepreneurship courses
iv) Lectures are the most frequently used teaching method, supplemented by case studies, guest lectures and team projects. About a third frequently used people with entrepreneurial experience as instructors
v) In addition to courses, about three fourths of the institutions have extra-curricular seminars and about half hold business plan competitions
vi) On average there were 1.8 tenured faculty members and 1.4 non-tenured faculty members in entrepreneurship at institutions with courses and degree programs. Less than a third of staff members had entrepreneurial experience
vii) In 40% of the schools, the fact that entrepreneurship education relied heavily on the active interest of one or a few staff members was seen as the most important limiting factor to the development of these educational programs.

However, as the results of the survey demonstrated only a few of the multidisciplinary HEIs have made entrepreneurial policies for all of their faculties - in more than two thirds of the institutions less than a third of the faculties have their own entrepreneurial policies. The results also depicted that faculty-level entrepreneurial policies are most prevalent in the business faculties and technical faculties. Entrepreneurial education is largely a multidisciplinary concept - it is in the cross-section between different disciplines that innovation and creativity emerge and the study shows that institutions could take greater advantage of this aspect of entrepreneurial education.

Bennet (2006) argued that entrepreneurial education should focus on having a skills-training approach, where students will learn to systematically analyse the environment and the information given to them by reading or attending lectures and an attitude development approach where students will learn by doing and solving problems. Similarly, Byrne and Fayolle (2010) found that the majority of courses in entrepreneurship are related to teaching for entrepreneurship. In these courses more emphasis is placed on the process of entrepreneurship, for instance business planning, opportunity, discovery, evaluation, exploitation, idea creation and opportunity recognition, opportunity evaluation, new venture creation, etc. Further, there is emphasis on the functional approaches of entrepreneurship such as entrepreneurial finance, new venture marketing, legal aspects for start-up creation. Nonetheless, there are also courses which focus on teaching about entrepreneurship with subjects such as the role and importance of entrepreneurship in society, entrepreneurship, macro-economic and social-cultural dimensions.

Entrepreneurial education should focus on a process of becoming through greater flexibility in course design. Byrne and Fayolle (2010) argued that there should be the development of specialised or trend based entrepreneurship courses such as family business, social entrepreneurship, corporate entrepreneurship, strategic entrepreneurship, international entrepreneurship, entrepreneurship in healthcare, IT, biotechnology, engineering etc. Further, there should be growth of entrepreneur psychology and entrepreneur personality courses which should address explicitly entrepreneurial behaviour, entrepreneurial competencies, entrepreneurial skills (such as creativity, leadership, negotiation, networking, teambuilding, team working), entrepreneurial thinking, entrepreneurial attitudes (such as achievement orientation, locus of control, initiative taking, self-confidence, self-efficacy) and key notions such as emotions, values or coping with failure.

Henry *et al* (2005) argued that there are three categories of entrepreneurial education. The first category, education about enterprise, deals mostly with awareness creation, and has the specific objective of educating students on the various aspects of setting up and running a business mostly from a theoretical perspective. Indeed, enterprise modules within business and other courses at undergraduate or postgraduate level which seek "to foster skills, attitudes and values appropriate to starting, owning, managing or working in a successful business enterprise" would be included in this category. The second category, education for enterprise, deals more with the preparation of aspiring entrepreneurs for a career in self- employment with the specific objective of encouraging participants to set-up and run their own business. Participants are taught the practical skills required for small business set-up and management, and the courses are often geared towards the preparation of a business plan. The third category, education in enterprise, deals mainly with management training for established entrepreneurs and focuses on ensuring the growth and future development of the business. Management development and growth training programs, as well as specific product development and marketing courses, might fit into this category. In addition, such training provides skills, knowledge and attitudes for people to go out and create their own futures and solve their own problems.

Today entrepreneurship education in America has exploded to more than 2,200 courses at over 1,600 schools, 277 endowed positions, 44 refereed academic journals, mainstream management journals devoting more issues (some special issues) to entrepreneurship, and over 100 established and funded centers. The discipline's accumulated "wealth" has grown to exceed $440 million with over 75 percent of those funds accruing since 1987 (Katz, 2003).

## IV. METHODOLOGY

In this paper we adobe a content analysis approach in order to examine the objectives and the structure of such programs, reveal their characteristics and further analyze their educational approaches. Information about the Entrepreneurship programs was gathered by content analyzing the programs' official websites.

The purpose of this study was to categorize and inventory the extent of programs and activities by institutions of higher education that have developed entrepreneurship curricula independently or within their existing programs. In order to analyse the content we used keyword combinations or variations thereof include, but are not limited to "entrepreneurship," "entrepren*" "innov*" "entrepren* and innov*", "entrepren* or innov*" and other teleological combinations of entrepreneurship such as: social "soc*", or leadership "lead*", and creativity "creativ*". Finally, we searched for other specific thematic approaches including the key words technology, electronic or information ("tech* or e-* or inform*").

### *A. Data Collection*

Content analysis has been extensively employed in the Management literature (Bergh and Fairbank, 2002; Scandura and Williams, 2000), and the Entrepreneurship literature as well (cf. Busenitz, West, Shepherd, Nelson, Chandler, and Zacharakis, 2003; Grant & Perren, 2002). However, as Smith and Duchon (2009) highlight relying on the information posted on various university and college websites can be problematic. For example, website information can be expected to present a "best face" view of a program that may not coincide with student accounts of their experience, or outside "objective" reviews. Yet, peer evaluation and "objective" data are important parts of the programs' ranking. Thus it is reasonable to accept accounts of what the programs claim they are doing because even if the claims cannot be fully substantiated, the claims at the very least represent what the programs believe they ought to be doing. In order to materialize our intentions we used the list of the Financial Times European

Business School Ranking for 2011 (the list is available at the Appendix of this paper).

## V. ANALYSIS OF THE RESULTS

Entrepreneurship as a distinctive course or an organized program of studies is offered in undergraduate, graduate, or a specific training course (professional, summer school, etc). The majority of the institutions of the sample include such a course in their curricula. Either as a distinctive organized focus or as an option embedded within their existing structures. Thus, entrepreneurship has been delivered even as a workshop, executive, postgraduate, summer school topic. The courses reported were: Entrepreneurship; Business plan; economics of entrepreneurship, Entrepreneurship management, Entrepreneurship in tourism, Family entrepreneurship. Here we focus our analysis on reporting some preliminary results on the descriptive statistics of our study and on the embeddedness of entrepreneurship courses in the programs of the EBSs.

### *A. Descriptive Statistics*

The findings of our study reveal the attitude of European Business Schools (EBSs) towards entrepreneurship education. The majority of the EBSs of our list (65%) provide educational programs in entrepreneurship (Table 1). Those programs are usually limited in a number. Thus, the 40% of ESBs provide only one program in entrepreneurship. There are though, although limited in numbers ESBs that offer two or even more programs in entrepreuneurship, recognizing the importance of this discipline in business studies.

| Number of Programs | Number of EBSs | Percent |
|---|---|---|
| 0 | 26 | 35% |
| 1 | 30 | 40% |
| 2 | 14 | 19% |
| 3 | 4 | 5% |
| 4 | 1 | 1% |
| Total | 75 | 100% |

**Table 1: Entrepreneurship in Educational Programs in EBSs**

Additionally, as seen on the following table (Table 2) the majority of programs offered are usually developed at the postgraduate level (57%). Undergraduate studies remain away from teaching entrepreneurship and this takes place in a limited only number of schools (9%). This is an important founding of our research since it highlights the weak embeddedness of entrepreneurship studies in the undergraduate programs of the EBSs. At the same time, it is important to notice that there is only one institution offering both postgraduate and undergraduate programs in entrepreunership.

| Level | Frequency | Percentage |
|---|---|---|
| Undergraduate | 7 | 9% |
| Postgraduate | 43 | 57% |
| Postgraduate + Undergraduate | 1 | 1% |
| Training | 25 | SS% |
| Total | 76 | 100% |

**Table 2: Type of Programs**

We should also emphasize on the role of training since 33% of the insitutions of our sample operate training courses in entrepreneurship. This result is another fact relevant to the weak embeddedness of entrepreneurial studies in the curricula of EBSs. Although, they do recognize its importance as a field of study they prefare to offer distictive courses on the topic rather than employ and add those courses within their existing programs.

### *B. Analytics: The Embeddedness of Entrepreneurship in Education*

As far as the results of the content analysis are concerned we found that out of the 76 programs, the 74 of them have a different title. There are only two programs of studies that include the word entrepreneurship in their title (Full-time MBA: entrepreneurship and MSc Management: Entrepreneurship). More analytically, as exhibit on the following table (Table 3) we found that there are 76 programs relevant with entrepreneurship. These include in their title titles the following words as seen on Table 3. There are 29 programs that include entrepreneurship in their title. Additionally, there are 38 programs out of 76 that include a relevant word (entrepren*). We should also highlight the fact that entrepreneurship is most usually combined with innovation. Thus, there are 14 programs that include both words.

| Key Word | Number of Programs |
|---|---|
| Entrepreneurship | 29 |
| entrepren* | 38 |
| innov* | 17 |
| entrepren* and innov* | 14 |
| Total | 76 |

**Table 3: Entrepreneurship Relevant Programs**

In our analysis we also had an analytical look inside the structure of the programs by studing their curricula. The following table (Table 4) provides information by offering insides on the programs of entrepreneurship in terms of the type of the courses and their categories (compulsory or elective). We are therefore examining the type of courses and the categories for those courses developed by the ESBs in order to have a view of

the structure of the programs. As our data show that we have a large number of compulsory postgraduate courses since the 62% of the programs are organized with compulsory courses. The same high presence of compulsory courses applies also for the undergraduate programs (65%). Only in the case of the training programs there is the posibililty for high flexibility, since there the vast majority of the courses are elective (60% vs 40% of compulsory). This is of course a natural result having in mind that those programs are usually offered outside the typical structures of education and thus allow for a better flexibility to emerge.

| Type of Course | Categories | | | | | |
|---|---|---|---|---|---|---|
| | Postgraduate | % | Training | % Undergraduate | % | Total Cources |
| Compulsory | 163 | 62,2% | 25 | 39,7% **24** | 64,9% | 212 |
| Elective | 99 | 37,8% | 38 | 60,3% **13** | 35,1% | 15G |
| Total | 262 | 100% | 63 | 100% 37 | 1GG% | 362 |

**Table 4: Type of Courses and Categories**

Finally, in the following table (Table 5) we present the findings of our content analysis in terms of the direction of the programs, their content in terms of their courses and for the structural characteristic of those courses (compulsory vs elective). As we see, there are four main catagories that emerge from our analysis. Firsty, we have those programs that offer a purely entrepreneurial direction. These programs usually are formed by courses relevant to business entrepreneurship, and have a large number of compulsory courses.

