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Bridging the research to high-technology ventures gap with experienced entrepreneurs

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Abstract
We report a new model for development of sustainable growth companies based on research from universities via systematic collaboration with experienced, external entrepreneurs having spin-out experience and market insight. The research has identified university structures that support the spinning out of new companies as well as the influence of technology characteristics and technology transfer units.

Keywords
Bridging the gap, experienced entrepreneurs, spin-outs, surrogate entrepreneurs, innovation model.

1 Introduction

The emergence of successful technology-based companies based on university research has focused the recognition of research universities as breeding ground for entrepreneurship. Universities contribute to entrepreneurship development through different mechanisms that help to exploit technological opportunities created by research (van Burg et al. 2008). This recognition has created an explosion in research focusing on the broad topic of university entrepreneurship which was reviewed by Rothaermel Agung & Jiang (2007).

Previous research has identified why some universities are better at spinning out new companies than others (Di Gregorio & Shane 2003). Nerkar & Shane (2007) have shown how the 'scope and pioneering nature' of different technologies influence commercial outcome while van Burg et al., (2008) and Jain & George (2007) have explored the role of the technology transfer unit in providing access to resources and support services.

The research on university entrepreneurship, of which technology transfer (including via spin-outs) is an important segment, has largely ignored the role of experienced entrepreneurs as part of spin-out teams in the technology commercialization process. These individuals, who are not part of the official university system, may be invited to invest time and possibly money to influence the commercial outcome or spin-outs of technologies developed in the university.

Experienced entrepreneurs are accepted as key contributors to the wider university entrepreneurship especially through their involvement as mentors or advisers to entrepreneurship students in education programs. Their involvement in the commercialization process as integral part of potential start-up teams, working closely with researchers, investing time and other resources into realizing commercial outcomes from university research is not widely researched.

Furthermore, key contributions concerning the role of surrogate entrepreneurs (a term used in the literature to describe entrepreneurs who are not academics/researchers and are brought into the university or incubator to help commercialize research results) such as the works of Franklin et al. 2001; Vohora et al. 2004; and Lundqvist 2014, have focused mainly on the presence of surrogate entrepreneurs and their impact on performance.

Experienced (or surrogate) entrepreneurs can bring accumulated experiences, knowledge about specific business environments as well as professional networks to the commercialization process (Lundqvist 2014). These competences aid the recognition and evaluation of opportunities emerging from research for new spin-outs (Davidsson, 2013). Individuals with start-up experiences and knowledge of operating in specific technology markets can help to improve the start-up situation which contributes to better resources and capabilities for new technology firms to navigate the many challenges they must overcome to be successful (Shane & Stuart 2002).

The process for identifying the suitable experienced entrepreneurs and incorporating them into the research setting in a productive way to successfully influence commercialization outcome remains mostly unexplored. In this paper we seek to contribute to filling this gap with empirical data from a programme which was created to increase technology spin-outs based on research teams in two departments in a technical university. Particularly, we examine the following research questions. Does the introduction of experienced entrepreneurs (EE) into the research team increase the number of technology based spin-outs? How do the entrepreneurs influence the spin-out process? And do researchers become more engaged in commercialization processes when experienced entrepreneurs are involved?

The main objective of the study is to outline a process by which the university increase the number of new ventures it spin-out by incorporating experienced entrepreneurs into research teams. We explore junctures in the commercialization process where the introduction of experience entrepreneurs are most promising (productive) as well as mechanisms governing the relationships/interactions. Finally we identify potential drawbacks from these interactions and how to alleviate them. The analyses is based on a set of procedures and their execution as part of the Bridging the Gap Model (BTG) and outcomes in the form of multiple new technology ventures emerging from two research departments at Denmark's Technical University over a period of two years.

The paper is structured in the following way. After this introduction chapter 2 contains a review of the literature that forms the basis for the conceptual framework. Chapter 3

contains the methodological framework including the model design and implementation. In Chapter 4 information on the cases is presented which is followed by the analysis and key findings in chapter 5. Finally, Chapter 6 wraps up with conclusions and implications for practice.

