Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

Title: Academic entrepreneurship revisited: university scientists and venture creation

Authors: Mats Lundqvist and Karen Williams Middleton
Dept. of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden 41296
Corresponding author: mats.lundqvist@chalmers.se

Structured Abstract

Purpose: Venture creation is often seen as the form of academic entrepreneurship least compatible with the role of university scientists. The purpose of the article is to explore the changing role of university scientists towards venture creation, and understand the influence of university-driven initiatives for venture creation.

Design/methodology approach: The article is based on a qualitative study of two venture creation cases: one from a US university, and one building from two universities in Sweden. The cases and associated university environments were selected due to their venture creation activity. University venture creation data of the three universities complements the cases.

Findings: Venture creation at universities can be more compatible with the traditional role of the university scientist. Centers and laboratories concerned with entrepreneurship and action-based education are identified as key university resources allowing university scientists to engage in venture creation in more compatible ways; not having to become the lead venture creator.

Research limitations/implications: The study underlying the article is limited to three university environments (in two countries) where venture creation activity is relatively frequent.

Originality/value: The article shows that venture creation can be more compatible the role of the university scientist due to more collective entrepreneurial activity at universities. Furthermore, university scientists, in synergizing between different entrepreneurial roles, are important for venture creation without taking the lead venture entrepreneur role. Involving students into venture creation together with scientists is proposed as one such important entrepreneurial role not previously recognized.

Keywords: *academic entrepreneurship, venture creation, roles, university scientist*

Acknowledgements: We would like to recognize Sarah Belford, Niklas Fernqvist, and Bryan Willson for their assistance in obtaining and reviewing background and case data. We would also like to especially thank Dr. Collette Henry and Dr. Lorna Treanor for their support through earlier drafts of the article, as well as the reviewers for their constructive comments to the article.

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

Introduction

A quarter century ago, Louis et al. (1989) explored the entrepreneurial activity of university scientists in the life science fields, determining five types of academic entrepreneurship stemming from university research: 1) engaging into large scale science through externally funded research projects, 2) consulting or knowledge transfer resulting in supplemental income, 3) gaining industry support for research, 4) generating intellectual property (IP), and 5) new venture creation. Louis and her co-authors argued that these five types of entrepreneurial activity were not readily compatible with the traditional role of the university scientist; venture creation being the least compatible.

Since the publication of the Louis et al. article, many universities around the world have operated under upwards of twenty-five years of governmental policy asking for more economic value coming from the university (Merrill and Mazza 2010; O'Connor 2010). Over time there has also been increasing concerns regarding how university scientists cope with demands for increased academic entrepreneurship (Larsen 2011; Philpott et al. 2011). Additional studies have drawn attention to the influence that universities have in supporting and confining academic entrepreneurship, both through social norms (Bercovitz and Feldman 2008) as well as organizational design (Brennan and Wall 2005).

The purpose of this article is to explore changes in the role of the university scientist towards the least compatible type of academic entrepreneurship, venture creation, and understand the influence that university initiatives may have upon this type of entrepreneurial activity. In line with previous research, the article specifies ventures as those in which the university is a licensing agent and/or holds equity (Lockett and Wright 2005). This article investigates cases where there are additional university actors, besides individual university scientists or technology transfer officers, involved in the venture creation process.

The article proceeds as follows. Literature on academic entrepreneurship is reviewed, mainly focusing on university venture creation activity. The methodology section qualifies the two case studies of university research-based ventures and the three selected university environments in

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

Sweden and the U.S. from which the ventures emerged. Historical data of venture creation at three universities is presented, followed by a review of the resources each university has invested towards venture creation. Next a longitudinal narrative of each case is presented. The discussion relates case findings to our understanding of academic entrepreneurship through venture creation. The article concludes suggesting venture creation can be more compatible with the role of the university scientist as long as complementary venture creation activities occur at the university.

Academic entrepreneurship and the entrepreneurial university

Louis et al. (1989) and others (Samsom and Gurdon 1993; Siegel et al. 2003) have found venture creation to be at odds with the core objective of the university scientist. Studies have pointed at challenges and disharmony for university scientists that deviate from a research path (Glassman et al. 2003; Mendes and Kehoe 2009). Nevertheless, visions of research universities transforming into entrepreneurial universities have added to the image that university scientists are also more or less voluntarily transforming into increasingly entrepreneurial roles (Etzkowitz 2003). The "entrepreneurial university" expanding beyond a research university in terms of outreach, collaboration and creating utility, has placed academic entrepreneurship in a new context since the work of Louis et al. (1989); if not in practice, then at least in regard to policy and debate (Deem 2001; Kirby 2006; Leslie and Slaughter 1997; Nelson 2004).

The university scientist and academic entrepreneurship have been studied from different angles, ranging from the characteristics of the individual scientist, to environmental influences, to the economic impact and performance measurements of the phenomenon as a whole (Glassman et al. 2003; O'Shea et al. 2004). Brennan and Wall (2005) describe four types of academic entrepreneurs – heroic, maverick, broker and prospector – where typology is dependent upon the individual's knowledge base and relationship to the university. Dickson et al. (1998) describes academic entrepreneurs as spanning from the 'pure academic' pursuing entrepreneurial endeavors to the hybrid individual with both science and business qualifications. University scientists pursuing venture creation have been found to experience a more commercial identity rather than that of a 'true' academic (Jain et al. 2009). Lockett et al. (2003) found that the more common roles for university scientists in a venture based on their research were as senior manager,

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

advisor, or technical director. To have the role of managing director (i.e. the lead entrepreneur) was less common and often not encouraged by the university.

