

The Role of Universities in Encouraging Growth of Technology-Based New Ventures

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In addition to typical university focus activities such as the education of students, dissemination of faculty research findings through publications, and partnerships with corporate firms and outreach, today, new venture creation has also gained substantial interest. In fact, universities worldwide are increasingly viewed as venues for spurring entrepreneurship and economic development. This conceptual paper seeks to explore the types of capabilities that universities could develop and enhance to support the growth of technology-based new ventures. Using an entrepreneurial competence framework that builds on insights from the academic entrepreneurship literature, the paper identifies and discusses some of the key factors to be considered for the development of these new ventures. The paper concludes with specific set of recommendations on how universities could encourage the growth of technology-based new ventures.

Keywords: Academic entrepreneurship; technology-based new ventures; new venture creation; university competencies.

1. Introduction

For a university, successfully engaging in academic entrepreneurship is likely to lead to many financial, reputational, and societal benefits [Wood (2011)]. It has been stated that the growing interest among universities in pursuing commercial applications of research, including new venture creation, is a clear trend of an increasing number of “entrepreneurial universities” playing an enhanced role in technological innovation [Etzkowitz *et al.* (2000)]. Several theories in the academic literature depict the university and its related activities as the source and catalyst for developing new technologies as well as a crucial source for talented and qualified employees [Markusen (1996); Porter (1990)]. Additionally, collective learning

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theories view the university as integral to the knowledge creation process [Keeble and Wilkinson (1999); Lawson and Lorenz (1999)]. According to the academic entrepreneurship literature, there are two key approaches for universities to focus on entrepreneurship. One approach is to focus on the commercialization of knowledge and research findings [Roessner *et al.* (2013)]. An emphasis of this literature is the contribution of the university to the transfer of knowledge. Universities are setting up institutional arrangements such as technology transfer offices (TTOs), incubators, entrepreneurship centers, and internal seed funds to increase the commercialization of research [Rasmussen *et al.* (2006)]. As such, the university provides knowledge through which industry can stimulate new innovations and develop new technologies [Breznitz and Anderson (2006); Clarysse *et al.* (2005); Di Gregorio and Shane (2003); Henderson (2006)]. In fact, several countries are undertaking university scale reform with a view towards increased commercialization of the results of public research [Wright *et al.* (2007)]. This process is generally viewed as a new task for universities, a task that has been inevitably added to universities' roles due to historical changes [Etzkowitz *et al.* (2000); Minshall *et al.* (2004)]. In the US the Bayh Dole Act contributed to significant changes in how universities commercialize and diffuse technologies developed in their research laboratories and elsewhere on campus. There has been a significant increase in technology-based economic development initiatives, focused mainly on stimulating technological entrepreneurship in universities via patenting, licensing, startup creation, and university–industry partnerships [Grimaldi *et al.* (2011)]. The second approach is through entrepreneurial education [Gibb and Hannon (2006)] and making entrepreneurship courses an integral part of the university's teaching curriculum and mission. It can be stated that entrepreneurship education is assuming extraordinary relevance within academic programs all over the world [Alberti *et al.* (2005)] and there seems to be widespread recognition that entrepreneurship can contribute to economic development [Szirmai *et al.* (2011, p. 26)].

Across the United States (US), many business schools are ramping up entrepreneurship programming, as students pursue dreams of lucrative innovation, and startup glory [Baron (2015)]. In addition to entrepreneurship courses taught for business students, it can be stated that a sense of initiative and entrepreneurship have become widely viewed as key competences necessary for all students regardless of their speciality [Küttim *et al.* (2014)]. In a unique partnership, during the Fall of 2014, Stanford University partnered with the startup accelerator Y Combinator to teach a class on startups to its engineering students [Techcrunch (2014)]. According to a recent survey report at the Massachusetts Institute of Technology (MIT), if the active companies founded by living MIT alumni formed an independent nation, conservative estimates indicate that their revenues would make that nation at least the 17th largest economy in the world [Roberts and Eesley (2011)]. The report went on to state that the combined annual revenue of companies founded by still-living MIT alumni whose companies have not been acquired or merged was \$2 trillion across 25 800 companies that employ 3.3 million people. 41% of MIT founders had in fact created multiple new ventures and 900 new ventures were typically started per year by MIT alumni.

However, despite high expectations and significant attention given to the role of universities in encouraging the growth of technology-based new ventures, the results in most contexts are disappointing [Harrison and Leitch (2009)]. While universities such as MIT and Stanford are true seedbeds of new ventures, US-based data demonstrates that the majority of institutions have not proven to be as effective when it comes to creating new ventures [O’Shea *et al.* (2005)]. In Europe, the number of new ventures created is growing, but the numbers are highly skewed to just a few institutions [Wright *et al.* (2007)]. The reasons behind these variations are multifaceted and a better understanding of how universities could encourage the growth of technology-based new ventures would be valuable for designing policies and infrastructure to promote entrepreneurship in academic settings. Universities are complex institutions in several different dimensions. On the one hand, they have a long and distinguished history as exemplars of creative and innovative thinking. On the other hand, they are often the champions of long-established traditions and ways of teaching and research. Studies have shown that the faculty quality [Powers and McDougall (2005)], intellectual eminence [Di Gregorio and Shane (2003)] and scientific productivity [Van Looy *et al.* (2011)] of universities are all related to its new venture activity. It has also been documented that a large share of university spin-offs does not involve intellectual property formally developed at the university [Aldridge and Audretsch (2011); Fini *et al.* (2010)]. In certain cases, star researchers are able to overcome both geographical distances from venture capitalists, as well as the disadvantages of not being affiliated with a top research university when founding a new technology venture [Fuller and Rothaermel (2012)]. That being said, the relationship within the overall university context could still be very important

Table 1. Theories on the role of the university and key ideas.

