# Student Incubators: A New Tool for Entrepreneurial Education?

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## ABSTRACT

This thesis studies the characteristics of student business incubators (SBIs) in Denmark. First, I investigate the distinctive characteristics of SBIs by comparing them with a residual category of commercial incubators (PBIs). To test the systematic differences between the two groups of incubators, I gather data from 5 incubators based in Copenhagen, through surveys and semi-structured interviews. The final sample includes 226 entrepreneurs, clustered in 175 firms. I find that SBIs tenants are younger and less experienced than PBIs tenants, and that SBIs tenant firms are earlier stage than PBIs tenant firms. Furthermore, I find that SBIs tenants need, expect, and then receive, more mentoring, advisory services, and peer-community support than PBIs tenants. These results about business assistance services provide a first original contribution to the literature about SBIs, which is still at a very early stage.

Furthermore, I focus on the educational outcomes of business assistance in SBIs. Prior research about entrepreneurship education and training (EET) programs implies that their effectiveness on entrepreneurship skills decreases with the age of the trainee (from the primary to the post-secondary level of education). Despite the greater amount of mentoring and entrepreneurial training provided to student entrepreneurs, I do not find evidence that SBIs tenants are more likely than PBIs tenants to acquire new entrepreneurship skills. I find, instead, that the age of SBIs and PBIs incubatees is negatively correlated to entrepreneurship skills acquired during incubation. In other words, the older is the incubatee, the less likely he or she is to acquire entrepreneurship skills; while the type of incubation program *per se* does not increase the probability of the incubatee to acquire such skills.

Finally, I study the dynamics of business assistance in SBIs and PBIs. I find that the performance of SBIs tenants is more closely related than that of PBIs ones to the "regular producer" (mentoring, peer-community) and "consumer producer" (effort by the tenant) inputs in the co-production business assistance. In other words, I find that SBIs tenants are more dependent than PBIs tenants on the business assistance relation that they engage with the incubator.

In conclusion, the thesis introduces the reader to empirical findings on student incubators and student entrepreneurship, and discusses the importance of these. Both the theoretical and empirical overview on the topic makes it fairly easy to extend this study, in order to make further investigations about the effectiveness of SBIs on entrepreneurship skills, and the dynamics of business assistance in SBIs.

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# INTRODUCTION

Business incubators are now recognized as important tools for accelerating the growth of startup companies through the provision of specific business assistance services. As a matter of fact, most startup companies usually lack the necessary financial resources and management expertise to overcome the so-called "liability of newness" – the absence of market visibility and financial records.

Business incubators germinated in the US during the late 1950s and then spread worldwide, reaching 9000 organizations in 2013. Prior researchers who studied the incubation phenomenon use to distinguish three generations of business incubators. The first generation of incubators offered only infrastructure based services, such as office space and lab facilities, to their tenant companies. A second generation emerged in the 1980s, when policy makers and universities increasingly recognized the importance of business incubators in fostering entrepreneurship, innovation and overall economic growth. At this moment, incubators started to offer more to their tenants, focusing on knowledge-based services such as mentoring and coaching.

The last generation of incubators is grounded in the Network Economy and aims at offering to tenant startups the access to a ramified networking infrastructure, extending towards external partners, investors, and mentors. The goal is to provide a whole resource network to startup companies that typically operate in a context of scarce resources.

The impact of business incubation on tenant firms' performance, growth, and survival has extensively been studied during the past decades. Prior research has produced controversial results with respect to this problem, for two main reasons. First, exploratory studies that compare a treatment group of companies on-incubator and a control group of companies off- incubator, may be subject to selection bias. Second, most studies focus on a single incubator and therefore may incur in a problem of endogeneity of results. In fact, a wide variety of business incubators exists today, with sometimes a totally different range of services and a target of totally different tenants.

The main distinction is between for-profit incubators and non-profit incubators. The former ones are relatively more recent than the latter ones, as the incubation phenomenon took off in US universities. The first university technology business incubators were established in

the 1970s in order to bridge the gap between scientific research and business, providing scientific and technical talents (researchers, professors, alumni) with the business resources and skills they lacked.

Recently a new type of university based incubators has emerged: the student incubator. Aiming at providing graduate and undergraduate students with a mix of business assistance services, teaching, and industry practices, student incubators developed in most universities during the last decade in response to European and international policies about youth entrepreneurship.

The literature about student incubators is still in its infancy. The main research questions that arise with respect to this particular types of incubators concern: (a) their role in promoting entrepreneurship as a career opportunity among university students; (b) the effect that they have in fostering entrepreneurship skills among their incubatees. In fact, most student incubators have transitioned from a commercial orientation (as that of other incubators) to an educational one, in response to European policy pressures. Institutionalization of student incubators is taking place in most universities, with a better integration between incubator management staff and academic staff.

The relatedness of student incubators to the "third mission" of academia casts interesting doubts. On one hand, incubator managers, their sponsors, and some policy makers claim that student incubators may be the ultimate tool for creating new jobs, dealing with youth unemployment, and teaching entrepreneurship at the post-secondary level. On the other hand, research suggests that entrepreneurial education at the post-secondary level is ineffective, with respect to both increasing entrepreneurial skills and intentions.