2 CONCEPTUAL FRAMEWORK

Universities are encouraged to engage in new venture creation for many reasons including accomplishing sustainable innovation with economic and societal impact and to diversify income streams through commercialization of knowledge through licensing technology and establishing new spin-outs (Mosey et al., 2007; Lundqvist, 2014). Spinning out new companies may create advantages over licensing both for the university and the academic inventor as equity holders.

Many researchers are reluctant to leave their university positions to concentrate wholly on forming spin-outs. Maintaining an academic position comprising research, teaching and administration and starting and running new technology venture is almost impossible. Other researchers are simply not interested in the commercial aspects of their inventions which also create challenges for start-ups based on their particular technology. Investors tend to look favourably on technology start-ups when the inventors are somehow involved in especially in the early stages when developing and testing are still crucial activities (Radosevich, 1995). Universities, however, walk a fine line between increasing commercialization of knowledge and the returns associated with those activities and maintaining academic reputation traditionally focused on research publication in academic journals with high impact factors. They must balance increasing commercialization activities among academics with core activities of research and teaching.

The core of entrepreneurship is opportunity and the key components for successful commercialization activities are the recognition, evaluation and exploitation of entrepreneurial opportunities (Shane & Venkataraman, 2000; Haynie, Sheperd and McMullen, (2009). In order to accelerate spin-out activities, research universities must facilitate and support the recognition/discovery, evaluation and exploitation of entrepreneurial opportunities that may be cultivated from research outputs. Most research on entrepreneurial opportunity and its exploitation has concentrated on the entrepreneur and her/his abilities. Several studies confirm that prior knowledge is beneficial for the process of opportunity recognition (Grégoire, Barr, & Shepherd, 2010; Vaghely & Julien, 2010). Others have shown positive relations between ‘years of industry experience’ and venture emergence (Dimov, 2010) and between entrepreneurial networks and experience and new firm outcome (Haug et al. 2013).

Novice academic entrepreneurs with no prior business ownership and associated credibility, financial resources dense social and business networks must find ways of circumventing these shortages/liabilities and the surrogate entrepreneur holds the potential to

meet these needs in an emerging tech start-up (Mosey, Westhead and Lockett, 2007). Radosevich, (1995) used the term surrogate entrepreneurs to describe experienced entrepreneurs who in the absence of inventors who are not desirous of starting new firms based on their inventions, takes 'ownership' of technologies developed in public research institutions including universities and use it to launch a new venture. Surrogate entrepreneurs potentially can reduce challenges associated with the liabilities of newness and smallness with credibility, financial resources dense social and business networks gained from prior entrepreneurial undertakings (Lundqvist, 2014).

It is based on the above observation that we propose in this paper that the addition of experienced entrepreneurs with complementary knowledge and industry experience to the research project team will lead to shorter time to firm emergence and more resource rich spin-outs. The latter should contribute to more sustainable new ventures able to interact with important parts of the product and market systems to improve both technology and product development aspects of the start-up. The framework combines elements necessary for successful 'entrepreneuring' in which experienced entrepreneurs are introduced to the research teams during commercialization to influence elements of the opportunity, its framing and subsequent exploitation as experienced demonstrated with the BTG programme.

3 STUDY DESIGN AND METHODOLOGY

The chosen approach to the current research is design anthropology, in that it is based on a combination of observations, iterative actions in the development process and reflections over the span of 2 years creating a longitudinal perspective. The purpose of using design anthropology is to be able to both study and produce a theoretical framework by observing the existing practice regarding the development of high tech start-ups, while being able to transform this practice and to design a new future model based on the active involvement and engagement of the participants. By using design anthropology as research design it has thus been possible to follow dynamic situations and social relations throughout the project and iterate the overall framework for the model (Gunn, 2013).