Theory	Author(s)	Key idea
Developing new technologies	Markusen [1996]; Porter [1990]	University and its related activities as the source and catalyst for developing new technologies as well as a crucial source for talented and qualified employees
Collective learning	Keeble and Wilkinson [1999]; Lawson and Lorenz [1999]	University as integral to the knowledge creation process
Financial and social contributions to society	Breznitz and Anderson [2006]; Clarysse <i>et al.</i> [2005]; Di Gregorio and Shane [2003]; Henderson [2006]; O’Shea <i>et al.</i> [2005]; Slater and Mohr [2006]	Contribution of the university to the transfer of knowledge
Spin-offs	Di Gregorio and Shane [2003]; Wright <i>et al.</i> [2007]; Aldridge and Audretsch [2011]; Fini <i>et al.</i> [2010]; Di Gregorio and Shane [2003]; Powers and McDougall [2005]; Van Looy <i>et al.</i> [2011]	Commercializing intellectual property generated from university research Commercializing all types of university-generated knowledge Role of university intellectual eminence on spin-off activity Role of faculty quality on spin-off activity Role of scientific productivity on spin-off activity

for the formation of new technology ventures and some of the university characteristics associated with new venture formation are established in the subsequent literature. Programs that provide access to finance, technology, networks, and business knowledge, as well as programs that offer tax incentives and reduce administrative burdens are perceived by academic entrepreneurs as useful for achieving their strategic development goals [Patzelt and Shepherd (2009)].

Table 1 presents a summary of the various theories addressing this topic along with their key ideas.

Given these theoretical constructs, in order to obtain a systematic overview of the types of capabilities that universities could develop and enhance to support the growth of technology-based new ventures, we performed an in-depth literature review covering the many years of research on universities and new venture creation. Section 2 provides an overview of whether universities should engage in new venture creation by highlighting key benefits and challenges of doing so. Section 3 explores how universities could support technology-based new ventures by providing a university entrepreneurial competence framework. A discussion of the university entrepreneurial competency framework highlighting some of the key factors to be considered for the development of new technology-based ventures is presented in Sec. 4. In conclusion, Sec. 5 provides specific recommendations on how universities could encourage the growth of technology-based new ventures.

2. Should Universities Engage in New Venture Creation?

“Entrepreneurial success in a university setting is not only about financial return but also about exciting and attracting students and faculty, and adding the element of societal impact to the academic ethos. Many of the most exciting basic science challenges were and are found in what has become known as ‘Pasteur’s Quadrant’, where basic science is driven by the desire for societal benefit. Pasteur’s Quadrant is terrain where all universities should dwell. Rao and Mulloth provide us with a roadmap.”

– Paul Horn, Senior Vice Provost for Research;
Senior Vice Dean for Strategic Initiatives and Entrepreneurship,
NYU Tandon School of Engineering

Interest in third mission activities has been accentuated with recent economic recessions and as regional and national governments are challenged to initiate and sustain successful growth policy. There is a growing interest in entrepreneurship education expressed by politicians, higher education institutions, and students [Küttim *et al.* (2014)]. Traditionally, critics have claimed that having too much of a commercial orientation would endanger the university as an independent knowledge producer and there can be conflicts of interest [Blumenthal *et al.* (1997)]. However, most empirical research shows that entrepreneurial activities in universities are associated with higher scientific productivity and they strengthen, rather than dilute,

the universities core missions [Van Looy *et al.* (2011)]. Further, although spin-off venture creation and industry collaboration can be seen as alternative ways of commercializing academic research, studies show that these activities are not substitutes but rather reinforce each other [Di Gregorio and Shane (2003); Powers and McDougall (2005); Van Looy *et al.* (2011)]. Within the US, the rise of commercialization associated with the Bayh–Dole Act has not resulted in less basic research [Grimaldi *et al.* (2011)]. Spin-off activity appears to be positively related to measures of research productivity and quality [Colombo *et al.* (2010); Di Gregorio and Shane (2003)]. Worries that universities suffer from a brain drain because scientists spend time and effort on entrepreneurial activities have not been confirmed by empirical studies [Toole and Czarnitzki (2010)].