I constructed, on the basis of this considerations and previous researches, three sets of hypotheses aimed at assessing the contribution of student incubators to the entrepreneurial process. (1) I formulated the hypothesis that systematic differences exist between student and professional incubators with respect to the individual characteristics of their tenants – in particular that student incubators act as catalysts for youth entrepreneurship, while professional incubators attract more experienced entrepreneurs. I also formulated the hypothesis that systematic differences exist between the two groups of incubatees with respect to the range of business assistance services that they need, expect, and receive from the incubator – in particular that student incubatees need, expect, and receive more mentoring, training, and peer-community support services than professional incubatees. (2) I formulated

the hypothesis that student incubators tenants are more likely than professional incubators tenants to develop new entrepreneurship skills during the incubation period. (3) I investigated the dynamics of business assistance in student and professional incubators, framing them in the co-production model proposed by Rice (2002). According to prior research on mentoring and peer effects, I formulated the hypothesis that mentoring and peer community are the two most relevant services for student incubatees, and that they are comparatively more relevant for student incubatees than for professional incubatees. Finally, I formulated the hypothesis that the amount of time spent on the entrepreneurial project by the founding team is more closely related to firm performance in student incubators than in professional incubators.

In order to test the hypootheses, I focused on a sample of 2 student incubators and 3 for-profit incubators, all based in Copenhagen. Denmark is a pioneering country for student entrepreneurship, and student incubators are well established in all its universities. I focused on a multi-faculty university and on a specialist university in order to embrace a broader understanding of the student incubation phenomenon. I also chose three for-profit incubators, including the leading Danish innovation hub.

I delivered a questionnaire to a total of 1,195 entrepreneurs over a period of five months, and collected 226 complete and usable responses. The survey included recognized standard measures for youth entrepreneurship and business assistance. I also engaged in five semi-structured interviews with the managers of the considered incubators, in order to get richer insights in the phenomenon. I used statistical tools, such as Chi-squared tests and Factor Analysis, and econometric tools, such as ordered logit regressions, to test my hypotheses.

The first set of hypotheses was supported at significant levels with respect to both systematic differences in the characteristics of incubatees, tenant firm, and business assistance by SBIs and PBIs. The second hypothesis was not supported at significant levels for any of the considered entrepreneurship skills acquired during incubation. The third set of hypotheses was partially supported at significant levels, providing further elements to elaborate "managerial tips" and best practices for the SBI staff, in order to optimize the incubator's aggregate output.

# 1. THE ROLE OF BUSINESS INCUBATORS IN THE ENTREPRENEURIAL PROCESS

## *1.1. Business Incubators: definition, assessment, and history.*

During the past 50 years, there has been an increasing proliferation of business assistance programs by both public institutions and profit-oriented organizations. These programs, aimed at increasing the birth and survival of small and medium enterprises (SMEs), include Small Business Development Centers, Small Business Institutes, Enterprise Forums, university-based entrepreneurship centers, programs offered by the local Chambers of Commerce, business incubators, and so forth. Despite the episodic and reactive nature of the other programs, business incubators (BIs) provide usually a continual and proactive business assistance to SMEs (Rice 2002).

The word *incubatio* refers to the religious practice, diffused among many ancient cultures, of sleeping in a sacred temple, typically laying down on the rests of animals just sacrificed. One of the main reasons for practicing *incubatio* was to experience a divinely inspired vision or cure (the ritual often took place in the temple of Aesculapius, god of medicine). In the course of the centuries, an "incubator" has become, according to the Mirriam-Webster Dictionary, "a device that is used to keep eggs warm before they hatch" or "a piece of equipment in which very weak or sick babies are placed for special care and protection after their birth".

Like prematurely born infants, startup companies usually suffer from low survival rates, and need external inputs to grow and succeed. Indeed, most founding teams operate in a context of scarce resources, as they lack the capital, management ability and financial expertise to successfully operate and scale their companies. They also face the so-called liability of "newness" problem, that Phan et al. (2005) define as "the lack of market visibility and connectedness with a resource network".

Typically, the most important resources of a newly incorporated startup company are the vision and the entrepreneurial talent of its co-founders. The overall aim of a BI is to leverage such entrepreneurial talent and overcome the liability of "newness", by providing its tenant companies with (all or some of) the resources they lack (Bøllingtoft and Ulhøi 2005). Under this respect, the American National Business Incubation Association (NBIA) defines a BI as

"an economic development tool designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services".

Adegbite (2001) provides a taxonomy of such resources and services provided by a BI, including:

- physical space, which typically consists of open plan offices, shared laboratories, meeting rooms and kitchen facilities, and is available to tenant startups on flexible and affordable terms (or even for free in some no-profit incubators);
- common services, including counselling and training, secretarial services, and so forth;
- strict entry and exit rules (the length of the incubation time may be either pre-determined or indefinite, with the tenant firms moving out of – or "graduating" from – the incubator when they grow and prefer to set their own headquarters);
- professional management, to ensure that both the tenant firms and the incubator itself operate in a business-like fashion;
- practical assistance on legal, financial, managerial, R&D issues, provided to the tenant firms by the incubator itself, or through a network of external partners.