The second category includes programs with a combined - joint focus on both innovation and entrepreneurship. These programs include course on business entrepreneurship, innovation, creativity and leadership and operate with a majority of compulsory courses. The third category is a teleological one, meaning a category where the focus lies on specific approaches of entrepreneurship targeted to specific results. in our case we found that there is a large focus on thematic were we have applications of entrepreneurship in specific fields. in our case we found a large number of courses targeted to technological entrepenreuship and more specifically to e-business and informatics.

## VI. CONCLUSION AND DISCUSSION

Education in entrepreneurship poses a major challenge in EU today, as it is closely related to creativity, innovation and the launch of new

| Direction | Key Word | Programs and Courses | Compulsory | Elective |
|---|---|---|---|---|
| Entrepreneurial | Entrepreneurship | 45 Programs | | |
| | entrepren* | 8G (almost 25%) | 55 | 25 |
| | innov* | 75 courses | 44 | 31 |
| Entrepreneurship and Innovation | entrepren* & innov* | 11 Programs | | |
| | entrepren* or innov* | 146 courses (4G%) | | |
| | lead* | 13 courses | 8 | 5 |
| | creativ* | 12 courses | 16 | 3 |
| Social | soc* | 15 courses | 6 | 9 |
| Technological | tech* | 19 courses | 9 | 1G |
| | tech* or E-* or Inform* | 49 courses | | |
| Total Number | | 362 | 212 | 15G |

**Table 5: Descriptive Statistics of Content Analysis for Programs and Courses**

social entrepreneurship. There, we have mostly elective courses and smaler number of compulsory ones. Finally, the fourth category is a business ventures. Although regarded as a key instrument for mobilizing economic and social advancement, education and training in

entrepreneurship still suffer from inadequacies in the methods and practices followed and the lack of comprehensive educational models. Here, we present the findings of an empirical

survey on the educational programs in entrepreneurship in the "top" European Business Schools, according to the FT 2011 ranking list. We adobe a content analysis approach in order to examine the objectives and the structure of such programs, reveal their characteristics and further analyze their educational approaches. The findings reveal the attitude of European Business Schools towards entrepreneurship education. Today, there is already a large number of the (top) European Business Schools provide educational programs in entrepreneurship which are usually developed at the postgraduate level. The analysis of the curricula and the educational methods of those programs reveal the most important topics of interest and at the same time help us to highlight best practices for the education of future entrepreneurs.

This paper is the first part of a greater research setting aiming to develop curriculum and educational models for teaching entrepreneurship. The empirical survey of the practices of the top European Business Schools is a starting point that offers a valuable input towards this process. Here, we presented the findings of an empirical survey on the educational programs in entrepreneurship in the "top" European Business Schools (EBSs), according to the FT 2011 ranking list. We adobe a content analysis approach in order to examine the objectives and the structure of such programs, reveal their characteristics and further analyze their educational approaches. The findings reveal the attitude of European Business Schools towards entrepreneurship education. Today, there is already a large number of the (top) European Business Schools provide educational programs in entrepreneurship which are usually developed at the postgraduate level or as independent training programs. The analysis of the structure and the curriculum content of those programs reveal the most important topics of interest and at the same time help us to highlight best practices for the education of future entrepreneurs.

The above analysis took a broader view on entrepreneurship to understand the trends and to highlight the importance of universities in facilitating and promoting entrepreneurship. Entrepreneurship is seen as a crucial factor in enhancing economic activity and development. The analysis of European Union policies, OECD guidelines and consulting agencies indications demonstrated that entrepreneurship is vital for the economic development of a region. This analysis pointed forward the benefits of entrepreneurship as well as the constraints that the full development of entrepreneurship faces. It could be concluded from this analysis that there should be a focus on entrepreneurship regions in which there will be policy development from the governments to facilitate the development of learning, education and culture for entrepreneurship. Following that aspects on entrepreneurship education were discussed. The promotion of entrepreneurial spirit and competence within education is the basic approach to promote the entrepreneurial learning of individuals, social settings and organisations. Through the analysis of how entrepreneurship is taught it showed that some programs tend to be more task oriented rather than behaviour oriented, focusing on specific skills for small business management such as finance and marketing, as opposed to creativity, innovation and problem solving abilities.

For entrepreneurship to be taught should mostly focus on a concept for personal growth. Bepart (2006) report concluded that entrepreneurship is an interaction and does not exist in a vacuum. As an entrepreneur one would integrate others' expectations and outside developments into one's own ideas and activities. Thus, reflection and interaction are core dimensions of entrepreneurial competence. Learning which aims at improving reflection and interaction contributes to personal growth. The report concluded that is entrepreneurship education and training are based on the learning goal of personal growth, entrepreneurship pedagogy is enabled, thus, supporting entrepreneurial activity.

Teaching entrepreneurship should be mostly aimed at supporting initiative and creativity. It should also incorporate methods which support experiments, alertness, critical and analytical thinking, interaction and avoid punishment of mistakes. Teaching methods should become more interactive and multidisciplinary and move away from the classic lecture-style teaching. It is imperative that most individuals from different academic and business backgrounds are involved in this process. Linked to this is the argument that entrepreneurship curricula should not be limited to only business studies. They shall provide the opportunity for students coming from different backgrounds to test their ideas, exchange views and collaborate so that to increase their entrepreneurial mind-set. Courses on entrepreneurship should focus on developing behaviour as well as skills and should promote the

process of becoming an entrepreneur. Learning should be based on interaction and on the practical aspects of entrepreneurship not on traditional lecturing and case study methods. Overall, universities are the catalysts for entrepreneurship as they provide the link between academia, business practice and the government. Finally, future reseach should emphasize on the analysis of the curricula and the educational methods of the programs studied in this paper. Such an effort would reveal the most important topics of interest and at the same time help us to highlight best practices for the education of future entrepreneurs.

## VII. ACKNOWLEDGEMENTS

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**Appendix 1: European Business School Rankings 2011**

| Current rank | 3 year average rank* | Business School | Country | Full time MBA 2011 | Executive MBA 2011 | Masters in Management 2011 |
|---|---|---|---|---|---|---|
| 1 | 1 | HEC Paris | France | 6 | 1 | 3 |
| 2 | 3 | Insead | France | 2 | 4 | |
| 3 | 2 | London Business School | UK | 1 | 6 (3) | |
| 4 | 6 | Iese Business School | Spain | 4 | 7 | |
| 5 | 4 | IMD | Switzerland | 5 | 8 | |
| 6 | 5 | IE Business School | Spain | 3 | 5 | |
| 7 | 7 | Rotterdam School of Management, Erasmus University | Netherlands | 14 | 19 (11) | 8 |
| 7 | 8 | Esade Business School | Spain | 7 | | 10 |
| 7 | 16 | SDA Bocconi | Italy | 10 | 28 | 24 |
| 10 | 12 | Essec Business School | France | | 15 | 6 |
| 10 | 13 | University of Oxford: Saïd | UK | 9 | 12 | |

| Current rank | 3 year average rank* | Business School | Country | Full time MBA 2011 | Executive MBA 2011 | Masters in Management 2011 |
|---|---|---|---|---|---|---|
| 12 | 10 | ESCP Europe | France / UK / Germany / Spain / Italy | | 14 | 2 |
| 12 | 19 | Universität St Gallen | Switzerland | 30 | 31 | 1 |
| 14 | 16 | Imperial College Business School | UK | 15 | 10 | 11 |
| 15 | 13 | City University: Cass | UK | 12 | 12 | 14 |
| 16 | 13 | Vlerick Leuven Gent Management School | Belgium | 17 | 32 | 33 |
| 17 | 15 | Cranfield School of Management | UK | 13 | 21 | |
| 18 | 20 | Warwick Business School | UK | 19 | 17 | 43 |
| 19 | 18 | Stockholm School of Economics | Sweden / Russia / Latvia | | 27 | 15 |
| 20 | 13 | EM Lyon Business School | France | 29 | | 4 |
| 20 | | WHU Beisheim | Germany | | 9 | 5 |
| 22 | 21 | Aalto University School of Economics | Finland | | 23 | 31 |
| 22 | 22 | London School of Economics and Political Science | UK | | 1 | 12 |
| 24 | 32 | Tilburg University: TiasNimbas | Netherlands | 25 | 35 (20) | 50 |
| 25 | 21 | University of Strathclyde Business School | UK | 21 | 33 | 24 |
| 25 | 28 | Mannheim Business School | Germany | | 15 | 9 |
| 27 | 31 | Eada | Spain | 23 | 38 | 35 |
| 28 | 38 | WU (Vienna University of Economics and Business) | Austria | | 18 | 16 |
| 29 | 25 | Grenoble Graduate School of Business | France | | | 7 |
| 29 | 27 | University College Dublin: Smurfit | Ireland | 22 | 24 | 55 |
| 31 | 31 | Ashridge | UK | | 26 | |
| 32 | 28 | Edhec Business School | France | | | 13 |
| 33 | 43 | Henley Business School | UK | | 22 | |
| 33 | 51 | Catolica Lisbon School of Business and Economics | Portugal | | 39 | 60 |
| 35 | 37 | Nyenrode Business Universiteit | Netherlands | | 33 | 57 |
| 35 | 41 | Euromed Management | France | | 25 | 28 |
| 37 | 36 | Bradford University School of Management | UK | 25 | 35 | 49 |
| 38 | 41 | Manchester Business School | UK | 11 | | 53 |
| 39 | | Nova School of Business and Economics | Portugal | | 39 | 56 |
| 40 | 31 | Copenhagen Business School | Denmark | | 30 | 36 |
| 40 | 47 | Politecnico di Milano School of Management | Italy | 28 | 37 | 62 |
| 42 | | ESMT European School of Management and Technology | Germany | | | |
| 43 | 40 | Lancaster University Management School | UK | 16 | | 58 |
| 44 | 36 | NHH | Norway | | | 39 |
| 44 | 37 | Durham Business School | UK | 17 | | 54 |
| 46 | 42 | Solvay Business School | Belgium | | | 23 |
| 46 | 42 | University of Cambridge: Judge | UK | 8 | | |