Most studies of academic entrepreneurship focus on technology transfer through patenting and licensing, of which licensing to new spin-out ventures is a subcategory (Bercovitz and Feldman 2008; Clarysse et al. 2005; Jain et al. 2009; Wright et al. 2007a). Compared to the original study of Louis et al. (1989) which ranged from attracting large research grants to venture creation, the majority of current research thus has a more narrow understanding of academic entrepreneurship, focusing on the commercialization of university inventions.

Academic entrepreneurship and university venture creation

Academic entrepreneurship through venture creation is not very common, even among the 100 most active research universities in the United States (Åsterbro et al. 2011). Many universities have not necessarily championed this form of entrepreneurial activity (Mendes and Kehoe 2009; Rogers et al. 2000; Samsom and Gurdon 1993; Wright et al. 2004). This can partly explain why venture creation is found to be the least compatible with the role of the university scientist. University scientists may face barriers such as lack of knowledge or skill in recognizing and exploiting opportunities stemming from their research (Mosey and Wright 2007). They can also lack support from their institutions in creating and developing opportunities into ventures, including access to financing (Patzelt and Shepherd 2009). 'Local' social norms can have both positive and negative effect on academic entrepreneurial activity (Bercovitz and Feldman 2008). University scientists successfully engaging in venture creation are seen to leverage business competencies and external resources at their disposal (Druilhe and Garnsey 2004).

Siegel et al. (2003) illustrate that the actions and motives of university scientists differentiate significantly from the university technology transfer officer as well as a typical venture entrepreneur. They found that the entrepreneur's primary motive is financial gain, facilitated through commercialization of a new technology. In comparison, the university scientist's main ambition when commercializing research is to illustrate the discovery of new knowledge in order to gain recognition within the scientific community, with financial gain as a secondary objective

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

as a means to securing more funding for research. The university technology transfer officer's prime objective is to protect university IP, while mediating deals between university scientists and commercial actors (Jain and George 2007; Kruecken 2003). The UTT officer's role has been found to only have a marginal influence in driving academics to start new ventures (Clarysse et al. 2011).

In resonance with the purpose of this article there are a few studies pointing at the engagement and commitment of multiple stakeholders – both internal and external to the university – to achieve new ventures (Druilhe and Garnsey 2004; Franklin et al. 2001). Successful venture creating universities in the U.K. have been found to have clearer strategies towards the spinning out of companies and the use of surrogate entrepreneurs (Lockett and Wright 2005; Lockett et al. 2003). Some universities establish or create stronger links to incubators and science parks (Rasmussen and Borch 2010; Siegel et al. 2005). Others have integrated technology transfer activities with entrepreneurship education, in order to build up on student capacity to champion the entrepreneurial process (Berggren 2011; Lundqvist and Williams-Middleton 2008; Moroz et al. 2007).

In summary, there are still competing perspectives around whether venture creation activity at universities should be seen as primarily an activity of the university scientist or whether it is something more systemic involving multiple university actors. There is reason to assume that university environments which are more resourceful regarding venture creation have an effect on the role of the university scientist. The current study explores this aspect further.

Methodology

A qualitative case study method is applied, to study academic entrepreneurship through venture creation, including level of engagement by involved actors, and processes and resources used to facilitate development. Case study method allows for study of phenomenon within real-life context, when boundaries between phenomenon and context are blurred, and multiple sources of data is utilized (Yin 1994). Case evidence is gathered through interviews, documentation, participant observation, and archival material. Data is triangulated (Flick 2006) where possible in order to determine replicable information and falsify inconsistent information in an attempt to

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

minimize the subjectivity of the data presented. Names of individuals and ventures in the cases have been made anonymous.

The ventures were selected with the purpose to understand and comparatively learn from the particulars of each case (Stake 2005) as university scientists engage in venture creation. Both cases exemplify venture creation building strongly, but not solely, from contributions of university scientists. In fact, the ideas for the two ventures originate external to the university environment in which they are developed, thereby breaking with the common understanding of academic entrepreneurship primarily being a concern for internal university scientists. The next section gives information regarding the host universities in order to contextualize the venture cases, including description of specialized university programs. This is followed by the cases.

University Context and Programs

The universities residing the two venture creation case studies support activities beyond traditional technology transfer, in order to facilitate research commercialization, including extensive venture creation. Each university has initiated programs enabling specialized innovation support, integrated action-based education, and collaboration across university and business resources, in order to move research ideas more quickly to the market.

In 2007, Chalmers University of Technology and University of Gothenburg in Sweden jointly received a six million Euro(€), eight year grant from a Swedish agency for innovation (VINNOVA) to develop stronger support for university scientist research utilization. Both universities had more than a decade's worth of university initiatives regarding advice, incubation, seed financing and entrepreneurship education aimed at supporting and even collaborating with university scientists aiming to create new ventures (see for example Berggren 2011; Jacob et al. 2003). The grant helped establish a stronger collaboration between university commercialization actors (incubators, institutes, and seed financiers) while investing more into early-stage proactive and reactive advice for researchers and research groups.