Recent data supports the importance of university supported new ventures and their economic impact. In an August 2013 global benchmark report released by UBI Index, a Sweden-based research initiative, the New York University (NYU) business incubators were cited among the 20 best university business incubators in the world [Strom (2014)]. The report presented 150 university incubators in 22 countries and measured their performance on 50 indicators, including job creation capacity, ability to boost the economy, and level of success of graduated companies. The incubators at the top of the list were calculated to have generated almost three times as many jobs as the global average and graduated twice the number of clients receiving venture capital or angel funding. Further, Worth magazine recently named the NYU incubators — Varick Street Incubator, DUMBO Incubator, and the New York City Accelerator for a Clean and Resilient Economy (NYC ACRE) — among the Top 10 Idea Labs in the US [The Business Journals (2013)].

In October 2012, NYU researchers assessed the economic impact of the university's incubators. They surveyed existing and graduated companies, analyzed available data, and applied standard economic formulae to determine the economic activity generated. As of January 2014, incubator companies have created more than 1256 jobs, raised more than \$145 million in capital, and had a local economic impact of \$352 million. This figure is projected to be \$719.8 million by 2015 [NYU Economic Impact Study (2012)].

Advocates of university spin-offs state two main reasons for universities prioritizing new venture creation. The first reason relates to the direct economic impact generated by new technology-based ventures, and can be referred to as the economic growth argument. In this view, new technology businesses are concrete examples that investments of public money in universities can lead to direct economic benefits in terms of new business activity at national and regional level [Rasmussen *et al.* (2006)]. As exemplified by the NYU business incubators above, new technology-based ventures can help create new jobs, generate tax revenues and raise significant amounts of external capital.

The second reason for encouraging technology-based new ventures is that these new ventures may act as a technology transfer mechanism that converts latest scientific knowledge into application in society. Following this technology transfer argument, venture creation can be seen as a tool to facilitate the dissemination of university research [Autio (1997)]. However, it must be noted that the effect of

TTOs and incubators in promoting academic entrepreneurship has been questioned, unless the universities undergo a structural change [Clarysse *et al.* (2011); Lockett and Wright (2005)]. Universities with established policies and procedures for the management of technology transfer tend to perform better [Caldera and Debande (2010)]. If done right, such university-derived new ventures have the potential to generate significant economic impact as well as bring new ways of tackling some of society’s toughest challenges in health, education, economic development, poverty, water, energy, environment, food/nutrition, technology, and agriculture.

Figure 1 provides a summary of the main arguments by the two schools of thought on universities engaging in new venture creation.

A key challenge for the initiation and development of university new ventures is the ability to transform research know-how into a commercial product/service that can be sold in the marketplace [Carayannis *et al.* (1998)]. Although some universities have succeeded in becoming more entrepreneurial than others, the development of commercial and entrepreneurial capabilities in universities is difficult. To quote Ambos *et al.* [2008]: “*At its heart, the challenge essentially involves taking an organization that is equipped for and accustomed to doing one thing (academic research)*”

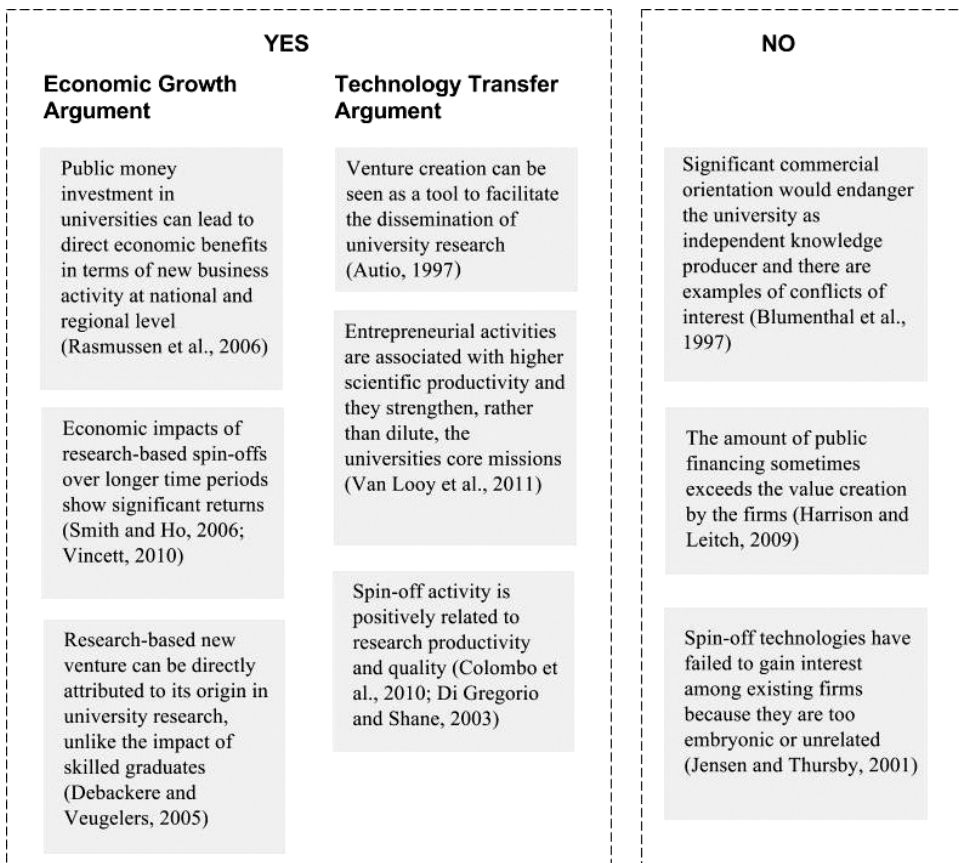


Fig. 1. Should universities create new ventures?