| Current rank | 3 year average rank* | Business School | Country | Full time MBA 2011 | Executive MBA 2011 | Masters in Management 2011 |
|---|---|---|---|---|---|---|
| 46 | | HHL-Leipzig Graduate School of Management | Germany | | | 17 |
| 49 | 58 | University of Edinburgh Business School | UK | 24 | | 52 |
| 50 | 46 | ESC Toulouse | France | | | 18 |
| 51 | 46 | Audencia Nantes | France | | | 19 |
| 51 | 48 | IAG-Louvain School of Management | Belgium | | | 20 |
| 51 | 51 | Rouen Business School | France | | | 20 |
| 51 | | HEC Lausanne | Switzerland | | | 20 |
| 55 | 53 | Maastricht University School of Business and Economics | Netherlands | | | 26 |
| 55 | 55 | Bem Bordeaux Management School | France | | | 26 |
| 57 | 41 | Aston Business School | UK | | | 29 |
| 57 | | Skema Business School | France | | | 30 |
| 59 | 51 | Reims Management School | France | | | 31 |
| 60 | 47 | Kozminski University | Poland | | | 33 |
| 61 | | IAE Aix-en-Provence Graduate School of Management | France | | | 37 |
| 62 | 57 | Antwerp Management School | Belgium | | | 38 |
| 63 | 45 | University of Bath School of Management | UK | | | 40 |
| 63 | | Aarhus School of Business | Denmark | | | 40 |
| 63 | | Leeds University Business School | UK | 27 | | 61 |
| 66 | 62 | University of Cologne, Faculty of Management | Germany | | | 42 |
| 67 | 63 | ICN Business School | France | | | 46 |
| 67 | 67 | ESC Clermont | France | | | 43 |
| 67 | | Warsaw School of Economics | Poland | | | 45 |
| 70 | 67 | ESC Tours-Poitiers | France | | | 48 |
| 70 | 68 | BI Norwegian Business School | Norway | | | 59 |
| 70 | | University of Economics, Prague | Czech Republic | | | 47 |
| 73 | 70 | Koç University Graduate School of Business | Turkey | | 29 | |
| 73 | | Brunel University | UK | | | 51 |
| 75 | 65 | Birmingham Business School | UK | 20 | | |

# CREATING INNOVATIVE MOBILE APPLICATIONS – A STUDENT DRIVEN APPROACH

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**Abstract: At Arcada University of Applied Sciences we have defined Digital Services as our strategic focus area in research, development and innovation (RDI). The ARBIT research group has focused on creating innovative and value creating mobile applications. The challenge of this RDI work is that it has to be conducted by bachelor students in multidisciplinary teams.**

**This problem has been approached by engaging teachers from three degree programmes. The critical degree programmes for creating mobile applications are business, IT and online media. The project in focus of this paper was conducted during the academic year 2010-2011. In the project the students developed two mobile applications, the Bus Tracker and the Event Manager. The project ended with real life tests of the two mobile applications which will be further discussed in the paper.**

**The results of the project can be summarized in increased knowledge of student recruiting, pedagochical challenges related to project management and innovation, as well as application testing in an external partners real business context.**

**The main contribution of this paper is the increased understanding of the innovation process when engaging students from different competence fields in a project with a common aim.**

**The action oriented approach to the project has given the ARBIT research group a valuable hands-on experience of engaging students in innovative RDI work.**

**Keywords:** Mobile applications, bus tracker, event manager, living lab

## I. INTRODUCTION

A new digital industry has rapidly been developing during the first ten years of the 21st century. This phenomenon is a megatrend where the industrial revolution of the 19th and 20th century with its focus on materia is followed by a technological revolution anticipated to last for two hundred years (2020-2219) with its focus on immateria (Laurento 2010, 14-15). The immateria here refers to the intangible digital services that are developed based on the information technology breakthroughs made during the latter part of the 20th century. The development of the internet during twenty years has been an important IT architecture that has enabled tools and services to be developed, e.g. Google, Wikipedia, Facebook and YouTube. Parallell with this development the telecommunications field has created a mobile device and network infrastructure that is capable of transferring large amounts of data. The mobile phone has therefore changed its role as merely a voice communication and SMS device to become a mobile internet and application device. The explosion of software applications for smartphones, tablet computers and social media has created nearly 500,000 jobs in the United States since 2007 (TechNet.org). This so called App Economy is constantly creating digital services for consumers and businesses.

At Arcada-University of Applied Sciences in Helsinki, Finland, digital services is the strategic focus area of the research, development and innovation (RDI) work. As a result of mobile technology developments the ARBIT research group has decided to focus on creating innovative mobile applications. During the academic year 2010-2011 ARBIT conducted a multidisciplinary RDI project where two mobile applications, the Event Manager and Bus Tracker where developed and tested. In this paper the project will be described and reflections will be made on the critical structural, process and pedagogical issues involved in a student driven RDI project.

## II. THE AIM OF THE PROJECT

The aim of the project was divided in three challenging RDI areas:

i) To create a student driven approach
ii) To create and develop two innovative mobile applications
iii) To test the two mobile applications in a real life context

These three areas will be discussed with a simple two-way approach where every area is divided in description and reflections made. The reader should acknowledge that there were numerous activities that were new for the involved teachers, i.e. the project process was not only a valuable learning experience for the students but also for

the involved teachers. Three important actors were involved in developing and testing the two mobile applications. First, the students that are in the ”drivers seat” when it comes to this RDI approach. Second, the partners that gave us important access to their real life context to test the applications in. Last but not least the ARBIT research team with its teachers that actively steered the project forward.

## III. THE STUDENT DRIVEN APPROACH

The student driven approach is multidisciplinary involving bachelor students from three degree programs at Arcada. The degree programs are business, IT and online media. To be able to mobilize students in three degree programs require that teachers in all three programs are involved and committed to this approach. To mobilize the teachers were easy because the ARBIT research team had allready earlier involved key persons in the three programs. This was done in a project where we identified what we could do together and how we should start to work on the chosen strategic focus area of digital services. As a result of this work we set our focus on mobile applications.

The engaging students involved first of all planning how the students could in practise be involved in a RDI project that lasted up to 7 months. The students' daily studies involve numerous different courses that are usually designed in 5 credit units per course and last in average 8-10 weeks. This project would demand both work and time vise much more. For this purpose we have developed at Arcada an individual profile module that can be used to tailormake individual solutions for a student. In practise this means that the students can work on a RDI project for a longer period of time and receive the appropriate amount of credit units for their work. We therefore started to define the needed work and activities within the project when it comes to business, IT and online media students. The business students tasks became to identify the user value with the applications, the distribution channels for launching applications (i.e. App Store research) and to lead the project group. The IT students main tasks were to do the programming of the applications on the chosen technical platform. The online media students tasks were focused on developing the graphical user interface of the applications. These tasks then became the aim of the project for the different students. Apart from the aim of the project for each student an individual profile module should include the learning outcomes, the student workload, the examination, the timetable and the external partner.

The second step in the project was planning and executing the recruitment of students. For this purpose we created and executed a recruitment campaign, i.e. an attractive A4 was formulated to communicate this special opportunity to students in all three degree programs. Especially we emphazised the practical and demanding experience for a student to take part in a real RDI project ending with a test in a business partners context. This experience would later be an important ingredient in the students CV. Based on the campaign we got the applicants we needed. As indicated in figure 1 each mobile application needed one student per degree program. Thereby we had created two multidisciplinary student driven project task groups.

The project was then started with a kick-off event where all the students and teachers met. At the kick-off the project leader (i.e. author of the paper) presented the whole project, its aim and the student groups' tasks. Among the teachers we had also decided that each mobile application would have one reponsible teacher that the project manager (business student) would report to. The responsible teacher would also support the group in the RDI process. The other teachers in the ARBIT team acted as expert supevisors for their specific field, i.e. IT, graphical user interface or business.

Based on the above description of engaging students in the project we here want to reflect on the positive and more challenging issues concerning mobilising students in RDI projects.

Positive issues:

i) good tools developed, individual profile module and recruitment campaign
ii) teachers very committed and engaged
iii) student interest to participate
iv) the test; a clear goal and exciting moment for the student groups
v) learning to work with students with another educational background
vi) practical project work with a clear goal, not only an assignment in a course

Challenging issues:

i) project leadership; both students and teachers
ii) students not communicating within the group
iii) students are used to be steered, difficult to be pro-active

iv) difficult with ”command-chain”, one student just informed quitting the project

As summary we can conclude that engaging students in RDI projects is challenging but at same time an enormous potential for valuable learning experiences for the students. This project clearly showed that a more systematic and steered process is recuired.

## IV. THE INNOVATIVE MOBILE APPLICATIONS

The two mobile applications have been developed to prototypes during 2010. The applications are used on so called mobile smart phones.

The Event Manager application work on an event organizers smart phone. The organizer can with the application in a flexible way communicate with the visitors of an event. The communication is based on sms-messages. The visitor sends an sms registration to the Event Manager application and based on specific tags the organizer can send tailormade push-outs to the right target groups. All communication is done by using the sms technology which enables every visitor with a mobile phone to receive the tailor made push-out messages. The chosen development platform is QT with Symbian. The application creates value both to the event organizer and the visitor. For the organizer the benefit of the application is that important and spontaneous information can be sent easily “on the move” to specific target groups of visitors. Because the visitors can choose between different tags of interest they will get exactly the information they are interested in. The Bus Tracker is an application that require a user to have a mobile smart phone with GPS technology. The user, i.e. a bus passenger, can with the application receive online information of the buses time of arrival to a bus stop and information concerning the nearest bus stop to the passenger´s current location. The chosen development platform is HTML5.