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

In 2007, Colorado State University (CSU) announced a strategy for addressing critical challenges through coordinating innovative research and development of commercial applications. The strategy focused on three areas – infectious disease, cancer and clean energy – in which CSU has long and strong history of research and innovation. The strategy allowed research laboratories in the three areas to have stronger connections to technology transfer and venture creation activities at CSU, thereby simplifying and leveraging commercialization processes.

Table 1 illustrates the quantity and basis of venture creation at the selected universities. Venture creation data at CSU, Chalmers and University of Gothenburg, has been collected through the university operations commercializing, incubating and/or taking equity of start-ups. The amount of venture creation occurring at the institutions and the proportion of ventures having external origins are indicative of university environments having strategies and resources attractive for venture creation. It is important to note that the data in Table 1 does not include ventures considered to be consultancy-based ventures or holding companies.

Table 1. Origin of all incorporated ventures co-owned and/or licensed by the selected universities (consultancy and holding companies are excluded)

	Colorado State University		**Chalmers University of Technology**		**University of Gothenburg**	
Primary origin	Internal	External (Joint)	Internal	External	Internal	External
Total ventures 1996 – 2010	16	7	36	46	14	1
1996-2000	2	1	3	10	6	0
2001-2005	4	4	23	13	3	0
2006-2010	10	2	10	23	5	1

Cases of Academic Entrepreneurship

Biomedical Venture Creation at Chalmers and University of Gothenburg

The first case follows a vaccine candidate invented by a University Scientist and two colleagues at the University of Gothenburg and being verified and developed by different actors at both Chalmers and University of Gothenburg into the venture here called ‘VacciH’. Figure 1 shows a timeline of the case.

In February 2008, a professor (hereafter called the 'Scientist') at the medical school at University of Gothenburg contacts an Innovation Advisor for advice on bringing a vaccine candidate to the marketplace. The Innovation Advisor works at the unit for research and innovation services at the University of Gothenburg offering independent advice to scientists. At the same time, the Innovation Advisor is part of the VINNOVA grant initiative through which actors at Chalmers and University of Gothenburg share information. The Innovation Advisor meets with the Scientist several times to further define key issues: novelty of the research findings and the possibility to turn them into an invention, associated contributors in order to determine IP claims and business opportunities related to the invention or knowledge, and intentions towards engaging in commercial activity in the future.

The Innovation Advisor independently investigates novelty utilizing readily available patent databases, as well as any potential conflict of interest (such as previous contractual agreements involving the Scientist in the research area) through university databases. Based on this, the Innovation Advisor initiates a meeting between an external IP consultant and the Scientist and his research team (a colleague and PhD student) to further clarify novelty, and also provides them with a draft collaboration agreement to review and sign, designating ownership percentage based each individual's contribution. The Innovation Advisor also recommends that the Scientist apply for public grants that can support activities towards verifying the commercial potential of the research findings, and provides access to funding options.

Over the next three months, the Innovation Advisor supports the Scientist and his team in designating novelty, and applying for and receiving financing. In the end of May, they discuss next steps with the Innovation Advisor, stating that while they wanted to engage in commercialization, the team has no interest in leaving the academy in order to pursue venture creation independently, nor do they want to develop the vaccine further within a larger company. However, they recognize that the vaccine requires further development before it is viable for market conditions. The Innovation Advisor recommends that they consider collaborating with an entrepreneurship education at Chalmers, utilizing teams of student entrepreneurs to enable

commercialization, and contacts actors coordinating the incubation activities of the program, informing them of the potential idea. The education is linked to a larger initiative – Biomedicine in West Sweden – in which two university actors collaborate around innovation with industry and institutes. The Scientist, however, at this point in time declines the opportunity to connect with the education.