Three of the co-authors worked in the field observing existing practice and developing and implementing the model, a process which will continue in the coming year. Triangulated evidence collected from various sources using the design workbooks also contributed to the development of the model. The design workbook is characterized by being quasi-participatory and provides participants with the possibility to interpret react to and elaborates upon the ideas as they emerge over time (Gaver, 2011). The design workbook enables the documentation and iteration moving from the original concept of the model through the various development stages. Participant observations, qualitative interviews, analysis and co-creation with the participating researchers and external experienced entrepreneurs (EE) have facilitated a transformative process for innovation and entrepreneurship practice in the university.

3.1 The BTG Model

The BTG model was initiated in 2013 by the Department of Chemistry and the Department of Photonics Engineering at the Technical University of Denmark which serve as the context for analysis in this paper. During a one year trial period, the framework for the model was developed and tested. This provided the input to create a model for bringing EEs into the university to work with researchers to improve technology transfer from research units. The final model was implemented in April, 2014.

The model is divided into the following five phases with some overlapping of the activities: (1) Screening and Patenting, (2) Matching EE to research team, (3) Connect to potential lead customers and Develop prototypes, (4) Spinning out, and (5) Follow-up (see Table 1). The BTG Model introduces EE in an in-spe CEO position as an integral part of the innovation and commercialization process of university owned technology. The EEs do not get paid, but are becoming cofounders of a potential future company. The model extends the scope within the university for a spin-out by focusing on both the early phases (where the technology is identified and patented) and on the life beyond the university. The goal is to create sustainable growth companies and we are, therefore, following the companies for an extended period up to two years.

The trial model had a strong focus on the matching and connect and develop phases which was changed during the trial year to the present state where the EEs of the BTG Model now entered at an earlier stage than the pre-organization phase, i.e. before the entrepreneurial commitment juncture (Vohora et al.2004). While this juncture is certainly as critical to BTG cases as for any university spin-out, the study aimed to analyse the effect bringing EEs into the university at the opportunity framing phase, or even early at the research phase.

While this is unconventional, the rationale is that EEs with relevant technical, market and business competences can ensure a more efficient opportunity framing phase, hence having a positive effect on the acceleration of the spin-outs from research to company and their sustainability due to finding the right business potential early in the process. A cornerstone of BTG is, therefore, the creation of trust between EEs and academics, and mutual acceptance of the EEs as venture champions. As described in Table 1 the technology is at a Technology Readiness Level (TRL) of 1-2 in the first phase, so the possibility to influence the technological development is crucial. During this early phase the EE is also able to take lead on the commercialization. Often the researchers are not motivated and even the motivated ones do not know which are the most important tasks necessary to create a strong foundation for the future business. The proposition behind the model is that early inclusion of EEs help in the building of trust among the parties. This also paves the way for the researcher accepting the EEs taking a significant equity in the start-which is a key motivator for them.

	Screening and Patenting	Matching	Connect and Develop	Spinning Out	Follow Up
Description of the different phases of the BTG model	Researchers and business developers within the university secure IPR and perform initial opportunity search. Typically TRL level 1-2.	Experienced entrepreneurs (EE) from outside the university are matched to potential spin-out cases. The EEs dedicate significant resources in terms of their own time to understand the details of the technology. Typically TRL level 1-4.	The EEs seeks to connect the technology to potential first customers. Development of prototypes and project-based feasibilities studies to clarify market demands. Typically TRL level 3 to 5.	EE and university researchers form founding team and establish a new venture. License agreements with the university for IPR. Securing of seed funding and/or customer-financing for spin-out. Typically TRL level 4 or higher.	Following the new spin-out via individual meetings and/advisory board roles. Collecting data on time from spin-out to receiving first commercial order, and on team dynamics between EE and university co-founders. Typically TRL level 5 or higher.
Legal activity	Draft Term Sheet developed by the university	NDA between EE and university. LoI between Uni and founder group. Uni states intention of spinning out a company	MoU among future founding team (Uni not part). Consultancy agreement between EE and University	Term Sheet. Shareholder agreement for New Company. License agreement between New Company and University	
Patent activity	Patent filed		Patent developed with a business perspective		
EE actions	No EE	Overview of business potential	Business plan and patent	Responsible for legal process and possible investments	
EE level of commitment	(0 EE)	EE participates via advisory boards or individual meetings (1-4 EEs)	EE is part of the team working at the university (1-2 EEs)	Part of the team away from university (1-2 EEs)	
Researcher actions	Filing of patent	Dialogue with EEs about technology and business potential	Working on the development of the technology for market	Part of the team away from university	