The impact of the above mentioned services on the survival rate and growth performance of an incubator's tenant firms is controversial. Allen (1985) and Campbell et al. (1988) have found higher survival and growth rates among BIs graduates, but Roper and Hewitt-Dundas (1998) argue that this evidence might be due to both positive impact of business assistance services or initial selection operated by the incubator. In other words, the admission rules of the BI might select only the best entrepreneurial teams, with superior human or financial capital, and this fact might account for most of the differences between the performance of firms on- and off-incubator.

A study by Colombo and Delmastro (2002) on 43 Italian new technology-based firms (NTBFs) showed that "incubated firms have superior post-entry performances than non-incubated ones", with the "econometric metrics suggest[ing] that such result could not be explained by the superior human and financial capital of the founders of tenant firms". In other words, there might be an added value from business assistance programs. Nevertheless, the authors recognize that their results might be influenced by the fact that "Italy (…) is a laggard in high-technology sectors, and the national innovation system is rather weak; in particular, the provision of key inputs to firms' innovative activities (…) suffers from serious market failures".

According to Phan et al. (2005) previous research on BIs often suffers from a problem of endogeneity of results; future research should try to examine more than just one BI at the same time to overcome this problem. According to Mas-Verdú et al. (2015) the impact of BIs on tenant firms' performance should be examined in conjunction with other factors (i.e. certain characteristics of tenants, such as firm size and sector).

However the impact of BIs on tenants performance is assessed, the impressive growth in the number of BIs worldwide (Figure 1), suggests that, in overall terms, business incubation has been a success. A closer look to the history of BIs will provide a better understanding of the evolution of the incubators' efforts to offer increasingly better support services to their incubatees.

The first BI, the Batavia Industrial Center, was opened in New York in 1959. At that time, incubation was still an isolated phenomenon. In the 1970s, when the energy crisis hit the US economy, the government increasingly recognized the value of innovation and entrepreneurship to achieve GDP growth and creation of employment. In 1973, the major US universities started their own incubation programs funded by the National Science Foundation. In 1980, the Bayh-Dole Act "facilitated patenting and licensing by US universities of inventions based on federally funded research" (Mowery et al. 2005), and the incubation phenomenon increased.

Bruneel et al. (2012) and Lalkaka (2000) provide an "evolutionary" model of business incubation that offers a dynamic, service-centric perspective of the evolution of BIs over the last 50 years. The authors identify three generations, or "waves", of incubators, according to their core business services (Table 1).

The first generation of incubators, between the 1950s and 1980s, offered mainly infrastructure based services (office space, reception, conference rooms, telephone, secretarial services, kitchen facilities and car parking). Leveraging on economies of scale, the purpose of these BIs was to offer low-cost services to facilitate the growth of new SMEs.

In the 1980s, US and European governments, dealing with increasing unemployment in the heavy industry sector, realized that innovation and entrepreneurship were key for economic development, and strengthened policies and support to entrepreneurship and creation of new jobs. At the same time venture capitalists, business consultants and other private players started to address the expanding market of business assistance for SMEs. The second wave of BIs grew between the mid-1980s and the mid-1990s, offering knowledge based services, such as training

and mentoring, in addition to the infrastructure based services of first-generation BIs. The purpose of such knowledge based services was to accelerate the learning curve of incubatees, who typically lacked marketing and managerial skills. In other words, second-generation BIs aimed at avoiding the costly "trial and error" processes that affect most SMEs, because of the co-founders' lack of business expertise.

The first US national study on BIs was conducted in 1984. One year later, the NBIA was established to provide information and support about the creation and management of an incubator, as well as statistical analysis and research about the growing BI industry. By 1995, 1500 BIs were operating worldwide (of whom 600 were reported in the US by the NBIA), and 90% of them were non-profit organizations.

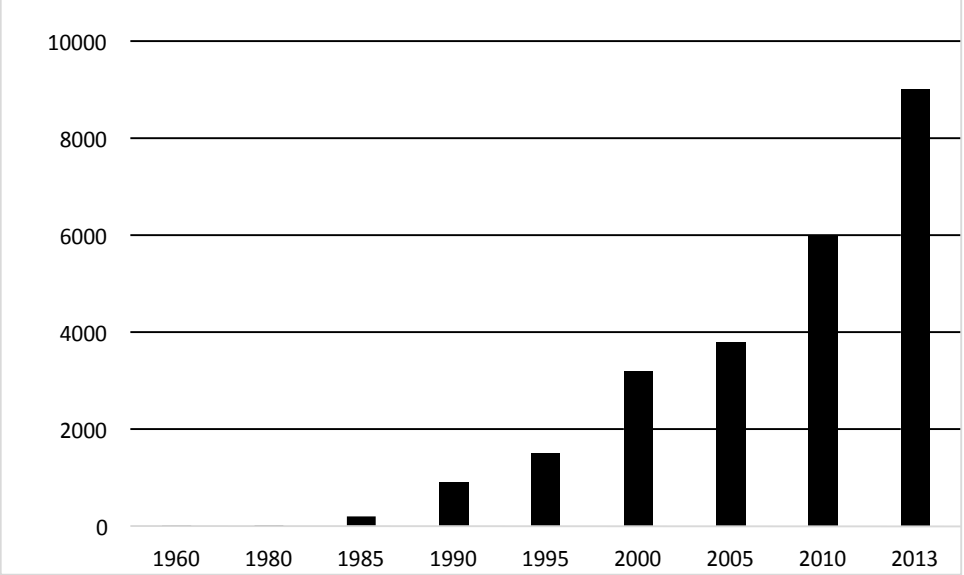



Figure 1. Growth of the number of BIs worldwide 1960-2013.