The development of the two applications to prototypes where done by an IT student. The technical development work of the Event Manager mainly included programming and creating a database for storing the telephone numbers and the tags. The application then combines the telephone numbers with the correct tags. The Bus Tracker application is technically more advanced and complex. This is due to the development of suitable algorithms that can estimate the time of arrival for a bus to the closest bus stop where the person is standing. This requires two GPS senders, i.e. one on the bus and one in the users mobile phone. Because the buses in Finland do not yet have GPS senders we solved this problem in the tests by using a mobile phone with GPS to send the position data from the bus. The mobile phone on the bus sends the position data to the Bus Tracker application that will register the position of the bus and show the position graphically on a map (Google Maps) in the users mobile phone. The users own position on the map is also shown. Apart from this the application will show in time (hours/minutes) when the next bus will arrive to the bus stop and also when it has passed the bus stop.

In the project the technicality of the two applications were further developed and especially the graphical user interfaces were created. The graphical user interfaces were designed by two online media students. This work was mainly done by using in-design and photoshop but the implementation in the applications was not established. As a reflection of the technical and graphical user interface development of the two mobile applications we identified certain positive and challenging issues in the project.

Positive issues:

i) the IT student was extremely motivated to create real applications that would be used and tested
ii) IT-student´s very pro-active approach to problem solving, e.g. chatting with Nokia developers
iii) Creative and user oriented approach to graphical user interface development
iv) Quick adaptation to change of technical platform concerning Bus Tracker from Symbian to HTML5 when Nokia announced Windows Phone focus in spring 2011

Challenging issues:

i) IT students and online media students communication and cooperation
ii) The graphical user interface was not implemented in the applications
iii) The use of a mobile phone as GPS sender on the bus, i.e. no installed GPS hardware on Finnish buses

As a summary we can conclude that the development of the applications from “scratch” to ready prototypes was very successful. The students were motivated and pro-active. However much better communication between IT and online media students is needed.

## V. THE REAL LIFE TESTS

The general method used here is not that of a test lab but rather one of a living lab. A living lab method as defined by Mitchell at MIT is: "Living Labs represent a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts". Apart from the technical functionality of the tested mobile applications the user of the application will here be in focus. The living lab method´s value lies in the fact that the user of the application is placed in the real life context and gets an opportunity to try out all aspects of the application on their own mobile phone. The real life tests of the Bus Tracker took place on the buses of Borgå Trafik in April 2011 and the test of the Event Manager took place at the largest handball tournament in Finland, Sjundeå Cup, in May 2011. The Sjundeå Cup event is a huge event with around 3000 players and about 2000 spectators. The three focus areas of the test were; the technical functionality, the usability and the value creating issues.

The approach to the technical functionality of the applications were different. In the case of the Bus Tracker the technical features were first tested by the IT student. The purpose of the IT students test was to see that the algorithms developed resulted in satisfactory results concerning the estimated time of arrival of the bus to the bus stop. The tests indicated good estimation capability. After that a small user group of three passengers used the application as it would be used in a real life situation. The users got the application downloaded on a smart phone. The smart phones used were iPhone with iOS, Samsung with Android and Nokia with Symbian. The functionality of the map function was problematic on the Nokia due to the fact that the web browser did not support geo-location. On the two other smart phones the application worked reasonably well. The technical functionality test of the Event Manager at the Sjundeå Cup event was done by an IT student. The test indicated problems with the connection between tags and phone numbers in the database. Visitors that had chosen two tags got information only concerning the first tag in their sms.

The usability of the applications was an important part of the real life tests. In the case of the Event Manager the communication between visitors and the organizer was tested partially. By partially we mean that the organizer was not the one using the application but rather the students steered by the organizer. This decision was made due to the lack of organizer´s time. However the visitor side was mobilized exactly as in a real situation. We had printed small cards (credit card size) that informed the visitor of the way to take part in the test. The visitor should choose one or both of the two tags either Final or Info and send an sms message to the "organizers" mobile telephone and the Event Manager application sends automatically a welcome message back. The Final tag would give information concerning the finals and the Info tag information about for example lunch, product offers etc.. As mentioned earlier the technical functionality connecting the tags and the telephone numbers did not work satisfactory for those visitors that chose both tags. This lead to a bad user experience. Another problem was to activate the users to really try out the application. They might have taken a card from the student but they did not necessarily send an sms message but rather put the card in the pocket. However we had approximately 130 visitors that actively used the service. The graphical user interface of the Event Manager was not tested because the implementation was not done and because the organizer was not really using the application. However with the Bus Tracker the graphical user interface was used by the test persons. It seemed that they could use it fairly easily but some had problems with using the new interface of a touch screen.

The customer value evaluation was the responsibility of the business students. The value of the applications are based on mobility, i.e. the information is instant and following a where-and whenever logic. Thus the user get the relevant information exactly when they need it and also choosing what they need. The customer value of the Bus Tracker is clear due to the critical information about when the bus is at the bus-stop. This gives the customer a possibility to optimize their usage of time while minimizing the need to wait at the bus at the bus-stop. The value of the Event Manager was indicated by some users by stating; "The application gives me the information I want and need", "I do not even need to be at the event to get results". We therefore see that both applications are valuable for potential users but we need to get some technical and usability problems fixed. Based on the real life tests we identified certain positive as well as challenging issues:

<u>Positive issues:</u>

i) external partners very interested and engaged in the tests
ii) students active in the tests
iii) users interested in the applications

Challenging issues:

i) some technical problems
ii) graphical user interfaces not really implemented
iii) no real user test for Event Manager

As a conclusion the ARBIT team saw the enormous value of having external partners involved and getting access to their real life context. This user driven approach is critical to be able to understand all the different situations that can occur when a user uses the application for real.

## VI. CONCLUSIONS AND RECOMMENDATIONS

I this RDI project the aim was to engage students in the project and to mobilize them in developing two mobile applications that were finally tested in their real life context. The aim of the project was achieved. The main results of the project can be summarized in three areas.

First, the valuable experiences that both students and teachers have aquired in the RDI project. The students clearly indicated during the project that working with real state-of-the-art applications together with business partners was both challenging and rewarding. The challenges were not very suprisingly related to communication, i.e. too little communication and coordination within the student groups. However many issues encountered by the students are those that they might well encounter in their coming personal careers. The experience by the teachers included knowledge about what it requires to work with a multidisciplinary approach. The teachers are mostly used to work within their own discipline and focusing on their own area of knowledge.

Second, the student driven approach to RDI projects. This approach is appropriate when it comes to digital services. Typical for digital services and the new digital industry is that the innovations have been made by younger people. At this stage of the digital industry it seems that the attitude to risk, new innovative thinking and entrepeneurial attitude is something that younger people might be more suitable to. However, important to notice is that all people irrespective of age have different abilities to work individually, in teams and proctively. This was also clear with our students.

Third, the real life context is the ultimate test of a mobile application. The project clearly indicated that the test must evaluate all three tested areas, i.e. technical functionality, usability and value creation. Without evaluating all three the possibility to conduct a succesful launch of the application in an application store, e.g. OVI, Windows Phone or iPhone appstore, is more difficult. The only way to gain understanding of the customer behavior is by studying their user experiences in a real life context.

Based on this student driven RDI project we have collected a vast amount of knowledge of engaging students in innovative RDI projects. Next step in the innovation process is focusing on the commersialisation of mobile applications. This was partly done in this project were one student wrote his thesis on the ditribution of mobile applications through app-stores. However we need to launch an app in an app-store to understand the technical requirements and marketing issues related to launching the application in the store. Therefore we have decided to launch the Event Manager in Nokia´s OVI app-store. By this we hope gaining an insight into the distribution and sales of mobile applications. This work is now underway and our target is to launch Event Manager in OVI by the end of March 2012.

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# GREEN INNOVATION: RAISING THE INNOVATIVE CAPACITY IN THE DUTCH GREENHOUSE HORTICULTURE INDUSTRY

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**Abstract: The Dutch greenhouse horticulture industry has a reputation to uphold of world leadership in high-tech innovation. The sector is characterized by innovation in production systems and automation, reduction in and greater efficiency of energy consumption as well as sharing limited space. Aspects of marketing and product innovation are more underdeveloped. In this paper we first try to establish a pattern in the ways that entrepreneurs in the Dutch greenhouse horticulture industry innovate, where their sources of information to innovative ideas lie and whether these (open) innovation strategies contribute to innovation performance. We continue by focusing on the question how the grower in the greenhouse horticulture chain can create added value and gain competitive advantage through market-driven innovation strategies and to what extent collaboration with others, both in gathering relevant information and in the implementation of innovative strategies, has influenced organisational success.**

**The paper introduces an innovation and entrepreneurial educational programme. This programme aims at strengthening multidisciplinary collaboration between enterprise, education and research. Using best practice examples, the paper tries to identify barriers for market-driven innovation by looking at the resistance from the existing chain, the amount of support from (local) government, the knowledge infrastructure, knowledge development and knowledge dissemination. The paper illustrates how companies can realize growth and improve the innovative capacity of the organization as well as the individual by linking economic and social sustainability. The paper continues to show how participants in the programme develop competencies by means of going through a learning cycle of single-loop, double-loop and triple loop learning: reduction of mistakes, change towards new concepts and improvement of the ability to learn. Furthermore, the paper discusses our four-year programme, whose objectives are trying to eliminate interventions that stimulate the innovative capacity of SMEs in this sector and develop instruments that are beneficial to organizations and individual entrepreneurs and help them make the step from vision to action, and from incremental to radical innovation.**

**Finally, the paper illustrates the importance of combining enterprise, education and research in networks with a regional, national and international scope, with examples from the greenhouse horticulture sector. These networks generate economic regional and national growth and international competitiveness by acting as business accelerators.**

**Keywords:** innovative capacity, value creation, branding, marketing, greenhouse horticulture

## I. INTRODUCTION

The Dutch greenhouse horticulture sector is generally characterized by small scale, often family run businesses. On the other hand, the Dutch greenhouse horticultural industry takes up a world leadership position in high-tech innovation. The dynamics of the sector are innovation in production systems and automation, reduction in and greater efficiency of energy consumption as well as sharing limited space. Earlier analyses show that entrepreneurs in the greenhouse horticulture industry have traditionally focused on cost leadership strategies. Over recent years however, the industry has experienced the strong pressure of international competition. This means that competitive advantage and sustainable growth of individual enterprises are no longer a certainty. Yet, the sector's ambition is to innovate better, grow faster and become more sustainable than the competition in the rest of the world. Realizing this ambition requires strengthening the knowledge base, stimulating entrepreneurship and innovation (not just technological, but especially business process innovation). It also requires educating and professionalizing people. To help realize this ambition we have developed several regional innovation programmes. The challenge lies in marketing innovation, in customer relationship, in developing new product/market combinations and in innovative entrepreneurship. Innovations in these fields are difficult to implement and require efforts outside the traditional comfort zone of the individual entrepreneur, while return on investments is less predictable than it is for

innovations in more advanced technology. In a recent study (Alkemade, Hekkert and Farla, 2010) two innovation strategies are considered important in the mature stage of a sector's development. They involve initiating new life cycles through product innovation and realizing higher margins through product differentiation based on marketing innovations. The authors of that study propose that one important reason for directing more attention to these innovation strategies is that, if successful, these generally generate greater economic gains than the current process innovations and cost competition strategy.