and asking it in addition to build a capacity for doing something entirely different (commercialization of technologies and ideas). The challenge here is that universities and their faculty are not simply required to switch from one activity to another, but to develop the simultaneous capacity for two activities (academic rigor and commercialization). This can cause tensions to arise at the level of the organization as a whole as it strives to manage these two sets of activities, and also at the level of the individual who has to work out balancing his or her time between competing demands.”

The university’s capability for encouraging technology-based new ventures is multifaceted and involves many facets such as entrepreneurially-minded faculty and students, TTO, business incubators, and innovation labs as well as external factors in industry and the public sector. Further, the amounts of technological, human, financial, social and other resources will also influence whether and how universities can promote new ventures.

The next section of this paper will explore how universities can support technology-based new ventures by providing an entrepreneurial competence framework.

3. Framework

Figure 2 below presents a framework for university entrepreneurial competency. The many competencies needed to transform research findings from a traditionally non-commercial university context provide specific challenges in the initial phases of development [Vohora *et al.* (2004)]. To analyze how the university context influences

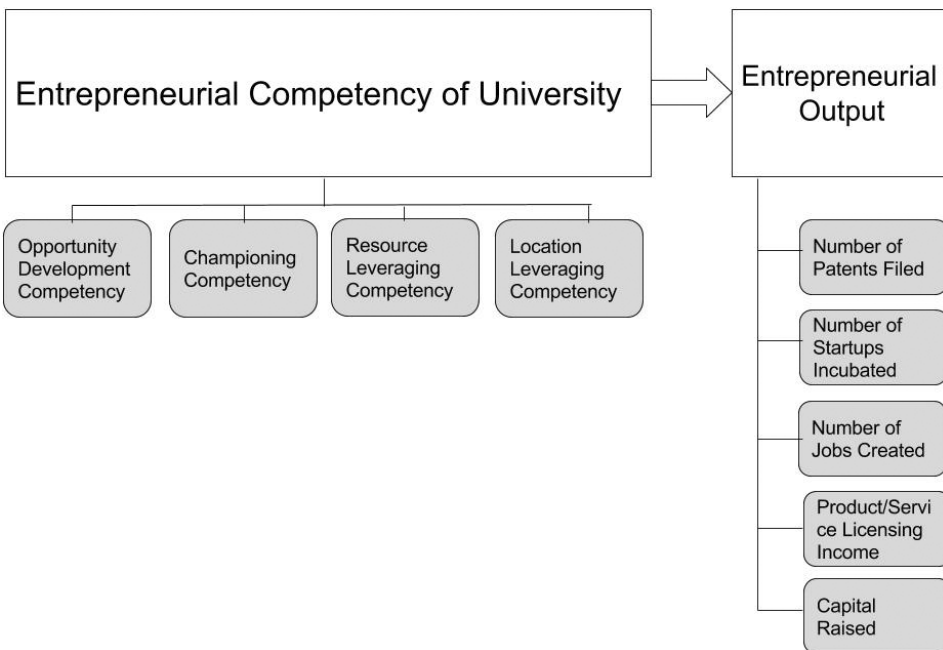


Fig. 2. University entrepreneurial competency framework.

the venture creation and development process, further examination of how a new venture is created within the university setting is needed. Entrepreneurship scholars have theorized on the properties that constitute the central aspects of emerging organizations [Brush *et al.* (2008); Katz and Gartner (1988)]. Ventures tend to engage in a continuous search for fit between the external context and internal resource conditions, rather than existing in a relatively “steady state” or “best” configuration [Autio *et al.* (2011)].

Adapting the entrepreneurial competency framework of Rasmussen *et al.* [2011] to also include the competency of leveraging the locational advantage of the cluster where the university or new venture is located, how each of the competencies is linked to new venture performance can be analyzed. The specific entrepreneurial competencies are:

- (1) The need to develop a viable business opportunity (opportunity development competency);
- (2) The need for championing individuals who provide meaning and energy to the entrepreneurial process (championing competency);
- (3) The need to access the resources necessary to develop the new venture (resource leveraging competency); and
- (4) The need to locate the new venture in the right ecosystem and support infrastructure (location leveraging competence).

The above four competencies provide the basis of a useful analytical framework as they highlight how different factors could play varying roles in the development of the new venture. Each of the competencies of the framework will be discussed in more detail and the example of entrepreneurship at NYU will be analyzed across the framework. With its explicit focus on entrepreneurship, NYU had consistently ranked first among US universities in income from technology licensing [Foss and Gibson (2015)]. Compared to other US universities, NYU had 80% more new startup companies created, per research dollar expended, than the national average in 2010 [New York University (2011)]. Dozens of products have been commercialized and more than 100 startups have been launched to bring NYU innovations to market. These and other activities have attracted millions of dollars from venture capitalists, the federal government, and the State of New York; produced new ventures, licenses, and patents, and led to acquisitions by large corporations. Further, in recognition of the quality of the research, NYU received over \$300 million in government research grants in 2010.