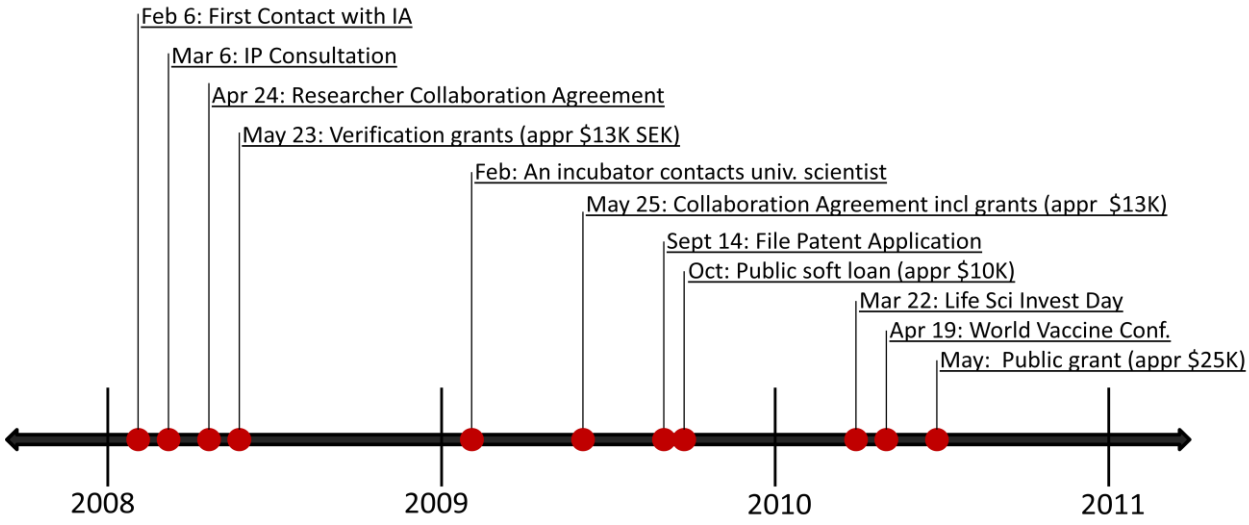

Figure 1. Timeline for 'VacciH' Case

Nine months later, a recruiter for an incubator linked specifically to the entrepreneurship education is in the process of recruiting ideas and contacts the Scientist. After a few rounds of discussions, he submits the idea as a potential venture to the education and associated incubator. The idea is screened and eventually selected for the incubation period starting in September 2009. This requires signing a new collaboration agreement designating ownership distribution to the Scientist and his team, the incubator, and a team of three student entrepreneurs, should the venture be incorporated. At this point, educators at the entrepreneurship education are engaged into the case not only in the role of teachers but also as coaches and mentors. In addition, these educators are also university scientists, and through all their roles, offer network links and innovation/entrepreneurship skills as part of an action-based pedagogy.

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

At the start of the incubation period, the student team reports an analysis of the R&D and IP assets of the venture, conducted during the summer of 2009, and proposes initial geographic markets to pursue, based on regulatory situation, competition and customer needs. The team files a U.S. provisional patent on September 14th and then proceeds to clinical trials preparation. Contacts are taken with units at the medical school at University of Gothenburg with capabilities for production at the scale required. A partnership is established for delivery. The student team screens local companies capable of conducting clinical trials to determine costs and availability, while applying for, and receiving, additional seed-financing to facilitate development costs. By December various resources are in place, and the student team has determined two business strategies: to verify findings up to a certain stage, and to sell the company to a pharmaceutical company within 5-6 years or to develop therapeutic vaccines, i.e. vaccines with a curative rather than preventive effect.

During the spring of 2010, the student team focuses mainly on competitive analysis, attracting additional financing, and securing additional key resources to the venture – advisors on IP and clinical studies, vaccine producers, etc. By April, the venture launches its website. By June 2010, 'VacciH' has established a network of partners, advisors and consultants, including eight bioscience business advisors and eight consultancy advisors, to provide support in the areas of vaccine development, vaccine formulation, clinical studies, virology, toxicology, production process, good manufacturing practice (GMP), regulatory affairs, industry experience, IP, and financing. Future plans involve pre-clinical and clinical trials, to be completed by 2014. 'VacciH' is subsequently incorporated, with the incubator, the students and the Scientist being among the shareholders.

Bio-energy Venture Creation at Colorado State University

The second case follows an independent researcher (hereafter called the 'Researcher') with a technological development for producing oil from algae. The Researcher co-founds a venture – here called 'AGFuel' – together with CSU in order to take a concept and early stage prototype to production capacity. Figure 2 provides a timeline for the case.

In 1978, United States President Jimmy Carter enacted the Aquatic Species Program, funded by the Department of Energy, to investigate energy production using algae, initially focusing on renewable fuel for transportation and eventually focusing on the production of biodiesel, with much of the research organized through the National Renewable Energy Laboratory (NREL) in Golden, Colorado. The program was discontinued in 1996, mainly as the department shifted focus to the production of bioethanol, but also due to challenges in controlling the growth conditions of the algae.