Over the last 20 years, BIs have experienced an unprecedented growth, peaking at 9000 in 2013. During the dot-com bubble, between 1998 and 2000, the number of for-profit incubators grew more than ten times, and new business models emerged. Based in Los Angeles, Bill Gross's Idealab pioneered the new wave of so-called "networked incubators".

Third-generation BIs provide a networking infrastructure on top of to the above mentioned physical infrastructure and knowledge based services. As a matter of fact, SMEs

lack financial history of operations, ergo credibility, when it comes to find external partners or investors (Dubini and Aldrich 1991). Third-generation or "networked" BIs provide access to such external resources, knowledge and financial capital, allowing SMEs to get faster legitimacy in a context of increased competitive pressure (Birley 1985). The networking infrastructure may consistently lower the venture failure rates, by reducing time-to-market and facilitating the access to external investors and top-tier service providers (with certain economies of scale enjoyed by the incubatees). Hansen et al. (2000) argue that "networked incubators combine the best of two worlds – the scale and scope of large, established corporations and the entrepreneurial spirit of small venture-capital firms".

*1.2. Models and frameworks of business incubation.*

With respect to the role of BIs in the entrepreneurial process, we may distinguish two approaches in the literature: (1) the transaction costs model, (2) the learning model. According to the transaction costs model, BIs accelerate the graduation rates of their incubatees by reducing their transaction costs (Williamson 1985). This happens because, thanks to economies of scale, the incubator is able to offer low-cost shared services to its incubatees. According to the learning model, instead, the added value of incubation concerns the learning made available by the incubator through networks and interactions among incubatees. Peters et al. (2004) argue that a more comprehensive model, combining the transaction costs and learning model, is necessary to properly explain the role of BIs in the entrepreneurial process. They also conclude that "when the objectives of the incubator match those of the tenants there will be a higher number of graduates", and "further research should be (…) carried out to see whether learning practices should be different for different types of incubators in order to reach their objectives".

In search for the most suitable framework to investigate the relationship between the incubator and its tenant firms in different types of BIs, I focus on the model of interdependent co-production of business assistance (Parks et al. 1981; Rice 2002). Formally:

$$Q = c \times RP^{d} \times CP^{e};$$

where $Q$ is the output of the business incubation process; $RP$ is the input of the "regular

Table 1. The 3 generations of BIs 1959-2016.

| Generation | Period | Core Services | Key Concept | Goal |
|---|---|---|---|---|
| | | *Infrastructure based services* | | |
| FIRST | 1950-1985 | Office space, secretary, conference rooms, telephone, kitchen facilities. Etc. | Economies of scale | Reduce time and costs allocated by startups to non-value adding activities, through the provision of low-cost infrastructure services |
| | | *Knowledge based services* | | |
| SECOND | 1985-1995 | Training and mentoring. | Learning curve | Compensate for the lack of business skills by startup founders |
| | | *Networking* | | Compensate for the scarcity of resources available to startup founders. Reduce their time-to-market, facilitate their access to capital and new knowledge, and their integration in existing value chains. |
| THIRD | 1995-2016 | Access to external mentors, partners, and investors. | Resource networks and legitimization networks | |

producer" (in the case of BIs the incubator); *CP* is the input of the "consumer producer" (in the the case of BIs, the incubatee-entrepreneur); *c* is a scaling factor; *d* is the elasticity of the regular producer input; and *e* is the elasticity of the consumer producer input.

The outputs (*Q*) of co-production are the different types of business assistance provided by the BI. Chrisman (1989) identifies five types of administrative, strategic and operating assistance:

1. administrative processes, such as accounting services, risk management, and legal advisory;
2. human resource management;
3. marketing and sales assistance;
4. access to funding and financial management;
5. product development assistance.

Mentoring provided by the incubator manager is certainly the most obvious and direct *co-production modality* through which such business assistance outputs are delivered to the incubatee. According to Rice (2002), in the BI context, mentoring is the "dissemination of knowledge and advice to entrepreneurs". Levinson et al. (1978) provide a broader definition of mentoring as "one of the most complex and developmentally important relationships (…); the mentor is ordinarily several years older, a person of greater experience and seniority (…) a teacher, adviser or sponsor".

Previous research about mentoring showed that it may stimulate career development (Kram 1985; Phillips-Jones 1982) and career progress (Zey 1984), and be related to greater career satisfaction (Fagenson 1989; Riley and Wrench 1985; Roche 1979) and clarity of professional identity (Kram 1985) of the "mentee" or "protégé". Moreover, mentoring may have psychosocial functions, such as counseling, friendship, acceptance and confirmation, which are complementary to its primary career-enhancing functions (Higgins and Kram 2001). For all these reasons, the impact of mentoring/coaching on business incubation is particularly important. Examining a sample of 49 US incubators, Peters et al. (2004) found that there was "a significant difference in the number of graduates between the incubators that offered coaching and those that did not".