We will also summarize the key characteristics for university new ventures to succeed in developing them. The proposed metrics for measuring the entrepreneurial output of universities are the number of patents filed, number of startups incubated, number of jobs created, the product/service licensing income generated, and the startup capital raised.

3.1. Opportunity development competency

The perception of a business opportunity is related to the knowledge and experience of the individual researcher, and this “opportunity recognition capacity” of

academics has been found to be the most important factor in the researcher's engagement in new ventures [Clarysse *et al.* (2011)]. The ability of seeing a potential business opportunity and developing it into a viable business is a cognitive act, with different individuals playing different roles throughout the entrepreneurial process [Rasmussen *et al.* (2011)].

At the individual researcher level, the likelihood of starting a spin-off company to commercialize research is much higher for faculty members who have received industrial support [Louis *et al.* (1989)]. Interestingly, work experience from the private sector is not necessarily significant for new venture formations but joint research projects with private firms are [Krabel and Mueller (2009)]. This indicates that the knowledge needed to establish a new venture is developed in the interplay between academia and industry, rather than within one or the other sectors.

The network and experience of founders and managers of university new ventures are likely to be more technologically-oriented than market-oriented. This may limit the search when exploring possible applications of the technology to familiar knowledge areas and only a few alternatives considered [Zahra *et al.* (2007)]. Technological innovations are fungible [Penrose (1959)] and new inventions can lead to different market applications depending on the process by which they are commercialized [Shane (2000)]. The ability to seek improvements in the opportunity combined with the ability of altering the opportunity according to new insights can be seen as an opportunity development competency [Rasmussen *et al.* (2011)]. The opportunity development competency is also dependent on high technological expertise in combination with industry or market knowledge. For new ventures that are launched by academics, interaction with industry is often critical to conceiving and modifying a viable business concept based on research knowledge. There can be many sources of industry interaction and market knowledge that provides the competency of opportunity development.

Figure 3 summarizes the key characteristics for university new ventures to succeed in developing their opportunity development competency.

NYU aimed to foster innovation and entrepreneurship through a wide variety of offerings both inside and outside the classroom. Researchers were encouraged to move science to application, product, and service, and from there to let their discoveries take flight as startup companies. Further, the university had launched several new technology transfer and IP commercialization initiatives bolstering and expanding existing programs to foster innovation, to bridge the gap between basic and applied science, and to look for opportunities to move discoveries from the laboratory to the marketplace. In the case of faculty-driven new ventures, the university's office of innovation development and technology transfer sought out and recruited serial entrepreneurs with relevant industry background to work in tandem with the faculty. The incubators served as a test bed for the new ventures to develop and demo their product or service offering to a wide audience and in return gather critical feedback. The incubators also provided a platform for the venture founders to connect back with the university by hiring students and be part of various forums and networking events.

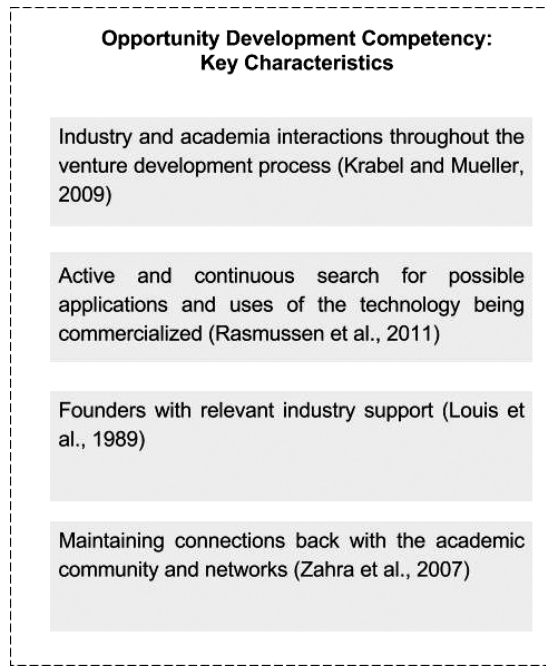


Fig. 3. Opportunity development competency.

3.2. *Championing competency*

The lack of growth and financial success of many university new ventures can be attributed to the motivations of the people who started the venture [Baum and Locke (2004)]. In the case of academic entrepreneurs, the individual motivation could be related to a range of factors such as technology diffusion, technology development, financial gain, public service, and peer motivations [Hayter (2011)]. Within the university setting, support from faculty colleagues, university managers, TTO staff, and people in the external network of the university are often critical, particularly in early stages [Rasmussen (2011)]. The role of these champions is to provide emotional meaning and energy to the venture process and in the process procure the commitment of others to the new venture [Howell and Higgins (1990)].