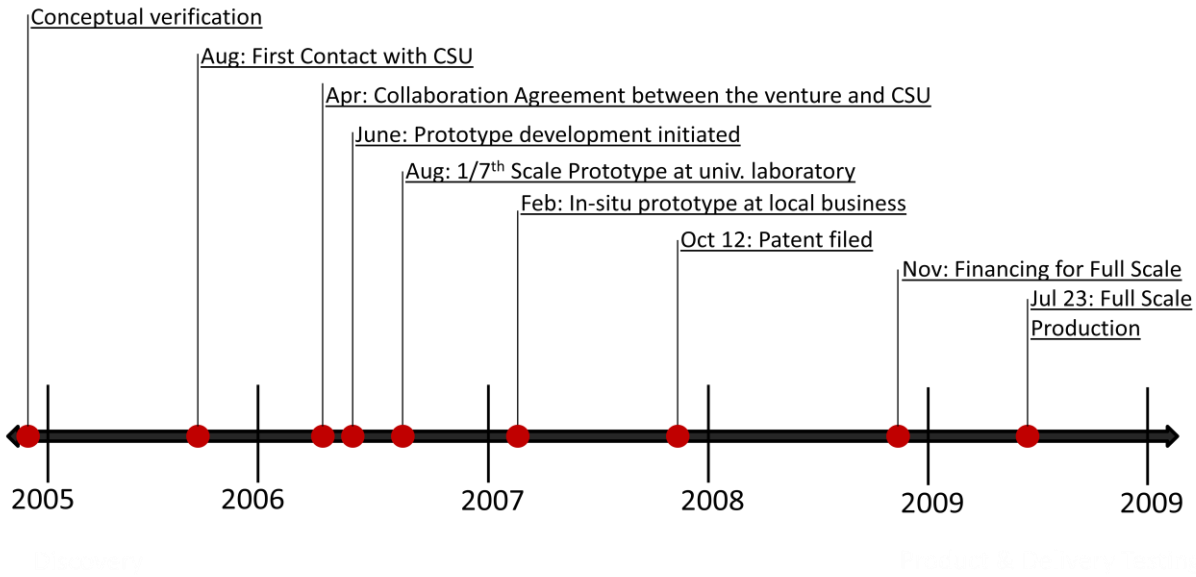

Figure 2. Timeline for 'AGFuel' Case

The Researcher based in Boulder, Colorado picks up where previous research had left off, addressing the productivity and other challenges. By 2005, he has developed an initial prototype and receives validation of his inventive step from a study manager from the National Renewable Energy Laboratory. However, the Researcher recognizes that the scale of development necessary to create proof of concept and production capacity for consumption reaches well beyond his own means.

The Researcher reaches out to his local entrepreneurial community, and eventually gets in touch with an Associate Vice President at CSU. The Assoc. VP sees a potential collaboration with the university, and puts the independent researcher in touch with the director of one of the

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

strategically identified research laboratories at CSU. Together, they co-found 'AGFuel'. By April 2006, a collaboration agreement between the university and 'AGFuel' is signed, and the venture is provided with 500000 USD in seed capital from a university-linked angel investor. Prototype development is initiated at the laboratory, which includes engaging a team of students to design and build the required machinery and create and build monitoring systems to collect and assess data on the biodiesel production methodology. The scale prototype is launched in August 2006, housed at the laboratory. By December, 'AGFuel' has hired a CEO.

Building upon positive findings, a full-scale installment, connecting directly to a waste material source, is built at a local business in February of 2007. On October 12, 2007, the director of the laboratory and a team of researchers (including some of the masters students working on the prototypes at the laboratory) file a U.S. patent application describing the design and function for the biofuel production. The patent is assigned jointly to 'AGFuel' and the university holding company. Over the following years, the venture goes through multiple rounds of funding to finance a large-scale installation facility, located in-state, which goes online in July 2009. The venture signs additional collaboration agreements with a National Laboratory to develop extraction processes (Sept. 2009) and a large chemical company to produce specialty chemicals (Sept. 2010). The director of the CSU research laboratory stays on as CTO until the beginning of 2011, and then remains as a technical advisor. 'AGFuel' delivers its first commercial product in April of the same year.

Discussion

Being situated in two different national contexts, the cases display obvious differences. For 'VacciH', the national 'professor's privilege' regime, where professors own IP stemming from research, is clearly illustrated by the Scientist taking his invention to the neighbor university Chalmers. Such a move would have required more involvement and ultimately approval of the employing university if this had occurred in most other national contexts where universities own IP generated from research, such as in the United States of America. Related to the 'professor's privilege' situation, considerable time and resources are spent in the 'VacciH' case on giving the Scientist advice especially around IP-related issues, in order to acquaint the Scientist with

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

different opportunities: 16 months elapsed between first contact and collaboration agreement in the case of 'VacciH', compared to nine months in the case of 'AGFuel'. This advice process could be seen as causing delays, resources and even missed commercialization opportunities. However, it also gave the inventors time to creatively relate to the idea and discuss any future engagements. Such creative aspects were also present in the 'AGFuel' due to the different actors at CSU investing their time into the idea. In these regards, both cases therefore underline the need for better understanding at a micro-level around incentives and activities behind a venture launch, while not putting too much emphasis only on the importance of IP regime or other national regulations (Goldfarb and Henrekson 2003; Louis et al. 1989).

Another difference between the cases is the characteristics of the two main venture creating environments: the entrepreneurship education and linked incubator at Chalmers as well as the laboratory and TTO at CSU. The Chalmers environment offered the Scientist and his team more generic business and venture creation resources and not technology-specific knowledge. The Researcher behind 'AGFuel', however, sought out specific expertise in a technology area, through the CSU laboratory. Interestingly enough, both of the cases show similar types of progress, despite the environmental differences. The ability of the environments and the ventures to attract more or less external resources, seem to have compensated for any weakness that either a too generic or a too resource-specific environment might have. Although often difficult to achieve, 'VacciH' supports the view that an educational environment can be valuable when relating to specific ventures as well as other university actors such as TTOs, university management and science departments (Wright et al. 2009).

The two cases also display several similarities that can be more or less related to literature. Both are examples of initial inventions generated externally to the specific university environment in which the venture was created. While in this regard 'AGFuel' is a less common form of venture creation at CSU, 'VacciH' is a more typical example of the Chalmers environment, as indicated in Table 1. However, the CSU strategy illustrates an increased willingness to play a larger role for venture creation beyond internally generated ventures.