## II. THEORETICAL BACKGROUND

Historically, the Dutch greenhouse horticulture industry is renowned both for its export of products, and for its export of knowledge and entrepreneurship. The Netherlands are leading in cut flowers, flower bulbs and greenhouse technology. A sector analysis (Alkemade et al, 2010) shows that entrepreneurs in the greenhouse horticulture sector concentrate primarily on the technological, process driven innovations. This type of innovation focuses on production methods and this focus is characteristic for mature sectors of industry. Subsequently, for growers these technological innovations are closely linked to cost competition strategies and often result in low profit margins. Aspects of marketing and product innovation are more underdeveloped. The challenge lies in marketing innovation, in customer relationship, in developing new product/market combinations and in innovative entrepreneurship. Innovations in these fields are difficult to implement and require efforts outside the traditional comfort zone of the individual greenhouse horticultural entrepreneur, while return on investments is less predictable than it is for innovations in more advanced technology. In the study by Alkemade, Hekkert and Farla (2010) two innovation strategies are considered important in the mature stage of a sector's development. They involve initiating new life cycles through product innovation and realizing higher margins through product differentiation based on marketing innovations. The authors of that study propose that one important reason for directing more attention to these innovation strategies is that, if successful, these generally generate greater economic gains than the current process innovations and cost competition strategy. Initiating new life cycles is a niche strategy and can only be pursued successfully by a small number of entrepreneurs. Encouraging this type of innovation can best take place by building a new innovation system outside of existing institutions and structures. If effective, this new innovation system will help to bring about a cultural change in the entire greenhouse horticulture sector. Product differentiation as the second innovation strategy is considered more suitable for the entire Dutch greenhouse horticulture sector. It offers a means of shifting away from cost competition towards product competition, internationally as well as within the home market.

The virtual absence of reliable consumer information makes it hard for horticultural entrepreneurs to take strategic decisions on product innovation. Market research is often executed for the sole benefit of wholesalers or large retail organisations and seldom shared with growers. Conversely, the individual grower is often too insignificant an enterprise to be able to afford large-scale consumer market research. Furthermore, product innovations in the horticultural sector are notoriously difficult to implement. Creating new varieties or cultivars can easily take five years or longer and often is only successful at great cost. Marketing these new products raises the issue of how to brand them. Branding is the norm for manufactured and processed products, but horticultural products are generally fresh and unprocessed and have no brands associated with suppliers, growers or producers. Greenhouse horticultural products such as fresh vegetables, fruits and potted plants are usually marketed as generic products. Labelling in these cases is done to provide information on country or region of origin, e.g. New Zealand kiwis or Dutch cucumbers. Labelling is also seen for products that are produced by a collective group of growers, e.g. FreshQ tomatoes or Air-so-Pure potted plants. Labelling products by names of the individual grower comes very close to actually branding the product. Even though the development of a brand name for consumers can be expensive (Bunte, 2009), branding has gained increasing recognition as a marketing instrument to differentiate products in the horticultural industry (Koelemeijer, Leutscher and Stroeken, 2003). Most agricultural brands enable producers or firms to distinguish themselves from their competitors in the chain. Once a brand is established it provides a differentiated product for the consumer and increases the added value for the producer (Bagnara, 1996). Brands usually aim to meet consumers' desire for variety, quality and service, and usually allow producers to retain higher profit margins (Hayes and Lence, 2002). A complicating factor in the horticulture greenhouse industry is that large retail chains are not

interested in buying branded products, because they prefer to brand under their own private label. In spite of this, horticultural brands have been established in recent years around the world. The Dutch greenhouse horticulture sector has developed brands over the past decade such as Tasty Tom (tomatoes), Les Meilleurs (strawberries), Salanova (lettuce), Tinkerbell (sweet peppers) and Koppert Cress (mini vegetables).

Branding, only when combined with effective marketing, can help agricultural producers develop awareness and create consumer loyalty, increasing price premiums, which can lead to long-term and sustainable competitive advantages (Collart, Palma and Carpio 2011). For horticultural growers, understanding how promotion programmes influence branded horticultural products is essential to understanding demand for these products. It is equally important for knowledge institutes and innovation brokers (Batterink, Wubben, Klerkx, Gardère and Molegnana, 2008, Batterink, 2009) to understand the market orientation of horticultural growers if they wish to assist these growers in product innovation processes. For this reason marketing in small firms needs to be distinguished from marketing in medium sized and large firms (Verhees, Lans, and Verstegen, 2011). Marketing as an academic discipline has focused on large corporate organizations and has overlooked small firms (Hills, Hultman, and Miles, 2008). However, small firms are different from large firms and, consequently, marketing in such firms is likely to be different too. Compared to large firms, small firms and thus most horticultural growers, are more likely to (1) lack economies of scale, (2) experience severe resource constraints, (3) have a limited geographic market presence, (4) have a limited market image, (5) have little brand loyalty or market share, (6) have little specialized management, (7) make decisions under more imperfect information conditions, (8) have limited time per major management task, (9) rarely have professional managers, and (10) have a mixture of business and personal goals (Bjerke and Hultman, 2002; Carson, Cromie, McGowan and Hill, 1995; Carson and Gilmore, 2000; Hills, Hultman, and Miles, 2008; O'Dwyer, Gilmore, and Carson, 2009).

In order to implement these market-driven innovation strategies successfully it is important to create an innovation climate that supports entrepreneurs and helps them to overcome barriers they experience. Entrepreneurs innovate within the context of an innovation system (Kisha, Alkemade, Negro, Hekkert, 2011). Such a system consists of all actors and organizations as well as all rules and instruments that contribute directly or indirectly to the sector's innovative capacity. Examples of actors and organizations are greenhouse growers, suppliers, supermarkets, banks and greenhouse grower organizations. Examples of regulations and instruments are subsidy schemes, rules governing the trade in fruit, vegetables, flowers and plants but also the culture and customs within the sector as a whole.

The open innovation model, as introduced by Chesbrough (2003), emphasizes that the innovation process should be flexible and may cross-organisational boundaries, so that it enables the transfer of knowledge and capabilities to and from other independent organisations. In spite of the recent emphasis on open innovation by innovation management scholars, the empirical evidence of its relevance to innovating firms has so far surprisingly been limited to mainly high-tech industries (Krebbekx and Wolf, 2008). Results of a study by Batterink (2009) show that an increasing number of innovating firms adopt an open innovation strategy. There appears to be an increase in cooperation between different types of partners, such as suppliers, customers and knowledge institutes. The most prevalent cooperation partners are actors from within the supply chain and it appears that small and medium-tech firms are catching up with large and high-tech firms in pursuing open innovation strategies. For open innovation to be successful people in organisations need to be socially innovative (Harkema, 2004). This theory appears to be supported by the results of a large-scale study (Volberda, Jansen, Tempelaar and Heij, 2011) among 11.000 Dutch enterprises (not exclusively in the horticulture industry). Organisations develop significantly (-5%) fewer new products and services and invest in social innovation (working, managing and organising in a smarter, more dynamic and more flexible way). Furthermore, Volberda et al (2011) maintain that organisations implementing social innovation show better results for innovation (+31%), productivity (+21%) and growing market share (+20%) than those that do not. Social innovation requires more informal leadership, a higher adaptability profile and greater mutual trust. Social innovation appears to be a prerequisite to make good use of external knowledge. This implies that enterprises should become more socially innovative to be able to collaborate better with other enterprises and knowledge institutes (Woude, van der and Harkema, 2008, Pagter, de

and Harkema, 2009). In order to assist the entrepreneur in this process we have developed an innovation and entrepreneurial education programme, KITE120.

## III. RESEARCH QUESTIONS

The above aspects have led to formulating the central research question:

i) How do leadership, organisational structure and culture influence the innovative capacity of the greenhouse horticultural enterprise? This is visualised in Figure 1.

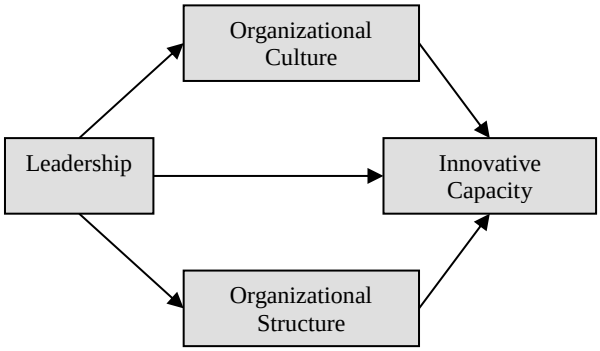


**Figure 1: Research model visualised**

Related questions are:

i) How can the grower and the supplier in the greenhouse horticulture chain gain sustainable competitive advantage through improving their networking capabilities?
ii) Which interventions contribute to a more constructive innovation process in order to make the step from strategic innovation to implementation?

The answers to these questions illustrate how companies can realize growth and improve innovative capabilities of both the organization and the individual in that organization by linking economic and social sustainability.