The traditional approach to mentoring illustrated above assumes a single dyadic relationship between the mentor (in the case of BIs the incubator manager) and the protégé (the

incubatee-entrepreneur). An alternative approach to mentoring, derived from social network theory, is proposed by Kram (1985). The author looks at mentoring as a multiple relationship phenomenon, based on multiple dyadic, or even networked, relationships between the protégé and a "developmental network" of mentors. Higgins and Kram (2001) define such developmental network as the "set of a people a protégé names as taking active interest in and action to advance the protégé's career by providing developmental assistance". In other words, a developmental network may extend outside the organization boundaries of single dyadic mentoring, to include also family, friends, and – most interestingly – peers.

According to Kram and Isabella (1985), peer relationships have, like conventional mentoring relationships, a strong career-enhancing function, because "peers give and receive feedback concerning work-related matters that (…) [is] an invaluable aid (…) [to their] learning processes". Peer relationships are, by definition, less hierarchical than conventional mentoring relationships, ergo they are characterized by higher mutuality and reciprocity (the individual may assume alternatively the role of the mentor and that of the protégé).

Burt (1992) defines "entrepreneurial" those developmental networks characterized by both a high number of peer relationships and strong ties between peers (which result in a strong level of trust, emotional support, reciprocity and frequency of interactions). The fact that most entrepreneurial communities inside BIs have such characteristics makes the incubator a sort of social aggregator, a facilitator of relationships among incubatees. According to Krackhardt and Stern (1998), strong peer relationships are particularly helpful in contexts of high uncertainty (like that in which startups operate).

Through the developmental network perspective, it is possible to integrate peer mentoring as a new co-production modality in the framework of co-production of business assistance. Conventional mentoring/counseling by the incubator is not the only "regular producer" input, but also (internal) peer networks enter in the model, as an equally valuable input for the incubatee. Peer networks imply a "passive environmental intervention" by the incubator: even if the incubator manager is not directly involved in the co-production process, peer effects occur because of co-location and share of common business services/facilities by the incubatees (Lyons 2000). Hence, the incubator acts as passive intermediary between the regular producer of assistance (the community of peers, or internal network) and the consumer producer (the incubatee). The support provided by the internal networking infrastructure is an intermediate output of the co-production process.

The same reasoning may be applied to the external networking infrastructure provided by third-generation BIs. The networked relationship between the incubatee and the external mentors, partners, investors, and service providers, makes the incubation manager an intermediary between the regular producer of assistance (the external mentor, partner, investor or service provider) and the consumer producer (the incubatee). Ergo, the networking infrastructure – external network – provided by the BI is an intermediate output of the co-production process (Rice 2002).

*1.3. Different types of BIs.*

Aernoudt (2004) categorizes five different types of BIs with respect to their objective or raison d'etre:

- *mixed incubators* are defined as those BIs that, without having any specific industry focus, generally aim at creating new SMEs;
- *economic development incubators*, which do not have an industry focus as well, target specific local/regional development gaps;
- *technology incubators* focus on high-technology startups (i.e. IT, mobile, biotech, medtech, greentech);
- s*ocial incubators* aim at creating job opportunities for people with low employment capacities (i.e. immigrants, refugees, disabled people, etc.);
- *basic research incubators* target high-tech firms and try to bridge discovery gaps by connecting scientific research to business assistance.

Another categorization for BI types calls for the length of the incubation time. In BIs *stricto sensu* the incubation process usually lasts for 9-12 months or more; in so-called *accelerators*, instead, the acceleration process lasts usually only 3-4 months, and business assistance has a temporary and transient character. An example of accelerator in Denmark is StartupBootcamp – a 3-month program targeting startups in the mobile industry[1].

Peters et al. (2004) categorize BIs also with respect to their business model, distinguishing between non-profit BIs (including government and community-based incubators), university-based incubators, and for-profit incubators. The revenue streams of for-

[1] URL: http://www.startupbootcamp.org/

profit BIs may come from both monthly rents paid by the incubatees, and participation in the equity of the tenant firms by the incubator - less than 10% in accelerators (Desmarais 2012), 30-40% in some "networked" incubators (Hansen et al. 2000), up to 70% in other for-profit BIs (Peters et al. 2004).

Although it could hardly be framed as a BI *stricto sensu*, another emerging for-profit model is the "startup studio". A startup studio is a private company that builds several startups in parallel, following a repeatable Business Creation Process. In other words, the studio recruits and assembles teams of entrepreneurs, assigning them to work on certain ideas/entrepreneurial opportunities. The teams maintain shareholding in the "child" company and their fully independent entrepreneurial status – they are CEOs and CTOs of their own companies, not mere employees of the startup studio (Elziere 2014).

With respect to university-based incubators, Phan et al. (2005) argue that sometimes the raison d'etre of BIs is to address an "innovation market failure", since "the incubation process may be the only way a startup that exploits an embryonic technology can emerge". In other words, the presence of a BI may be socially desirable, under certain conditions, even if the incubator *per se* is not financially self-sustained and needs capital injections by a public institution (e.g. a university). With this regard, Bjerregaard (2010), Valdivia (2013), and Hjortsø et al. (2015) argue that universities are engaged in a so-called "third mission": that of "patenting faculty inventions, supporting academic spin-offs, and incubating student and graduate startups".