Table 1: The five phases in the BTG Model and main activities

4 OVERVIEW OF CASES AND THE ROLE OF THE EEs

In this section, we will present 6 cases representing key features in the BTG model with emphasis on the EEs; their characteristics and the means we adopted to attract them to the future spin-outs. The cases have been chosen based on how far they are in their development, since the programme is ongoing we focus on the cases that have spun out, or

are in the process of spinning out during spring 2015. Table 2 outlines the cases and highlights the time of EE entry at the university, the means for attracting the EEs, and main characteristics of the EEs.

Spin-out company	Technology	Time of EE entry	Means for EE entry	EE characteristics
Case 1: Photonics	Lasers for medical applications, sensors and lighting.	Opportunity framing	Member of advisory board established by business developer at the university. Serving 6 months on the advisory board to get comfortable with the team and 'hooked' on jumping to the spin-out.	Research background similar to academics. 15 years of industry experience (R&D engineer, product manager, technical sales support). Working in two early ventures (not founder). Technical and market insight.
Case 2: Imaging	Infrared cameras with high sensitivity. Based on nonlinear optics.	Research	EE approached university by own means and granted guest rights to scout for opportunities within the research groups of one department. Deciding to dedicate full time to future start-up after 3 months of scouting.	Engineer (non R&D). Entrepreneur in IT business (90'ies) Venture capital. Technical and market insight.
Case 3: Sensor	Laser-based structural sensor. Bend measurements of microscopic mechanical deformations.	Pre-organization	Members of advisory board setup by innovation officer at the university. Two EEs from the advisory board forming CEO and CTO (6 month timeframe).	Engineer from cell phone industry. Business angel with strong general management skills. General technical skills, but no market insight.
Case 4: IR spectroscopy	Measuring devices developed in order to conduct new in situ IR spectroscopy	Opportunity framing	EE identified by an individual selection process performed by the business developer and research team. Two entrepreneurs interviewed.	Engineer with a long history within management and development of new business areas in larger companies in Denmark and internationally
Case 5: Glycoscience	High-throughput solution for enzyme screening	Pre-organization	EE candidates identified through network search. Advisory board formed and one EE quickly got more involved and became lead,	Business training and very experienced in starting up companies within the overall research area.
Case 6: Formulation chemistry	New formulation for a greener cleaning product	Research	EE approached university and suggested a possible spin-out case.	Business training and experience with starting up companies.

Table 2: Overview of BTG cases and EE characteristcs

EEs are identified through various means, when the programme was first launched a press release was issued and the project managers received a substantial amount of ap-

plicants, who were interested in participating. The criteria for joining is that the EEs need to be able to spend at least 500 hours on each case, they would need to invest at least €7k of their own funding and they would have to be able to attract customers, preferably within the first six months from the day the company is formed. Furthermore, the EEs were screened based on their experience with entrepreneurship, sales & marketing and their insight and network within the specific technology area. The screening of the EEs is initially conducted by the project managers, when the EEs are matched with the researchers the personal chemistry is quite important. The matching is done either through an advisory board or by individual matching.

Advisory boards usually comprise 3-5 EEs having different profiles and backgrounds. The starting point is always to find the right market fit for the technology which makes it beneficial to have more EEs representing a broader set of expertise. The advisory board and the research teams usually meet every month and each meeting generates deliverables for each party for the next meeting. In addition, frequent individual contact is initiated between the researcher team and EEs. In this way the advisory boards become an important forum for discussion and progress – and from the EEs point of view, a way to get to know the technology and its potential. Within six months one or two EEs from the advisory board become strongly involved in the case due to either personal interest and/or shared goals with the research team and they take lead and become co-founders of the company together with the researchers. The rest of the EEs in the advisory board typically transition into a formal board member role of the new company (often as seed investors).