## IV. MATERIALS AND METHODS

The current KITE120 innovation and research programme aims at strengthening multidisciplinary collaboration between enterprise, education and research. Using best practice examples of a group of 30 companies in the greenhouse horticulture industry, a model is developed that might serve as a driving mechanism for process and product innovation and that fits the nature and characteristics of the companies in this industry. The activities in the greenhouse horticultural industry are embedded in a wider research programme that is partly funded by a grant from the European Fund for Regional Development (EFRO). The programme is known as KITE120, which is an acronym for Knowledge and Innovation Towards Entrepreneurship. The main aim is to support enterprises and assist them in making an important step forward with their organisation by guiding them through the process from ambition to action. In KITE-terminology, we help them make a metaphorical 'Amazing Jump'.

Apart from the enterprise objectives, educational goals were formulated for students and faculty, who participate in the programme. These concern professionalizing and raising the quality of education and knowledge circulation. The latter aspect deserves separate attention, as it is characteristic to research in the applied sciences. Professionalizing staff is characterized by the development of knowledge and skills that allow faculty to better reflect on, define and conceptualise professional practice. Undertaking research is an important part of this. During that process lecturers apply knowledge and in so doing bring it up to date. Subsequently, it is embedded in their teaching modules and curricula.

Considering these aims, we had to find a way of linking entrepreneurs, students and faculty. Our method consists of three elements:

i) a process model in which entrepreneurs, undergraduate students and faculty are brought together and collaborate within the fairly rigid system of the academic timetable in universities of applied sciences,
ii) a research model addressing several methods of data collection,
iii) a theoretical model that provides a framework for companies.

In our research programme the innovation model of Tidd and Bessant (2009) acts as a framework. They describe phases that an organisation should go through from strategic innovation to implementation. Four aspects are important according to the authors:

i) looking for opportunities and recognising them
ii) selecting opportunities and formulating a strategy
iii) implementing the strategy
iv) learning from that implementation

We use a modified version of the Tidd and Bessant model (see Figure 2) as we introduce reflection and learning stages after each of the steps in the model, thus introducing a continuous learning experience.

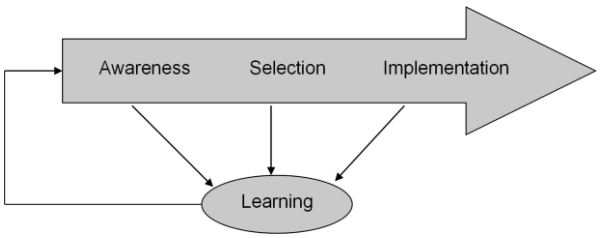


**Figure 2: modified innovation management model of Tidd and Bessant**

To illustrate the scope and layering of our innovation programme, some of the KITE120-projects are given here as examples: They fit the designated problem areas in the greenhouse horticulture industry.

i) promoting the use of direct current in the greenhouse horticulture industry. Together with a hardware producer we are looking for a stable infrastructure in and around the greenhouse to reduce installation cost and operational expenses for the grower.
ii) finding new business models for branding greenhouse horticulture produce in order to achieve competitive advantage for the grower
iii) developing new ways of reverse chain management in collaboration with a greenhouse horticulture consultant. Growers should benefit from this scheme through increased product demand
iv) finding a business model for innovative water reservoirs that solve problems deriving from the impending restrictions on reverse osmosis and waste brine disposal.

## V. DISCUSSION

If we observe changes and improvements within the industries of similar research programmes we have undertaken, our findings show (Van der Woude, 2008, De Pagter, 2009 and Boost et al, 2010) that innovation is both product and process innovation and in most cases incremental. Rather: what we do, we do a little better and / or faster. This is a recognizable pattern with entrepreneurs who develop their products to the demand of customers or end-users. Innovation here is re-active. We expect that the greenhouse horticultural industry does not innovate in this fashion, simply because there is a notable lack of knowledge on customer / end-user demand in comparison to the other sectors mentioned. Whether this means that this industry innovates pro-actively remains a matter for further research. Pro-active innovation in other sectors frequently goes together with larger companies having R&D departments. In the greenhouse horticulture industry this type of organisation is rare. Here the individual entrepreneur plays a crucial part, because it is the individual entrepreneur who started the company and consequently has an enormous impact on its development.

Although almost all companies innovate, our first observations show that there is no conclusive opinion on definition and importance of innovation for business growth among entrepreneurs. Most of them focus on product innovation, with the greenhouse horticulture industry as a notable exception. This is interesting, as it appears to be contradictory to Tidd and Bessant's finding that process and product innovation are closely interlinked, especially where the step form strategic innovation to implementation is concerned.

Considering the model of Tidd and Bessant (2009) as the 'looking glass' and framework through which we research and analyse the sector the following observations can be made:

To most entrepreneurs in the greenhouse horticulture industry scanning external developments and looking for opportunities is not an integrated part of everyday entrepreneurship. And if it is, entrepreneurs have difficulty in adapting and applying their findings to their own situations. The question is why so little attention is paid to external influences, knowing that they are an important source of information and are the basis for recognising opportunities. There are several reasons for this attitude: it is not considered important enough, entrepreneurs pretend or presume to know developments, it is too great a burden on the entrepreneur due to lack of time, and competencies and interests of the entrepreneur quite often do not lie in the field of research or strategy.

During the next phase in the innovation process, that of selecting opportunities and formulating strategies, the entrepreneur should select opportunities and translate them into a strategy that fits his organisation. This requires not only looking at people's competencies, at financial feasibility, but also at processes that offer the best chance to realise the formulated strategy. Within smaller organisations it is the entrepreneur who is crucial to decisions taken and to the culture in the organisation that influences the innovation process. The smaller the organisation, the bigger the influence of the entrepreneur appears to be.

Klerkx (2008) suggests that innovation intermediaries assist agricultural entrepreneurs with innovation processes, bridging the managerial knowledge gap (Bessant and Rush, 1995). This is on the assumption that innovation

is within the focus of the entrepreneur; that the entrepreneur is the "agent of change", who has sufficient absorptive capacity (Cohen and Levinthal, 1990) to learn how to innovate and be able to influence the innovative capacity of his organisation. Klerkx (2008) also shows the fragmentation in (types of) innovation intermediaries, from public to private, from for-profit to not-for-profit organisations. Klerkx does not focus on the role universities and colleges of higher education can play as both sources of knowledge and innovation intermediaries. Recent developments of this are the Green Knowledge Cooperative and the Greenport Campus Initiative.

Our research (Van der Woude, 2008, De Pagter, 2009 and Boost et al, 2010) shows that in spite of an independent analysis or external advice, the entrepreneur easily disregards the outcome of the analysis or advice if it does not fit his own perspective. This would seem to reduce some of the added value of innovation brokers in the agri-food business as advocated by Batterink (2009).

When implementing product innovation strategies, the entrepreneur should realise that process and people management play an equally important part. Through a clear implementation plan, such as the stage-gate model introduced by Cooper (1987) it is decided in advance which restrictions apply during product development stages and how to monitor progress. The process has built-in 'go' and 'no go' moments that should lead to successful market introduction of the new product of service. In fact this is the moment where ambition turns into action. This is quite a step where radical innovation is concerned, because there is a high degree of uncertainty about the success rate. In the case of incremental innovations the risk involved is considerably less.

However, earlier research (Van der Woude, 2008) also shows that in innovation processes in smaller enterprises a structured approach appears to be the exception to the rule. It is the entrepreneur who plays a pivotal role, at the expense of learning lessons and embedding experiences for future projects. It is our aim to develop the entrepreneur's competencies by means of going through a learning cycle of single-loop, double-loop and triple loop learning: reduction of mistakes, change towards new concepts and improvement of the ability to learn. This can more easily be effected when an entrepreneur withdraws from the daily routines and takes time to develop processes to professionalize his organisation and his employees.

## VI. IMPLICATIONS

In this paper we have described a model through which we aim to contribute towards regional development and improve the innovative capacity of SMEs in the greenhouse horticulture industry. The programme we developed to that end is aimed at gaining insight in the way SMEs in this sector innovate, and simultaneously professionalize lecturers and involve students in research. The multi-layered objective of our KITE120-programme is to try and eliminate innovation barriers among SMEs in the greenhouse horticulture industry and to develop instruments that are beneficial to organizations and individual entrepreneurs. A secondary aim is to help them make the step from ambition to action and from incremental to radical innovation. Metaphorically speaking we want entrepreneurs to make an 'Amazing Jump'.

Realizing this ambition requires strengthening the knowledge base, stimulating innovation, entrepreneurship and education. It also requires professionalizing people. It appears equally important to bridge the gap between the sub-sectors of Flowers and Food by developing and strengthening elements in the value chain, or conversely, by shortening the value chain. More interaction with sectors outside the glasshouse horticultural industry is welcome. This will bring on the need for more and better knowledge management and knowledge circulation.

We have illustrated the importance of combining enterprise, education and research in networks with a regional scope, with examples from the greenhouse horticulture industry. These networks generate economic regional and national growth and international competitiveness by acting as business accelerators. Subsequently, the need arises for programmes that focus on improving the image of the sector, if the sector is to remain attractive for entrepreneurs and their employees to work in. For the near and distant future most is to be gained from flexibly managing expectations and predictions and by reacting quickly to changing circumstances. Including organisational culture in times of innovation and including employees in the process are critical success factors. According to McGuire and Rhodes (2009) it is clear that effective innovation management starts at the top. Managers should never delegate innovation processes. Moreover, it is essential they themselves are committed to the change, if not, success is highly unlikely. By changing first and setting an example, management itself becomes the instrument of change. It helps if teams and individuals are open

to more than one opinion, set great store by collaboration with others and opt for experiment and growth.

What we need are visionary entrepreneurs; people who are prepared to think out of the box and who can come up with radical alternatives, charismatic leaders, who inspire and help their organisation forward. On-going research is necessary to provide a better insight into the ways innovation processes can be organised, considering the size of the greenhouse horticulture enterprises, considering the limitations in human and financial resources and considering the options for collaboration across the value chain.