Among university-based incubators, it is possible to further distinguish between *university technology business incubators* (UTBIs) and *student business incubators* (SBIs).

### *1.3.1. University technology business incubators.*

UTBIs aim at nurturing NTBFs (Mian 1997), by lessening the "liability of newness" (Stinchcombe 1965) and by facilitating the commercialization of university-owned/licensed technology (Smilor and Gill 1986; Link and Scott 2003; Grimaldi and Grandi 2005). The incubatees are typically university professors, researchers, and alumni, who have high scientific and/or technical knowledge but low business expertise. UTBIs aim at compensating such lack of business knowledge, bridging the gap between industry and academia.

The effectiveness of UTBIs in addressing the "innovation market failure" is controversial. On one hand, Siegel et al. (2003) argue that UTBI incubatees are more effective

than off-incubator firms in generating new products and patents. On the other hand, Colombo and Delmastro (2002) have found that "the R&D intensity of firms, an indicator of innovative input, is not significantly different between the on- and off-incubator categories". With respect to university-based technology transfer offices (TTOs), Markman et al. (2005) conclude that "the most attractive combinations of technology stage and licensing strategy for new venture creation (…) are least likely to be favored by the university (…) because universities and TTOs are (…) extremely risk-adverse with respect to financial and legal risks".

*1.3.2. Student business incubators.*

Student incubators are among the most recent BI types that emerged, and the literature about them is still in its infancy. The main difference between SBIs and UTBIs lies in the targets and objectives they focus on. First, SBIs incubate (mostly) graduate and/or undergraduate student entrepreneurs. Second, contrary to UTBIs, they have a core educational mission. According to Hjortsø et al. (2015), student entrepreneurship is "a combination of incubation, teaching, and industry practices (…); the goal is [to create] a broad foundation for innovation and entrepreneurship, that can provide students with innovative competencies and an open attitude towards establishing their own enterprise".

SBIs are characterized by distinctive objectives and modalities of co-production of business assistance. Increasing firm survival and firm growth is not the only objective of SBIs. In fact, infusing "innovative competencies", entrepreneurship skills, and an "open attitude" towards entrepreneurship in student incubatees is often a top priority for SBIs directors. Hence, in student incubators training/education is a fourth modality of business assistance, in addition to the three modalities already analyzed – passive environmental intervention, counseling/mentoring and networking (Rice 2002).

Even when individuals have entrepreneurial knowledge and skills, they may decide not to adventure in startup creation, if they do not have a positive image about entrepreneurship (Alberti et al. 2004). For this reason, universities have the chance, through the promotion of an entrepreneurial culture on campus, to positively influence students' decisions to create startups. Autio et al. (1997) argue that higher educational institutions (HEIs) are the ideal places "to shape the entrepreneurial culture and the aspirations of students during their studies, in such a way as to give them a better chance of survival in a difficult business

setting like today's". In this sense, universities are the "cradle of entrepreneurship" (Del Giudice 2014), and should position themselves as "*nuclei* of entrepreneurship", contributing to favor the development of entrepreneurship (Gnyawali and Fogel 1994).

It is particularly interesting to study Danish SBIs, because this country has been one of the strongest supporters of the EU policies encouraging student entrepreneurship. According to Aernouldt (2004), Europe has been behind the US for a long time, with respect to business incubation. This fact is due to both a lack of entrepreneurship and a lack of business angels networks and seed financing opportunities for SMEs. Recent policies have tried to reduce such "entrepreneurial gap" with the US[2].

The Treaty of Lisbon (2001) stressed the role that higher education institutions (HEIs) should have in supporting entrepreneurial competences and attitude towards innovation. After the turn of the century, the European Commission and the Organisation for Economic Co-operation and Development (OECD) started developing policy agendas on startup promotion (EC 2003, 2004; OECD 2003, 2005) and, lately, student entrepreneurship in HEIs (EC 2008; OECD 2010). Last but not least, "Horizon 2020 will fund researchers and innovators at the cutting edge of their fields […]; it will support projects across the cycle from research to innovation" (EC 2013).

Denmark proved to be extremely receptive towards this policy pressure, and pioneered the efforts towards student entrepreneurship. As a matter of fact, all the major Danish HEIs – Aarhus University (AU), University of Southern Denmark (SDU), Aalborg University (AAU), Roskilde University (RUC), University of Copenhagen (UCPH), Copenhagen Business School (CBS), Technical University of Denmark (DTU), and IT University of Copenhagen (ITU) – have today their own SBI programs.

Hjortsø et al. (2015) identify three historical stages (Table 2) in the evolution of SBIs in Danish multi-faculty[3] universities: (I) Experimentation (2003-2009); (2) Demonstration (2010-2013); (3) Integration (2014-present).

During the first stage, HEIs recognized and assimilated policy papers and recommendations by the European Commission and the OECD. SBIs and universities were org-

[2] As a result, the per capita number of BIs in EU now matches that of the US (Elena Andonova, *The evolution of startup incubators – an insider's view*, 2015, in theguardian.com, 4 April).