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

Apart from the difference regarding "generic" resources, as discussed previously, the two venture creation environments display strong similarities. Firstly, they both offer resources, networks and legitimacy attractive for the inventors behind the two cases. The cases thereby confirm the importance of entrepreneurship centers at universities (Barr et al. 2009; Jacob et al. 2003; Lundqvist and Williams-Middleton 2008; Meyer et al. 2011; Rasmussen and Sørheim 2006; Wiggins and Gibson 2003; Wright et al. 2007b). Characteristic of such environments is operating beyond the formal and transactional role of traditional Technology Transfer Offices (Kruecken 2003). The TTO can be seen as a necessary bureaucratic public-private interface (Siegel et al. 2003) not to be confused with the entrepreneurial capabilities (Rasmussen and Borch 2010) displayed in the studied environments.

Secondly, the involvement of students in the two environments has been important for the progress of both cases. The important role which students can hold for university venture creation is only scarcely recognized in literature (Berggren 2011; Lundqvist and Williams-Middleton 2008; Moroz et al. 2007; Ollila and Williams Middleton 2011). Involving students in the two cases not only offers inventors and other university scientists a way to avoid becoming lead entrepreneurs, it also seems to add new business development dimensions to the ventures apart from offering action-based entrepreneurial learning. Scant literature has already hinted at the contribution that entrepreneurship education can lend to university commercialization (Boni and Emerson 2005; Siegel et al. 2005), but this contribution is not without challenges (Wright et al. 2009). Nevertheless, drawing from the important roles played by students in both cases, there is reason to propose that the integration of students into science-based venture creation ought to be seen as yet another type of academic entrepreneurship, adding to the forms listed by Louis et al. (1989).

Thirdly, both cases illustrate venture ideas going into university environments thereby engaging a much larger network and resource-base, extending beyond the border of the university. The cases confirm a view of universities acting as "gateways" for innovations thus deviating from an "ivory tower image" (Glassman et al. 2003). However, in the cases the university also offers legitimacy

and enables personal engagement – for and from scientists, students and others – which extends the gateway metaphor into something more collaborative and transformational.

Fourthly, the university scientists are venture creating in multiple ways, while avoiding the role of lead venture creator. This confirms previous findings from more venture creation active universities in the U.K. (Lockett et al. 2003). In 'VacciH', the Scientist played the roles of inventor, advisor, co-founder and board member but not as the lead entrepreneur. Added to this, university scientists involved in the entrepreneurship education also acted in different roles important for the venture, such as advising, tutoring, involving students and ultimately upholding the university environment making the venture creation possible. In 'AGFuel', university scientists at the laboratory took on in different capacities such as advising, tutoring, involving students, co-founding the venture, inventing technology, developing products, and upholding the entrepreneurial laboratory environment. Thus, relative to the purpose of exploring changes in the role of university scientists, the cases provide evidence that university scientists not only engage into venture creation in a variety of ways compatible with their role as scientists (Jain et al. 2009), but also are critical in upholding collaborative environments for venture creation and entrepreneurial learning.

Finally, university level developments to support venture creation are exemplified – the VINNOVA grant initiative and the CSU strategy directed at three areas of research. These programs have helped build legitimacy around venture creation at universities as well as improve collaboration among actors, such as innovation advisors, incubators/TTOs and laboratories, within the universities. However, notable for both programs is that they primarily legitimize, enhance and integrate entrepreneurial capabilities already existing.

Conclusions and future research

This article has explored changes in the role of the university scientist towards academic entrepreneurship through venture creation, while adding to our understanding of the influence of university initiatives towards supporting venture creation. Previous research had positioned venture creation as the type of academic entrepreneurship least compatible with a traditional role

of the university scientist. University venture creation has also primarily been studied from the perspective of the venturing scientist or as one of many commercial transactions carried out by TTOs.

From the two case studies, a more collaborative perspective on venture creation can be proposed, in which university scientists play multiple and compatible but not necessarily lead entrepreneurial roles as regards venture creation. They advice, develop and legitimize specific ventures while also upholding entrepreneurial environment and entrepreneurship educations that play key roles for early ventures. The entrepreneurial environments act beyond being transactional TTOs or 'gateways' for innovations through their ability to legitimize and connect with internal and external university resources, including students as key drivers. In relation to the cases, government and university-level initiatives helped legitimize, enhance and integrate resources already existing, indicating that entrepreneurial capabilities at universities fostering venture creation primarily are to be initiated and supported from within universities. Although differences in, for example, IP regime around the two cases had some impact on how and when certain decisions were made, the similarities between the cases point at understanding of venture creation as creative, collaborative and transformational (rather than only transactional), where university actors – including students – can play a variety of important roles.

The current study is of course limited to two cases thus leaving open many questions. We still know relatively little about entrepreneurial capabilities, how common they are at universities and how they can be generated through entrepreneurship centers, entrepreneurship educations, laboratories, etc. University scientists engaging into building and upholding entrepreneurial capabilities and collaborative environments beyond individual ventures are taking on roles and career paths that are poorly understood. Thus, the sustainability of more collaborative and entrepreneurial university environments that, among other things, develop ventures is worthy of further study.

Last but not least, we need more research around policy initiatives on the national, regional or university level aimed at promoting academic entrepreneurship through venture creation. Some

Version of Record available at: http://doi.dx.org/10.1108/JSBED-04-2013-0059

policies, such as gap or verification grants and other seed financing, such as soft loans, seem to be relatively straight forward and make a difference for new ventures. However, apart from this, the cases point more at legitimizing, enhancing and integrating different existing university resources (TTO:s, incubators, educations, and – not the least – collaborative and entrepreneurial university scientists) than creating new add-on functions at universities or intermediaries in the interface between universities and business.