University-based new ventures are usually championed by academics or by teams consisting of both academics and external entrepreneurs. Entrepreneurial teams often change over time and university spin-offs often develop through dynamic interaction of different individuals with different competencies throughout the startup process [Rasmussen (2011)]. It is beneficial to include champions with backgrounds from outside the university in the founding teams of university spin-offs [Wennberg et al. (2011)]. The role of academics social capital and networks has been emphasized by several studies [Murray (2004); Nicolaou and Birley (2003)]. It has been stated that if the new venture founders have relationships with venture investors, they are more likely to receive venture funding and are less likely to fail [Shane and Stuart (2002)].

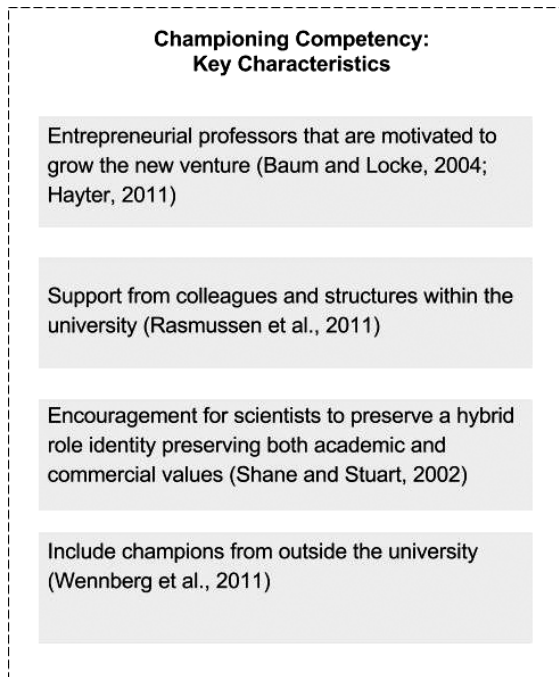


Fig. 4. Championing competency.

Figure 4 summarizes the key characteristics for university new ventures to succeed in developing their championing competency.

In the case of New York University, there had long been a tradition of new venture creation. Starting with Professor Samuel F. B. Morse (inventor of the electric telegraph and among the original 14 faculty members), NYU had been a major source of prolific inventors, scientists, and entrepreneurs. Today, NYU’s science and technology researchers increasingly bear in mind the importance of commercializing discoveries, helped by the 2008 addition of the Polytechnic Institute (NYU-Poly), NYU’s School of Engineering (now NYU Tandon School of Engineering), where the motto is “i2e” — invention, innovation, and entrepreneurship. It is also important to consider the important steps made by Mayor Bloomberg’s administration to solidify a strong present and future for NYC’s entrepreneurial ecosystem throughout the five boroughs. The Bloomberg Administration and the city council had appointed the city’s first Chief Digital Officer, provided financial support for tech incubators and workshare spaces, and had underwritten the BigApps and Next Idea competitions/hackathons and helped create the New York City Entrepreneurial Fund — a \$22 million fund to provide promising New York City-based technology startup companies with early-stage capital.

3.3. Resource leveraging competency

University new ventures often pursue several business models at the same time [Clausen and Rasmussen (2012)]. The market application of technological inventions

and knowledge is rarely clear from the outset [Gruber *et al.* (2008)] and the business models are modified as entrepreneurs gain more knowledge about resources and potential opportunities [Chesbrough and Rosenbloom (2002)]. A key resource for university-based new ventures in their early stages is the university researchers behind the technology being commercialized. Not surprisingly, many studies have shown that academics with access to more resources are more likely to form spin-offs. According to Landry *et al.* [2006], the likelihood of launching university spin-offs increases as the researchers have access to more financial resources from grants and university–industry partnership programs, have more intellectual property assets, have knowledge assets in the fields of computer sciences and engineering rather than in the other natural sciences, have knowledge expertise in consulting, have higher social capital assets, have access to the resources of large research universities, have access to the resources of large laboratories, and have many years of experience in research.

It would also be beneficial for local high-tech startups to be able to detect, absorb, and use the research being produced by universities in the region [Colombo *et al.* (2010)]. A number of different resources such as human capital, financial capital, physical assets, technological resources, and organizational resources are essential for building a new startup venture. It has also been mentioned that very often the intangible “soft” resources are more useful than tangible resources, especially during the early stage of venture development [Brush and Lichtenstein (2001)]. Successful creation of a new venture depends on both the ability to assemble and organize resources.

It must also be noted that the resource acquisition process is highly iterative and involves many different institutions with the appropriate competencies [Rasmussen and Clausen (2012)]. While most new ventures do not have access to many of the required resources, those who succeed may be better at leveraging the resources they need for their survival and growth. This may explain why successful new ventures sometimes also emerge in resource deficit contexts.

Figure 5 summarizes the key characteristics for university new ventures to succeed in developing their resource-leveraging competency.

In its efforts to broaden the academic mission of the university with an emphasis on invention and to enrich the academic community through a new dimension of creative expression, NYU supported several competitions that help identify, nurture, and showcase entrepreneurial talent among its students. Numerous new programs and resources had been developed to support NYU entrepreneurs throughout the full life cycle of startup development — from ideation and inspiration, through business model validation, and seed funding.