The individual matching is used when the market fit is more obvious or if the research team needs a specific profile, for instance sales and marketing experience within a certain area. Usually the research team meets with 2-3 potential EEs. At the first meeting the researchers present the technology and their visions in a very informal setting. At the second meeting the tables have turned and the EE present a potential business case based on the knowledge gained about the technology at the first meeting. Based on this presentation the researchers decide to work with the EE, whose vision, knowledge, profile and personality fits best with the technology and their personal vision.

The following section will exemplify this process with six cases focusing on how the EEs involvement accelerated the process and created a strong market fit for the technologies:

Case 1: The technology for this case, (European research project (FP7), was proven successful as a new concept for lasers in the medical device market. Furthermore, the research team had received significant attention from the Danish innovation environment, including winning the high-tech category in a national venture competition. However, the researchers had no interest in going full time into a new venture, and the case was lacking industry insight in order to find the right market approach. A BTG advisory board was established comprising 3 experienced entrepreneurs: a product manager with experience from two start-ups and a research background in the core technology of the

case, a CEO from the medical device industry, and a senior executive consultant with 60 years' experience from the laser industry and strong personal network. Following the procedure outline earlier for a board of directors, after 6 months the EEs and the researchers reached a mutual understanding about the future venture and the sharing of equity among them. Furthermore, one of the EEs had committed to serve as CEO. The team also engaged two business school students to serve as personal assistants to the CEO. He also received the support of the three additional researchers and one additional EE, all with technical and business know-how to help the new venture, and committed 10 hours monthly work free of charge. Seed funding from this group of 11 individuals (on average €5k each) funded the hiring of the CEO for one year. Within the first 3 months, the company made its first sales, and within 11 months, they secured a further investment of around €500k from business angels and a venture capital firm. The founding group holds around 75% of the company. The company has 4 employees today, including a sales representative in the US. The company's first products address a niche market that was originally identified within the university, and has entered a second market of medical lasers It has also secured grants from three successful research proposals, together with the university, to explore a disruptive market opportunity within the energy sector. The success of this case is seen as a result of the combined competencies of the EEs and the researchers, and of the relatively large founding team being able to distribute the workload among them, for example by the business student leading the administrative and accounting work, and fundraising being performed by other members of the co-founders than the CEO. The total period from engagement of the EEs to spinning out the company was 12 months.

Case 2: The research team for this case comprised three individuals, two with previous experience from a spin-out, albeit with hesitation to join the start-up full time. The last researcher had an interest in joining the start-up, but had a lack of business and management experience. Working on maturing the technology, the team had realized significant improvements compared to present solutions on the market, and filed a total of 7 patent applications. The team was approached by an EE, who an electrical engineering has worked with several early high-tech ventures and had worked for almost a decade in the venture capital business as investment manager. This passionate EE was looking for a new venture that he could engage in fully and committed 1 year of dedicated work with the research team to understand the improved imaging technology and to gain mutual confidence. The EE was granted access to university on guest terms and during the year, the EE and the research team decided to form a company with shares split equally between them (25%) and to pursue a business strategy without need for investments, hence a fully customer-financed start-up. The team visited potential customers in segments including Agricultre, Oli&Gas and Defense. Negotiations of a feasibility project was concluded successfully, and served as pilot project for the spin-out; two-phased project with a stage-gate approach where the successful completion of the first phase would trigger the founding of the company and the customer financing the second phase directly to the spin-out. The company further secured IPR form the university and today

has two employees, the EE as CEO and one researcher as lead engineer. The total period from engagement of the EE to spinning out the company was 18 months.