References

Barr, S. H., Baker, T. E. D., Markham, S. K. and Kingon, A. I. (2009), "Bridging the Valley of Death: Lessons Learned From 14 Years of Commercialization of Technology Education" *Academy of Management Learning & Education,* 8, 3, 370-388.

Bercovitz, J. and Feldman, M. (2008), "Academic Entrepreneurs: Organizational Change at the Individual Level" *Organization Science,* 19, 1, 69-89.

Berggren, E. (2011), "The entrepreneurial university's influence on commercialisation of academic research - the illustrative case of Chalmers University of Technology" *International Journal of Entrepreneurship and Small Business,* 12, 4, 429-444.

Boni, A. A. and Emerson, S. T. (2005), An Integrated Model of University Technology Commercialization and Entrepreneurship Education. *Colloquium on Entrepreneurship Education and Technology Transfer.*

Brennan, M. C. and Wall, A. P. (2005), "Academic entrepreneurship: Assessing preferences in nascent entrepreneurs" *Journal of Small Business and Enterprise Development,* 12, 3, 307-322.

Clarysse, B., Tartari, V. and Salter, A. (2011), "The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship" *Research Policy,* 40, 8, 1084-1093.

Clarysse, B., Wright, M., Lockett, A., van de Elde, E. and Vohora, A. (2005), "Spinning out new ventures: a typology of incubation strategies from European research institutions." *Journal of Business Venturing,* 20, 2, 183-216.

Deem, R. (2001), "Globalisation, New Managerialism, Academic Capitalism and Entrepreneurialism in Universities: is the local dimensions still important?" *Comparative Education,* 37, 1, 7-20.

Dickson, K., Coles, A. and Smith, H. (1998), "Science in the market place: the role of the scientific entrepreneur" in: During, W. and Oakey, R. (eds.) *New Technology-based Firms in the 1990s.* Paul Chapman, London, 27-37.

Druilhe, C. and Garnsey, E. (2004), "Do Academic Spin-Outs Differ and Does it Matter?" *Journal of Technology Transfer,* 29, 269-285.

Etzkowitz, H. (2003), "Research groups as `quasi-firms': the invention of the entrepreneurial university" *Research Policy,* 32, 1, 109-121.

Flick, U. (2006), *An Introduction to Qualitative Research,* Sage Publications, London, UK.

Franklin, S., Wright, M. and Lockett, A. (2001), "Academic and surrogate entrepreneurs in university spinout companies." *Journal of Technology Transfer* 26, 1/2, 127-141.

Glassman, A. M., Moore, R. W., Rossy, G. L., Neupert, K., Napier, N., Jones, D. E. and Harvey, M. (2003), "Academic Entrepreneurship: Views on Balancing the Acropolis and the Agora" *Journal of Management Inquiry,* 12, 4, 353-374.

Goldfarb, B. and Henrekson, M. (2003), "Bottom-up versus top-down policies towards the commercialization of university intellectual property" *Research Policy,* 32, 4, 639-658.

Jacob, M., Lundqvist, M. and Hellsmark, H. (2003), "Entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology" *Research Policy,* 32, 9, 1555-1568.

Jain, S. and George, G. (2007), "Technology transfer offices as institutional entrepreneurs: the case of Wisconsin Alumni Research Foundation and human embryonic stem cells" *Industrial and Corporate Change,* 16, 4, 535-567.

Jain, S., George, G. and Maltarich, M. (2009), "Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity" *Research Policy,* 38, 6, 922-935.

Kirby, D. (2006), "Creating Entrepreneurial Universities in the UK: Applying Entrepreneurship Theory to Practice" *Journal of Technology Transfer,* 31, 5, 599-603.

Kruecken, G. (2003), "Mission impossible Institutional barriers to the diffusion of the third academic mission at German universities" *International Journal of Technology Management,* 25, 1-2, 18-33.

Larsen, M. T. (2011), "The implications of academic enterprise for public science: An overview of the empirical evidence" *Research Policy,* 40, 1, 6-19.

Leslie, L. L. and Slaughter, S. (1997), *Academic Capitalism: Politics, Policies, and the Entrepreneurial University,* The Johns Hopkins University Press, Baltimore, MD, USA.

Lockett, A. and Wright, M. (2005), "Resources, capabilities, risk capital and the creation of university spin-out companies" *Research Policy,* 34, 7, 1043-1057.

Lockett, A., Wright, M. and Franklin, S. (2003), "Technology Transfer and Universities' Spin-Out Strategies" *Small Business Economics,* 20, 2, 185-200.

Louis, K. S., Blumenthal, D., Gluck, M. E. and Stoto, M. A. (1989), "Entrepreneurs in academe: an exploration of behaviors among life scientists" *Administrative Science Quarterly,* 34, 1, 110–131.

Lundqvist, M. and Williams-Middleton, K. (2008), "Sustainable Wealth Creation beyond Shareholder Value" in: Wankel, C. and Stoner, J. (eds.) *Innovative Approaches to Global Sustainability.* Palgrave MacMillan, New York, NY, 39-62.