[3] The authors chose to "avoid studying the Danish universities that focus on management (Copenhagen Business School) and Technical Innovation (Technical University of Denmark and IT University of Copenhagen) as their mandates are much more clearly related to economic development and complementary of SBIs, reducing the theoretical implications of innovatively implementing SBIs".

anized on a dual structure, with the incubator separated from the classical university structure. The type of teaching provided by the incubator was primarily oriented towards commercialization (with entrepreneurship and business plan development courses as extra-curricular activities).

During the second stage, public funding privileged large-scale "demonstration" projects, in order to increase awareness around SBIs. A problem that emerged in this stage was the lack of incentive structures for the academic staff to contribute to extra-curricular activities in the SBI, as all the incentives were anchored on bibliometric research indicators (Philpott et al. 2011).

During the third stage, significant institutional changes occurred. Both EU Horizon 2020 and changes in the research funding schemes gave to the third mission of universities a greater importance (Woollard et al. 2007). As a result, many Danish SBIs are now in the process of framing startup incubation as a credit-awarding university activity. In other words, if in the first stage student incubation was commercial-oriented and extra-curricular, now it is in the process of becoming a proper educational activity. Nevertheless, according to Hjortsø et al. (2015), an obstacle to the institutionalization of SBIs remains: the lack of incentives to encourage the involvement of the academic staff in SBIs activities.

The aim of my research is to contribute to the development of the literature about SBIs, by focusing on: (1) their distinctive characteristics with respect to other for-profit, or professional, business incubators (PBIs); (2) their impact on the development of new entrepreneurship skills in their incubatees; (3) the dynamics of co-production of business assistance that occurs into them.

Table 2. History of Danish SBIs (Hjortsø et al. 2015)

| Stage | Period | Orientation | Relation with HEI | Objective |
|---|---|---|---|---|
| Experimentation | 2003-2009 | Commercial | Separated | Adopt EU policies on entrepreneurship |
| Demonstration | 2010-2013 | Commercial | Separated | Increase awareness about SBI programs |
| Integration | 2014-present | Educational | Integrated | Integrate SBIs in the university curricular activities |

## 2. HYPOTHESES

### H1. Systematic differences between SBIs and PBIs: characteristics of tenant firms/entrepreneurs (H1a) and business assistance services (H1b).

Research suggests that the propensity of an individual towards entrepreneurship is strongly influenced by his or her family business background, alias the self-employment history of his or her parents (Koh 1995; 1996; Reitan 1997; Breen 1998; Lin et al. 2000; Dunn 2004; Smith 2005; Veciana et al. 2005; Kirkwood 2007; Del Giudice et al. 2014). Moreover, according to Schmitt (2007) and Falck et al. (2010), entrepreneurial intentions in adulthood are influenced by previous entrepreneurial aspirations in adolescence.

Other authors suggest that influence from the peer-group in the decision to become entrepreneurs is stronger than family business background or previous entrepreneurial aspirations in adolescence. Peers might be either entrepreneurial colleagues (Nanda and Sørensen 2010) or entrepreneurial friends (Dillard and Campbell 1981; Djankov et al. 2004). According to Del Giudice et al. (2014), undergraduate and graduate students engage in a continuous process of re-thinking their own career opportunities; classmates and fellow students, as well as the whole university environment, play a crucial role in such process. The presence of an on-campus SBI may expose non-entrepreneur students to success stories from their entrepreneurial peers, and stimulate them to question their own entrepreneurial skills and business ideas. In this sense, USBIs may act as legitimation networks (Petretto 2009) – by legitimizing the students' entrepreneurial aspirations and increasing their "perception of feasibility", providing them with a network of contacts and relationships with resource providers.

It is worth remarking that all BIs, in general, not only SBIs, are designed to provide such benefits. However, I formulate the hypothesis that, due to the above mentioned network effects in the university environment, and to a greater legitimization provided by on-campus location, SBIs are more likely than other BIs (PBIs) to attract young entrepreneurs. This argument might seem tautological; in fact, some SBIs do not define student status as an entry requirement for the incubation service, thus being open to entrepreneurs of any age and prior experience. PBIs, on the other hand, usually do not care about the educational status or age of

their incubatees, ergo they are potentially open to student entrepreneurs as well.

I argue, however, that due to above mentioned effects, systematic differences exist between SBIs and PBIs. The first ones accomplish their mission of attracting youth entrepreneurship on campus, while PBIs are more attractive for the senior segment of the tenant market (middle aged, prior experienced entrepreneurs).

*H1a: SBIs are more likely to attract early-stage startups managed by young entrepreneurs with little prior experience, while PBIs are more likely to attract growth-stage and mature companies managed by prior experienced entrepreneurs.*

According to Hjortsø et al. (2015), SBIs have shifted from a commercial to an educational orientation, and now provide their incubatees with more entrepreneurial education and training services than any other BI (through individual and group mentoring, pitch workshops, and so forth). In fact, student entrepreneurs (who are significantly less experienced than PBIs incubatees, according to hypothesis H1a) are in greater need for such mentoring & training services, as well as for advisory & professional assistance services. Lacking prior business experience, SBIs tenants are less likely than PBIs tenants to have developed their own network of mentors, advisors, and entrepreneurial colleagues, ergo they need more inputs from the incubator. I formulate the hypothesis that SBIs tenants need, expect, and receive more mentoring and advisory services than PBIs tenants.