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# TECHNOLOGY PUSH AND DEMAND PULL – PERSPECTIVES ON LIFE SCIENCES START-UP AND EARLY GROWTH COMPANIES IN AN ACADEMIC CLUSTER

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**Abstract: Traditionally, innovation has been seen as a process starting with a novel technology or innovation generated by an individual or a group of individuals. According to this perspective, it is then further developed into a new product or service, which is introduced to the market. This traditional "technology-push" concept of innovation has been the prevailing perspective in several industry sectors. However, several industry sectors have shifted towards having a customer focus as the starting point for innovation, hence shifting strategy towards "market or needs pull". There are different opinions in literature regarding utility of these perspectives. In the present paper, we analyzed three companies from the biomedical innovation cluster in Gothenburg; a medtech company (Carmel Pharma), a pharmaceutical company (DuoCort) and a medical information/service company (Internetmedicin). By using unstructured interviews we analyzed the innovation process from a technology push and market pull perspective. We also explored the importance of strategic alliances and networks, which have been expressed in literature as a crucial factor for success in life science start-ups and growth companies.**

**Our analysis of the three cases shows that in each of the start-ups, there was a mix of perspectives, and that there were frequent shifts from a "demand/market/needs perspective" to a "technology push perspective" during early growth and development. Our analysis demonstrates that innovators and entrepreneurs shift perspectives during the course of development of their early ventures and that strategic alliances and networks were of high importance in the innovation process.**

**Keywords:** Life Sciences, biomedicine, start-up, early growth, technology-push, innovation, market-pull, demand, mixed perspectives.

## I. INTRODUCTION

Innovation and knowledge is the core of life science companies (Hall and Bagchi-Sen, 2002, Thornblad and Hedner 2011). Traditionally, innovation has been seen as a process starting with a novel idea that is further developed into a new product or service and introduced to the market. This traditional "top-down" concept of innovation has been the prevailing perspective in several industry sectors. However, many sectors have now shifted towards having a customer focus as the starting point for innovation, hence shifting strategy from "technology push" towards "market/demand/need pull".

Interestingly, in the life sciences arena, biological/technological breakthroughs often initiate and represent major drivers of early innovations market demand is realized, sometimes in the form of user innovations, once the novel technology is present and available on the market (see Hedner 2012).

So far, little empirical research on has been performed in the life sciences in respect to the technology-push, demand (market/need)-pull (TPDP) perspective. This paper aims to provide an exploration of the innovation process in three early life science firms in relation the TPDP perspectives as well as the need for strategic alliances/networks for success.

## II. THEORETICAL BACKGROUND

### A. *Technology Push and Demand Pull*

The debate on the TPDP perspectives has been ongoing since Schumpeter (1934) articulated that the pace and direction of the innovation process is determined by the advances in the underlying scientific base i.e. entrepreneurs are driven by technological opportunity – technology push. In this perspective technology, generated outside the economic system or in large R&D laboratories of a closed innovation system, represents the leading driver for growth. Schmookler (1962) on the contrary, presented a view on innovation where firms innovate to maximize profit, why the market, and not the scientific base, is the prime mover of innovation – demand/market/need pull.

An overview of the different perspectives is presented in Figure 1.

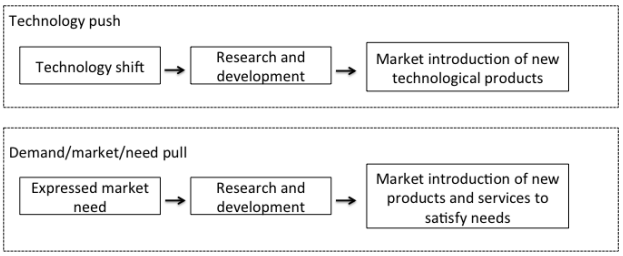


**Figure 1. Overview graphical presentation of demand/market/need pull and technology push perspectives.**

Since then, the dichotomy of technology push and demand pull in respect to innovation is commonly found in academic literature and several studies have been performed to further explore the drivers of innovation and to define the concepts.

Later research shows an agreement with the demand-pull view by Schmookler (1962) arguing that user "need" represents the most prominent driver of innovation and inventive activity in early businesses (for a review see Chidamber and Kon, 1993). Importantly, Mowery and Rosenberg (1979) pointed out that user "need" was a poorly defined measure of demand and that the construct should be more distinctly defined. More recently, the debate has been re-invigorated and Goldenberg et al. (2001) argued that technical attributes of inventions predicted market and financial success.

However, a view on the innovation process as a combination of the two drivers has also been presented. Research by Åstebro and Dahlin (2003) has shown that technological opportunity represents a major driver of innovative capacity and that it is mediated by expected profits. Fetterhoff and Voelkel (2006) states that technology push and demand pull have equal roles in defining the innovation process, which can be referred to as the innovation space, see Figure 2.

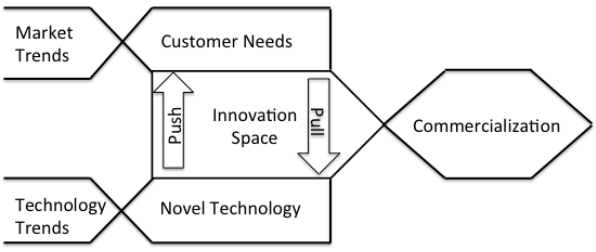


**Figure 2. Illustration of the "technology push" and "demand (needs) pull in respect to the innovation space (Fetterhoff and Voelkel, 2006).**

Hence, the linear approach to innovation presented in Figure 1 is being replaced by far more complicated structures involving complex systems of disruptive and discontinuous events (Brem and Voigt, 2009, Schmoch, 2007).

### *B. Technology Push – Market Pull in the Life Science domain*

Until now, little empirical research has been performed in the life sciences in respect to the Technology Push-Market Pull perspective in the early phase of firms. However, it has been shown that once a novel technology is present and available on the market there are a shift from technology push towards market pull in the life sciences arena (Hedner 2012). This as the early innovations makes the market demand activated, sometimes in the form of user innovations.

In the life science domain, small drug development firms present a technology push whereas larger actors in the pharmaceutical industry are more directed towards market pull (Renko et.al. 2005). Strategic alliances are often used for innovation and the alliances can include universities, biotechnology firms and larger companies (Hall and Bagchi-Sen, 2002). The innovation process in life science and biotechnology is therefore often complex as several actors often are involved in e.g. research, product development, manufacturing and marketing of a commercial product. Several studies shown that it is of great importance to the companies how well they succeed in creating and maintaining external networks for commercialization processes (Renko et.al., 2005, Hall and Bagchi-Sen, 2002, Gilsing and Nooteboom, 2005).

Looking at the innovation process in emerging biotechnology firms, the focus shifts from an initial technology focus towards a commercial focus in the development of the firms (Hamilton et.al., 1990, Schmoch, 2007). This theory was further strengthened by Hall and Bagchi-Sen (2002) in a study on the Canadian biotechnology industry. Their study showed that the innovation in emerging firms initially was science-driven rather than market need or demand driven. The study also showed that while scientific breakthroughs in the laboratory might have been the starting-point for innovation, market need was the primary driving force behind the push for further development of a product. Hence, the process was described as a combination of technology push and market pull. However, so far, little empirical research has been performed in the life sciences in respect to the Technology

Push – Demand (/market/need) Pull (TPDP) perspective.

## III. METHODS

### A. *Life Science Cases*

To further investigate the concept of technology push v.s. market pull in the life science domain three examples (Table 1) representing different life science solutions were selected; 1) Carmel Pharma, a medtech company; 2) DuoCort, a pharmaceutical company; and 3) Internetmedicin, a medical information/service company.

| | |
|---|---|
| carmel. Carmel Pharma | Carmel Pharma started out of the realization of risks for health professionals associated with handling of cytostatics. Initially, a professor of surgery came up with the idea of a closed system for cytostatic management in 1983. After initial problem formulation and prototype development, research was conducted to verify the new closed system which associated with lower risks handling cytostatic drugs. Carmel Pharma was then founded in 1994. |
| DuoCort | DuoCort has developed Plenadren, a replacement therapy for patients with chronic adrenal insufficiency. The company originated from research in endocrinology, and an idea for improved therapy for this patient group formed the basis for commercialization of a novel rapid release/slow release hydrocortisone tablet. The company was formed in 2004 and exited to a large pharmaceutical industry in 2011. |
| internetmedicin.se | In 1998 a team competed in the business plan competition Venture Cup with an idea of an internet site for medical doctors providing etc. up to date treatment procedures for different medical conditions. One of the members in the jury for the competition, became involved in the project and the collaboration lead to the medical information/service company Internetmedicin founded in 2000. |

**Table 1. Brief outline of the three life sciences companies analyzed**

The cases were analyzed using unstructured interviews and the reason for using case studies was that they have been stated to bee particularly useful in the TPDP research question as they provide rich details of the underlying process that is being observed (Chidamber and Kon, 1993). However, the disadvantage is the lack of generalizability of the findings and results. Therefore, available internet sources such as Google Scholar (sholar.google.com), PubMed (www.pubmed.com) and Elesevier (www.elsevier.com) were scanned for information to further enrich the analysis.

### B. *Research questions*

Until now, little empirical research has been performed in the life sciences in respect to the Technology Push – Demand (/market/need) Pull (TPDP) perspective.

Since there is a considerable lack of knowledge in respect to what forces represent the primary driving forces behind the early start-up and growth firms, we investigated the following research questions (RQs);

RQ1: Do early life science start-up and growth companies employ a predominantly technology push or market pull in the innovation process?

RQ2: Is the innovation focus shifting between TPDP perspectives in the early start-up and growth firms over time?

RQ3: What role do networks and strategic alliances play in terms of “technology push” and “market (demand) pull” during start-up and growth in life sciences companies?

## IV. RESULTS

### A. *Carmel Pharma*

The starting point for Carmel Pharma was an identified need as the inventor, working as a medical doctor, had started to become aware of how cytostatic were managed by the healthcare personnel. In addition, some reports had shown that management of cytostatic could be a health hazard for the people handling it. Hospitals had therefore started to make personnel utilizing fume cupboards or protective overalls. However, the use of cupboards was only reducing the contact with the cytostatic and the healthcare personnel did not appreciate the overalls since they did not want to treat patients in overalls with covered faces. Therefore, the idea came up of a closed delivery system, which would ensure that no one would get in contact with the cytostatic.