Mendes, A. and Kehoe, C. (2009), "Academic entrepreneurship: possibilities and pitfalls" in: West III, G., Gatewood, E. J. and Shaver, K. (eds.) *Handbook of University-wide Entrepreneurship Education.* Edward Elgar Publishing Limited, Cheltenham, UK, 73-94.

Merrill, S. A. and Mazza, A.-M. (2010), Managing University Intellectual Property in the Public Interest. *In:* Property, C. o. M. o. U. I. (ed.) *Lessons from a Generation of Experience, Research, and Dialogue.* National Research Council.

Meyer, A. D., Aten, K., Krause, A. J., Metzger, M. L. and Holloway, S. S. (2011), "Creating a university technology commercialisation programme: confronting conflicts between learning, discovery and commercialisation goals" *International Journal of Entrepreneurship and Innovation Management,* 13, 2, 179-198.

Moroz, P., Hindle, K. and Anderson, R. B. (2007), Exploring the linkages between university technology transfer and entrepreneurship education programs: attitudes and perceptions amongst entrepreneurship academics. *International AGSE Entrepreneurship Research Exchange.* Brisbane, Australia.

Mosey, S. and Wright, M. (2007), "From Human Capital to Social Capital: A Longitudinal Study of Technology-Based Academic Entrepreneurs" *Entrepreneurship: Theory & Practice,* 31, 6, 909-935.

Nelson, R. R. (2004), "The market economy, and the scientific commons" *Research Policy,* 33, 3, 455-471.

O'Connor, S., G.D. Graff and D.E. Winickoff (2010), Legal Context of University Intellectual Property and Technology Transfer. National Academy of Sciences.

O'Shea, R. P., Allen, T. J., O'Gorman, C. and Roche, F. (2004), "Universities and Technology Transfer: A Review of Academic Entrepreneurship Literature" *Irish Journal of Management,* 25, 2, 11-29.

Ollila, S. and Williams Middleton, K. (2011), "The venture creation approach: integrating entrepreneurial education and incubation at the university" *International Journal of Entrepreneurship and Innovation Management,* 13, 2, 161-178.

Patzelt, H. and Shepherd, D. A. (2009), "Strategic Entrepreneurship at Universities: Academic Entrepreneurs' Assessment of Policy Programs" *Entrepreneurship: Theory & Practice,* 33, 1, 319-340.

Philpott, K., Dooley, L., O'Reilly, C. and Lupton, G. (2011), "The entrepreneurial university: Examining the underlying academic tensions" *Technovation,* 31, 4, 161-170.

Rasmussen, E. and Borch, O. J. (2010), "University capabilities in facilitating entrepreneurship: A longitudinal study of spin-off ventures at mid-range universities" *Research Policy,* 39, 5, 602-612.

Rasmussen, E. and Sørheim, R. (2006), "Action-based entrepreneurship education" *Technovation,* 26, 2, 185-194.

Rogers, E., Yin, J. and Hoffman, J. (2000), "Assessing the effectiveness of technology transfer offices at U.S. research universities" *Journal of Association of University Technology Managers,* 12, 47-80.

Samsom, K. J. and Gurdon, M. A. (1993), "University Scientists as Entrepreneurs: A Special Case of Technology Transfer and High Technology Venturing" *Technovation,* 13, 2, 63-71.

Siegel, D., Waldman, D. and Link, A. (2003), "Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study" *Research Policy,* 32, 27-48.

Siegel, D. S., Phan, P. H. and Gary, D. L. (2005), "Analyzing the Effectiveness of University Technology Transfer: Implications for Entrepreneurship Education" *Advances in the Study of Entrepreneurship, Innovation, & Economic Growth.* No longer published by Elsevier, 1-38.

Stake, R. E. (2005), "Qualitative Case Studies" in: Denzin, N. K. and Lincoln, Y. S. (eds.) *The Sage Handbook of Qualitative Research.* Sage Publications Inc., Thousand Oaks, CA 443-466.

Wiggins, J. and Gibson, D. V. (2003), "Overview of US incubators and the case of the Austin Technology Incubator" *International Journal of Entrepreneurship and Innovation Management,* 3, 1, 56-66.

Wright, M., Birley, S. and Mosey, S. (2004), "Entrepreneurship and University Technology Transfer" *Journal of Technology Transfer,* 29, 3-4, 235-246.

Wright, M., Clarysse, B., Mustar, P. and Lockett, A. (2007a), *Academic Entrepreneurship in Europe,* Edward Elgar Publishing, Cheltenham, UK.

Wright, M., Hmieleski, K. M., Siegel, D. S. and Ensley, M. D. (2007b), "The Role of Human Capital in Technological Entrepreneurship" *Entrepreneurship: Theory & Practice,* 31, 6, 791-806.

Wright, M., Piva, E., Mosey, S. and Lockett, A. (2009), "Academic entrepreneurship and business schools" *The Journal of Technology Transfer,* 34, 6, 560-587.

Yin, R. K. (1994), *Case Study Research: Design and Methods,* Sage Publications, London.

Åsterbro, T. B., Bazzazian, N. and Braguinsky, S. (2011), Startups by Recent University Graduates versus their Faculty - Implications for University Entrepreneurship Policy. SSRN.