3.4. Location leveraging competency

New ventures greatly benefit from the locational advantage of the cluster where the university or new venture is located [Keeble *et al.* (1998)]. Brannon *et al.* [2013] noted that new ventures are imprinted with characteristics that fit the specific environment in which they were founded. The internal and external characteristics at

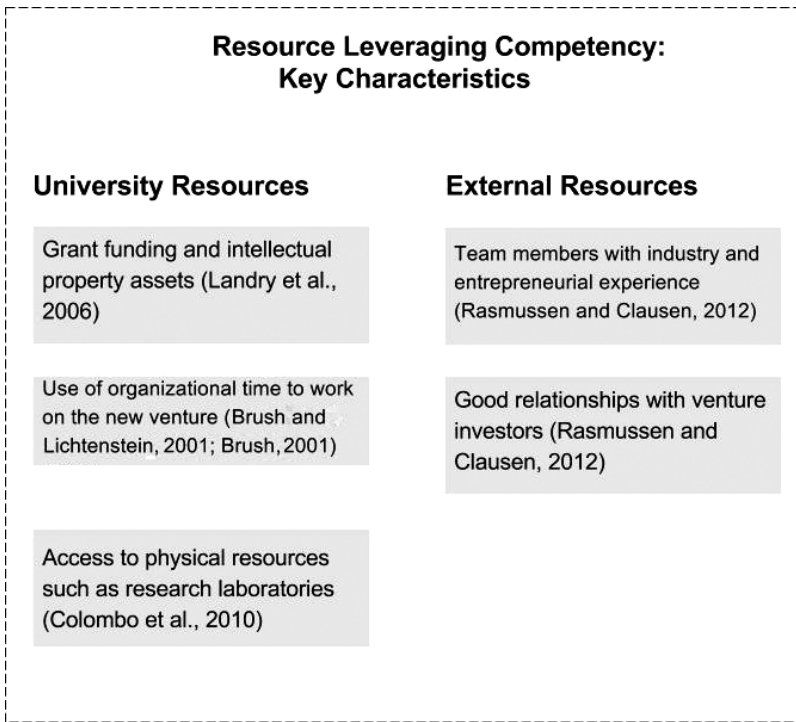


Fig. 5. Resource leveraging competency.

foundings have long-term effects on the development, survival, and performance of new ventures [Ganco and Agarwal (2009)]. Studies also indicate that the perceived viability to act entrepreneurial in a university setting is to a high degree influenced by the local environment. Scientists who are trained or currently work in a setting where entrepreneurial behavior is encouraged are more likely to become entrepreneurs themselves [Bercovitz and Feldman (2008); Kenney and Goe (2004)]. However, if the university culture and environment does not actively support entrepreneurship, potential entrepreneurs are discouraged [Bercovitz and Feldman (2008)]. The role of the local work environment is particularly important for university spin-offs because these ventures are usually developed by teams where several persons play an active championing role [Vanaelst *et al.* (2006)].

Specifically Keeble *et al.* [1998] showed the role that Cambridge University played in creating a robust local ecosystem based on collective learning and networking among the existing technology-based enterprises in the region. In another study, Kostianen and Sotarauta [2003] showed the key role played by the establishment of local universities such as the Tampere University of Technology and other institutions in transitioning Tampere from a industrial to a knowledge-based economy and cluster that in turn spurred technology-based entrepreneurship and innovation in the region.

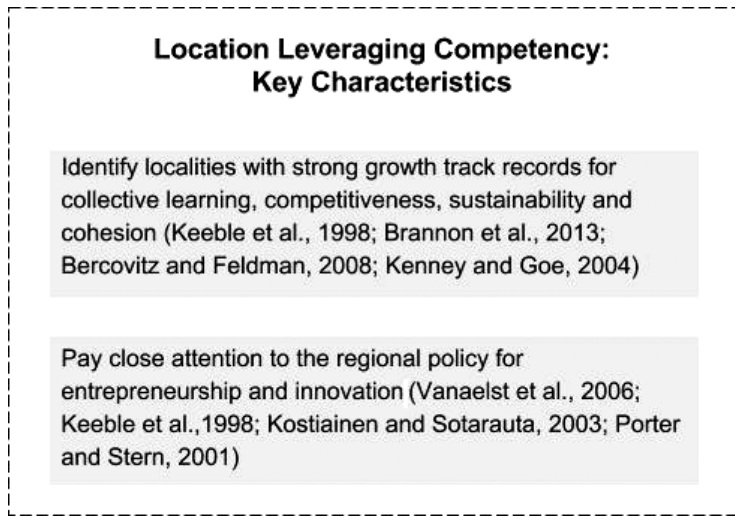


Fig. 6. Location leveraging competency.

Specifically in the case of universities, the location-leveraging component could also include the following:

- (a) Seeding of new generations of startups in a given geo-economic region or cluster through talent, know-how, networking, and capital.
- (b) Creation of a support network for graduates through internship and placement opportunities; and serving as a node for upgrading skills and knowledge through graduate and doctoral studies.
- (c) Bringing together key stakeholders to further enhance the entrepreneurial capacity of the location/region (e.g. government, trade associations, key firms).