Case 3: This case initiated from an academic team with a strong focus on applied research. The team spotted a potential application in the consumer business (sports equipment), where traditional technologies appear highly expensive to them and they envisioned a new, cheaper solution based on their core research area. The team had no prior experience in the sports equipment market. Nonetheless, the case appeared convincing to the university business developer, and IPR was filed from the university. Like the previous cases, the academics had no interest in joining the spin-out and would be happy to see the technology sold off, either as a license agreement to an existing company or as a spin-out headed by someone else. Hence, a BTG advisory board was set up with three individuals; a sales and marketing person with specific market insight (25 years of experience in marketing), an experienced entrepreneur with technical background (20 years of experience), and a business angel with focus on management of start-up teams and executive sales (25 years of experience). After 4 months of work, two of the EEs (technical and management persons) decided to engage full time to spin-out the technology. The third EE had a different perception of the right business strategy and after mutual agreement he decided to leave the team. A series of customers meetings was set up and held during the first 6 months from EE engagement. Based on encouraging feedback on the business plans, the company was formed after another 6 months. Hence, the total period from engagement of the EEs to spinning out the company was 12 months. The new company was formed with the EEs having around 80% ownership, 10% to the researchers and 10% to the university that transferred IPR to the company. During the follow-up phase, it was realized that the new technology had unforeseen disadvantages (in terms of stability and sensitivity) and the EEs realized that they had to move to existing technologies. Having planned a potentially promising business model, one of the EEs (with the technical background) decided that he would like to pursue the business case alone. With the other EE deciding to quit and the university IPR and technology no longer playing a role going forward, the company was agreed upon to be liquidated. Today, the EE continuing the course has demonstrated a prototype based on existing technology and secured partnership with a leading player in the market. He has currently collected a new team of three individuals to continue operations and looking to grow the business.

Case 4: The research team consisted of one PhD-student and two master students therefore it was crucial to find an EE with a lot of experience and knowledge of both entrepreneurship and sales and marketing. The research team wanted to set up a webshop and sell their technology worldwide primarily focusing on the R&D segment. They expected a turnover of €1m after three years selling devices at €4k pr. unit. The research team had already met with a potential investor, who wanted to provide them with the first early investment for 25% of the shares in the company. The team met with two potential EEs and at the second meeting where the EEs had to present their vision, it was clear that they had very different profiles and interests. EE1 wanted to move forward with the

existing business model. EE2 did not see any potential in the current business model but instead suggested that the team focus on a specific B2B segment, develop a large scale installation where test results did not have to be analyzed by other researched but were presented as finished results. Instead of €4k pr. unit this would represent a value of approx. €70k pr. unit based on feedback from potential customers in the EEs personal network. The team decided to go with EE2, who was also responsible of applying for a soft funding grant, which they got. This allowed the team to bootstrap and keeping the company shares for a potential future investment round, when the company has increased its value. From the point when the EE became part of the team it took the joint team six months to spin out, developing the technology from early prototype (TRL 2) to a more advanced prototype (TRL 5). The company currently employs two of the researchers full time and the EE and the last researcher part time. Furthermore a programmer has been hired part time.

Case 5: The research team had not been able to commercialize the two year old patent, when they were included in the BTG programme. They were interested in seeing the technology spun out, but they were not interested nor believed they had the skill set to lead the process. An advisory board was set up, but already after the first meeting one EE became lead. The advisory board consisted of five EEs all with a network and expertise within this area. However, the rest of the board did not see any commercial value and were not willing to spend time on the case. The remaining EE set up bi-weekly meetings with the EEs and engaged a business graduate to conduct sales and set up a website for the product. During the process it became evident that the current patent would not provide the necessary protection for the company and the EE co-wrote a new patent together with the researchers and a patent attorney. This provided a crucial foundation for both the company and the investment the EE landed for the case. Without proper IPR protection the team would not have been able to get the investment needed. The EE furthermore provided insight into how to set up a production line and actually ship the product to customers. The company will employ the business graduate full time to conduct sales and marketing and one technician and the EE will continue as CEO.