### B. *DuoCort*

Initially, the foundations of the DuoCort company was based on a patient need, recognizing the side effects and lack of compliance with conventional exogenous hydrocortisone substitution therapy for Addisson´s disease and other conditions of chronic adrenal insufficeiency (hypocortisolism and hypoadrenalism), which are rare, chronic endocrine disorders in which the adrenal glands do not produce sufficient amounts of steroid

hormones (glucocorticoids and often mineralocorticoids). Although treatment of these disorders has been available since the 1950ies, they have resulted in an increase in cardiovascular disease and metabolic complications such as diabetes and osteoporosis. A way of providing an improved therapy had been sought by the medical community for decades. This demand, or needs pull was identified by three medical doctors and one pharmacist who initiated a pre-study to come up with a novel concept to allow a more "physiological" administration of hydrocortisone to primarily reduce side effects and improve quality of life. During early commercialization, the concept of a novel immediate release/slow release tablet formulation was developed and later tested in formal clinical trials. The project was run from 2004 until 2011, when it was exited to a large pharmaceutical company.

### *C. Internetmedicin*

As in the previous cases, the starting point for the development of Internetmedicin was an identified need. This was evident since medical doctors carried around notebooks where they had written down information on different medical conditions e.g. symptoms and treatment procedure. Since Internet services became more common some medical doctors had started to utilize computers to register patient information etc. the idea of an internet site presenting information and up to date treatment procedures came up.

The company, Internetmedicin grew out of the realization to use a great number of medical experts to write and up-to-date descriptions of different medical conditions and best practice treatment procedures on their webpage. This is much in line with the role of strategic alliances in biotechnological innovation presented by Hall and Bagchi-Sen (2002). In addition, in agreement with the earlier cases, Internetmedicin presented a combination of technology push and innovation pus as the predominant driver of innovation. Looking over time, the initial demand (pull) focus was replaced with a technology push focus when having developed the Internet site. Once acceptance was reached, a more pull oriented innovation perspective has become predominant, as new Internet sites, in e.g. odontology, have been launched.

### *D. Comparison of the cases*

A summary of the overall findings to the research questions previously given in Table 2.

| **Research question** | **Carmel Pharma** | **DuoCort** | **Internet-medicin** |
|---|---|---|---|
| RQ1 – Push or pull perspective? | Combi-nation | Combi-nation | Combi-nation |
| RQ2 – Shift of focus over time? | Yes | Yes | Yes |
| RQ3 – Strategic alliances/networks crucial? | Yes | Yes | Yes |

**Table 2. Summary of the result.**

## V. DISCUSSION

The case reports demonstrate that Life Sciences innovators and entrepreneurs use a mix of technology push and marker (demand) pull strategies in the start-up and early growth of their companies.

Since early innovation models stated that the inventive activity was more or less linear, the technology push had a dominating influence over the demand market/need pull models early practice and debate. However, when more dynamic models of innovation evolved, involving complex systems of discontinuous and disruptive events the simple models been refined and less simplistic models of innovation have emerged.

Although the idea for the three companies analyzed in the present study, the cytostatic delivery system, the improved glucocorticoid therapy and the medical information site came from an identified demand. To build the business case around the idea, appropriate technologies and strategic networks and alliances were created early on. These networks and alliances proved to be very important for the further development of the start-ups, which is a perspective that has been discussed in previous studies (Hall and Bagchi-Sen, 2002, Renko et al, 2005).

As described by Hall and Bagchi-Sen (2002), the innovation process in firms often represents a combination of technology push and demand (needs) pull. Looking over time, the initial predominant demand (needs) pull focus was alternated with a technology push focus when trying to satisfy the different stakeholders over the course of product/project development. Once acceptance in the technology push perspective was reached, a more pull oriented innovation perspective became predominant. This agrees with the findings of Hamilton and coworkers (1990); the typical biotechnology start-up initially focuses on technical activities and later on

business priorities as the focus of innovation shifts toward commercialization.

### *A. Innovative start-ups and growth companies in academic clusters*

Innovations (both product and process) are the main force behind increased productivity, which in turn is the main source of long-term economic growth. The distinction between process and product innovations is particularly important for employment. The main reason is that the process is labor-saving innovations, while product innovation is a driver of job creation. Product innovations that either replace an existing product, or later are used as process innovations, have the greatest positive impact on employment. Product innovation is also the main mechanism behind the changes in production structure. In respect to the perspective of "growth accounting", the residual - or total factor productivity – is the key factor behind the acceleration in labor productivity and accounts for about half of that growth. More capital allocation per worker and better training of the employees account for about a quarter each (Abramovitz 1989, Denison 1985).

The residual is often called the 'technology factor' and this is largely a matter of 'knowledge advances.' Knowledge advances are related to both technological and organizational knowledge, and it does not matter where (at home or abroad) or the way in which knowledge has been developed (through organized research in universities or companies, individual inventors, or through experience and learning on the job). But knowledge as such does not contribute to increased productivity. It must be brought or "pushed" into production, i.e. companies' ability to absorb and use knowledge is critical. The way knowledge brought into and used by businesses is through innovation.

Innovation is the main source of increased productivity. Productivity growth is several tens of times higher in some knowledge-intensive industries than in others. Change in production structures in knowledge-intensive direction is important for productivity. The main force behind the change in production structure is product innovation in knowledge-intensive industries.

The increase in productivity can vary between one per cent per year in traditional industries and 30-40 per cent in some knowledge-intensive industries (such as computers and telecommunications products) (Edquist, 2002). Productivity is thus several tens of times higher in some industries. Changes in the structure of production in a knowledge-intensive direction are therefore critical to productivity development. The main force behind the change in production structure is product innovation in knowledge-intensive industries. Product innovation is thus an important dynamic force in the innovation system than process innovations (although the latter are by no means be neglected).

### *B. Technology push and demand pull for Life Sciences innovations*

In academic and other innovation clusters, academics invariably encounter solutions to biomedical projects. Ideas can be drawn from the "market pull" of sensing real or potential customer needs or demands, or from the "technological push" of outlining a technical solution, which lead to commercial project initiation, or lead to a more or less systematic innovation-seeking behavior.

The technology push perspective suggests that innovation is driven by science, and thus innovation drives technology and application. The initial scientific discovery is considered to trigger a sequence of events, which end in a technical or market application of the discovery. The technology push perspective thus stems from recognition of a new technology as means for enhancing innovation and market performance and that adoption of new technology could create substantial and sustainable competitive advantages taken that an appropriate structure and strategy was adopted (Chau and Tam, 2000).

From a classical economics' point of view, Schumpeter argued that the pace and direction of innovation would be determined by underlying scientific advances. His view was supported by Phillips (1966), who also argued that the user needs had a relatively minor role in determining the pace and direction of innovation. As an alternative model, Gauvin and Sinha (1993) proposed that there were two types of opportunities for adoption of new technology; either from productivity gains achieved by the new technology, or from expansion of demand that resulted from the replacement of the technological base.

On the other hand, the NP proponents argue that user needs are the key drivers of innovation adoption. For example, Meyers and Marquis (1977) retrospectively examined innovation within organizations. According to their results, more than 70% of the innovations were classified as need-pull, which suggested that organizations should pay more attention to the market needs for

innovation than focusing on technical development. In later work by Langrish (1972) the conclusion was that both the TP and NP models existed, but that the NP model was often employed. Zmud (1984) also noted that need-pull innovations were associated with higher probabilities for commercial success as compared to technology-push innovations. Additional researcher, such as Munro and Noori (1988), proposed that successful innovation would occur when a TP and the TP simultaneously emerge in a firm. Thus, according to this perspective, the integration of both generally contribute to more innovative solutions for early start-ups or growth companies.

Also, market instruments may be policy instruments, which may be implemented to achieve an increasing demand for products or services with particular characteristics, such as innovative life sciences or biomedical products or services. Increased demand for such products or services would be expected to result in a generally higher level of innovation in response to shifts in demand patterns.

In addition to the TO and NP perspectives, the concept of user-driven innovation was first described by von Hippel (1976). In his work, he documented a number of cases where customers modified or adapted existing products according to their own needs before the industry did. A number of related concepts have been described in the literature, including early customer integration, participatory design, and user-centered development (Grunert et al. 2008). These are variations of the NP concept, focusing more on user-oriented innovation which is defined as a process towards the development of a new product or service in which an integrated analysis and understanding of the users' wants, needs and preference formation play a key role. Additional terms and emerging paradigms used in this area of innovation science are; crowd-sourcing and crowd-casting (Hedner et al 2011).

It may also argued that the implementation of a market orientated "pull" or "needs" strategy in innovation and NPD processes can also be an important step in leading technology "push" oriented organizations into a more market-oriented perspective (Kok et al., 2001). The key stages in the adoption of the consumer-led NPD concept closely follows a market-oriented TP approach; need identification, idea development to address the need, product development to develop the idea followed by the market introduction of the product to fulfill a defined need (Urban & Hauser, 1993).

Key issues in a NP oriented consumer-led NPD process a thorough understanding of its own and the competitors' core competences and unique strengths, as well as dynamic market demands. With such a strategy, potentially attractive markets and ideas can be found, and an market-informed decision can be taken to initiate a development process (Urban & Hauser, 1993). The design stage to follow, seeks to identify the key consumer benefits the new product or service, and also the positioning of such perceived benefits in respect to the competition. Also of strategic importance is to early on submit potentially rewarding ideas to the test and review of the target consumers.

## VI. CONCLUSION

The present paper addresses the classical discussion whether a "technology-push" concept of innovation or a "market or needs pull" is the prevailing perspective in innovative life Sciences start-up and growth companies. In the three Life Sciences companies were analyzed; a medtech company (CarmelPharma), a pharmaceutical company (DuoCort) and a medical information/service company (Internetmedicin), all used a mix of push and pull dynamics during early development and growth.

This case report demonstrates that Life Sciences innovators and entrepreneurs use a mix of technology push and demand pull strategies in the start-up and early growth of their companies. Therefore, the innovation process can not be stated as neither technology push nor market pull solely. In fact, the processes have been a combination of the two innovation drivers, especially over time. The initial ideas for the three start-ups were all a result of an identified need and the initial pull focus was at some point altered to technology push as the predominant driver. However, as described in literature, the innovation process became more focused on market pull in the later stages of the innovation process. In addition, networks and strategic alliances were crucial in the development of the start-ups and growth companies.

Our finding that Life sciences start-ups use a mix of perspectives, may not only provide further insight into how entrepreneurs develop their ventures, but may also have interesting and important policy implications.

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