All these ensure that universities play a primary and continual role in enhancing the “local innovative capacity” by upgrading the overall infrastructural and linkage conditions in a given location [Porter and Stern (2001)].

Figure 6 summarizes the key characteristics for university new ventures to succeed in developing their location-leveraging competency.

The center of NYU is its Washington Square campus in the heart of Greenwich Village. One of the city’s most creative and energetic communities, the Village is a historic neighborhood that has attracted generations of writers, musicians, artists, and intellectuals. The University itself has no walls and no gates, purposely and deeply intertwined with New York City, drawing inspiration from its vitality. In addition to its Manhattan locations, the University is located in Brooklyn with the second oldest school of engineering and technology in the country, and the university has research facilities in Sterling Forest, near Tuxedo, New York — notably the Nelson Institute of Environmental Medicine. The University has also established itself as the first global network university, with a comprehensive liberal arts campus in Abu Dhabi — the first to be operated abroad by a major US research university — and other sites for

study and research in Accra, Ghana; Berlin, Germany; Buenos Aires, Argentina; Florence, Italy; London, England; Madrid, Spain; Paris, France; Prague, the Czech Republic; Shanghai, China; and Tel Aviv, Israel, among other locations.

Tech entrepreneurs and startups at New York University were in an excellent position to take advantage of the recent favorable policy recommendations encouraging the development of a robust entrepreneurial ecology. This favorable ecosystem coupled with NYU's explicit commitment and focus on entrepreneurship, and the extensive resources to foster and support entrepreneurial education and related activities had resulted in producing startups as well as generating economic activity within the University.

4. Discussion

The four types of competencies described above provide an understanding of the type of capabilities that universities need to develop in order to facilitate and promote new venture creation within academic settings. It is apparent that the factors and features of the competencies required for new venture creation are quite inter-related and studies showing that single factors lead to more new venture activity should be interpreted with care. There are inherent tensions between academic and the commercial values and motivations that can be a serious impediment for university new venture creation. It appears that researchers involved in commercial activities adopt a hybrid role identity that preserves the academic identity alongside their commercial role.

The following factors seem most important to consider for universities seeking supporting new venture creation.

4.1. Level of support

Initially, universities could help address the key challenge of scarce resources for new venture development by providing access to serial entrepreneurs and members with industry experience. Although Grant funding and such "soft funds" are important, they could create a longer term liability for these ventures because they do not develop a competency of accessing external resources. When universities support new ventures, it is important to distinguish between new ventures based on faculty research and new ventures based on intellectual property coming from the outside. It is important that universities align their venture support activities with the surrounding innovation ecosystem to be able to best access the external network and identify localities with strong growth track records for collective learning, competitiveness, sustainability, and cohesion. The availability of financial resources increases academic entrepreneurs' perceptions that they can capitalize more on other, non-financial resources such as networks and business knowledge. These resources have been shown to independently promote venture growth [Patzelt and Shepherd (2009)]. The specific university policies also have an impact whereby low support–low selectivity policies are more fitted to entrepreneurially developed

environments, whereas high support–high selectivity policies are more efficient in entrepreneurially underdeveloped environments [Brunitz *et al.* (2008)].

4.2. Stage in the venturing process

The university's influence on new venture development is highest in the earliest stages of the venturing process. Initially, the venture is formed within, or at least partly connected to, the university context and relies heavily on university resources. Decisions made at this early formative stage are likely to have a long lasting effect on the future development paths of the venture. The university may also become, for more developed ventures, a collaboration partner. Even for ventures that have reached the stage of initial public offering, an affiliation with a university enhances valuation, in particular when academics are present in the top management team at the time of the initial public offering [Bonardo *et al.* (2011)]. It can be stated that in the later stages of development, it is important that the new venture continues its connection with the university.

4.3. Type of university

Considering the importance of the opportunity development and resource leveraging competencies it can be stated that the extent of university support depends on the mission and core research areas of the university. Engineering and technology focused universities with a good mix of world-class faculty and practitioners may be more likely to attract and produce new ventures. Since the new venture creation requires deep coordination and understanding between those involved, universities that follow a more distributed model and empower individual departments in the decision-making processes may be better-suited for new venture development. Also new ventures that are set up by researchers who are encouraged to work closely with industry or research groups with extensive industry experience and networks seem better able to integrate technological and market knowledge.

5. Conclusions

This study concludes that to build and enhance capacity for creating technology-based new ventures, universities should aim to do the following: (1) create university-wide awareness of entrepreneurship opportunities and stimulate the development of entrepreneurial ideas, (2) support new venture teams by providing champions from both within and outside the university and encouraging the development of a hybrid role by focusing on both academic and commercial values, (3) help entrepreneurs in obtaining access to both university resources and external resources that are important in developing their social capital by creating a robust network of advisors with industry and entrepreneurial experience, and good relationships with venture capitalists, and (4) pay close attention to regional policies on entrepreneurship and innovation and set clear rules and policies that encourage the development of new ventures within a university culture that appreciates both academic and commercial values and orientations.

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