Case 6: It was the EE who approached the university with an idea for a potential business. He was matched with a research team, who had specific knowledge within the area. They worked together intensively for six months, the EE set up weekly meetings where he brought in potential investors and board members for a potential company. This focused the development of the technology and within the first month the goal was set and the time could be spent developing the technology specifically for this goal. This made the research team very focused and driven. At the same time the EE was setting up both a production line, sales channels and future customers. After six months the research project finished and the EE took over and after nine months the product was available in stores. This process is different from the other cases because it was not a technology that emerged from an existing research project or idea from a researcher, however it was the joint sparring and development between an EE with market insight and a researcher with an understanding of the technology that created the right condi-

tions for the development and acceleration of the development from idea to spin-out. This case is not a traditional BTG case since it's not based on an idea coming from the university, but rather a close collaboration between research team and an experienced entrepreneur, who wanted to pursue a new research-based venture. However, the commitment from the EE to find customers and create sales channels provided a fast track from research to market.

5 KEY FINDINGS

The presence of experienced entrepreneurs in the research team has developed what we considered to be a more 'entrepreneurial mindset' among researchers early in the technology development process. This mind-set helped to accelerate the progression from patent to spin-off by setting more targeted goals based on specific product-market fit. The experienced entrepreneurs used their knowledge and experiences to connect the research environment with key stakeholders in specific markets contributing to more customer focused development activities. Thus, successful co-existence helped to create a dynamic interaction between the research laboratory and the market structures which helped to eliminate much of the information asymmetry typically associated with new technologies. The relatively short time to market depicted in the 5 cases was due importantly to more effective evaluation of the technologies.The relatively short time between evaluation and exploitation of the identified opportunities through spin-out ventures is directly related and influenced by the overall characretics of the EEs which we collectively referred to as their experience.

The cases outlined above shows evidence of star-up companies able to attract needed resources through traditional investment as well as through innovative means such as customer-financing and soft funding grants .The EEs also contributed to a strong focus on customers and co-development with potential customers which also helped the financing of the companies by bringing in unusual early sales. Altogether the BTG model contributed to the launching of companies with more innovative business models, better technology-to-market fit which should make them more sustainable over time.

An unexpected result from the BTG model and programme is the development of a new entrepreneurship culture at the university. As the researchers learn that they can receive committed and competent advice and have EEs take the lead in the commercialisation process, they are becoming more and more interested in the commercial prospects of their research results. Some are more open to pursuing a life as an entrepreneur while others are happy to work along with EE to bring technologies to market. Since the launch of the BTG programme the number of researchers who have expressed interest in getting an advisory board or meeting with a potential EE have increased significantly.

6 CONCLUSIONS AND IMPLICATIONS

The results show that experienced entrepreneurs and researchers can co-exist to improve the commercialization process by creating common commercial goals and allowing those goals to direct the later research development process. This co-existence, however, requires concerted effort on the part of the university due to challenges aligning the goals of key parts of a research team and the entrepreneur and handling major divergences that can derail the corporations.

Furthermore, the programme requires facilitation of the network of the EEs and matching them up with the potential spin-out cases. Getting the right set of competencies in an advisory board is crucial for the success of the commercialisation process.

The results can help those charged with helping universities create more spin-outs based on research by showing how more open structures for successful technology commercialization can be created without threatening their integrity and fundamental goals. The model presented may be adapted by other universities which are struggling to realize commercial gains from their research investments and fulfil the mandate to contribute more directly to the economic conditions of their locale.

The results may also help experience entrepreneurs see how they can create more successful technology based on new ventures by working closer with and at an earlier stage with the research teams in order to shape technology opportunities.

While the spinning-out of technology and other research results continue to gather attention and importance, universities are still to a large extended rated and ranked based on publication and other traditional academic output. University leaders must therefore create the balance between these two kinds of activities and create the environment in which both can co-exists and remains a key challenge for many research universities.

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