With respect to the support from fellow incubatees (peer-community), Petretto (2009) and Del Giudice et al. (2014) stress the power of student and university networks within SBIs, and the "legitimation" effect that they may produce on students' entrepreneurial intentions. I argue that such informal networks are more likely to develop, and be expected, in the SBI environment than in the PBI environment. In other words, I formulate the hypothesis that SBIs tenants need, expect, and receive more peer-community support than PBIs tenants.

Finally, I argue that no systematic differences exist between the two groups of incubators (SBIs and PBIs) with respect to all the other business assistance services (both groups provide office space, lab facilities, and so forth), with the unique exception of "links to HEIs", which are better developed in SBIs (for obvious reasons).

*H1b: SBIs tenants need, expect, and receive more mentoring, advisory, peer-community*

*support, and links to HEIs; no systematic differences exist between SBIs and PBIs with respect to the other business assistance services.*

**H2. Entrepreneurship skills development in SBIs and PBIs.**

Questioning the mission of SBIs, I focus on new entrepreneurship skills learned/developed by tenant entrepreneurs during the incubation period. According to Hjørtso et al. (2015), SBIs have increasingly put efforts into entrepreneurial education, for example trying to involve the teaching staff of HEIs in mentoring & training activities. On the other hand, PBIs: (a) have a core commercial mission, (b) are not concerned about the entrepreneurial education of their incubatees, and thus (c) provide overall less mentoring and peer-community support (hypothesis H1b). I argue that SBIs tenants are more likely than PBIs ones to acquire new entrepreneurship skills, because they are more likely to receive entrepreneurial education and training from the incubator.

This statement is subject to many important caveats. Prior research on EET programs (entrepreneurship education and training programs in schools and universities) suggests that they often exhibit weak or no effects on entrepreneurial skills (Oosterbeek et al. 2010; von Graevitz et al. 2010) – in particular that the older are the participants, the weaker are the effects of the program on entrepreneurship skills. According to Oosterbeek et al. (2010), college students (aged 18-22) are already too old for being able to learn entrepreneurship skills through EET programs. The authors analyzed the effects of a student mini-company (SMC) program in the Netherlands on both entrepreneurial intentions and students' self-assessed entrepreneurial skills (and traits), and concluded that the program did not have the intended effects, producing no or negative impact on skills and intentions.

I argue that SBIs provide a more practical learning experience than most university EET programs. The participants to an EET program are exposed to a *simulation* of the startup process, while SBIs tenants actually engage in *real* business development. There might be then some dynamics of business development, relevant for entrepreneurship skills development, that EET programs are not able to reproduce realistically while SBIs programs are. Therefore, SBIs might be more effective than EET programs in teaching entrepreneurship skills to students.

In conclusion, I argue that prior research about EET programs cannot automatically be extended, by analogy, to BIs. If entrepreneurial education alone does not (or does weakly)

affect entrepreneurship skills at the post-secondary level, I argue that entrepreneurial education *combined with incubation* may have a positive on effect on entrepreneurship skills. Consequently, I formulate the hypothesis that SBIs (which combine entrepreneurial education with incubation) are more likely than PBIs (which do not provide entrepreneurial education, or do provide a neglectable amount of entrepreneurial education) to foster entrepreneurship skills among their incubatees.

*H2: SBIs tenants are more likely than PBIs tenants to develop new entrepreneurship skills during the incubation period.*

**H3. Co-production of business assistance in SBIs and PBIs: "regular producer" input (H3a & H3b) and "consumer producer" input (H3c).**

I focus here on the dynamics of the business assistance process that occur in SBIs and PBIs, framing them in the model of interdependent co-production of business assistance (Parks et al. 1981; Rice 2002). I qualify the incubator as the "regular producer" of business assistance, and the incubatee as the "consumer producer". My goal is to identify best practices for the SBI mentor/supervisor, with respect to the optimization of student entrepreneurs' performance.

First, I focus on the "regular producer" side. Previous research by Fagenson (1989), Riley and Wrench (1985), and Roche (1979) showed that mentoring is related to greater career satisfaction of the protégé; moreover, Peters et al. (2004) have found that mentoring in BIs increases the graduation rate of incubatees. According to Kram and Isabella (1985) and Higgins and Kram (2001), the effects of peer networks ("developmental networks") may be analogous, or even more important, than those of traditional dyadic mentoring relationships.

On the basis of these arguments, I formulate the hypothesis that, among the various business assistance services provided by SBIs, mentoring and peer community are the ones which are more closely related to tenant firms' satisfaction and performance.

*H3a: Within SBIs, mentoring and peer-community are more closely related to tenant firm performance/satisfaction than any other business assistance service provided by the incubator (in other words, they are the most relevant "regular producer" input for student entrepreneurs).*

Consistently with Levinson et al. (1978), Phillips-Jones (1982), Zey (1984), Kram (1985), Whitely et al. (1991), Higgins and Kram (2001), Rice (2002), I argue that mentoring in BIs (usually directed to test idea feasibility and Business Model Canvas) is more important for SBIs tenants than PBIs tenants, because the former ones are yet in the establishment stage of their career, while the latter ones are in the mid-stage of their careers (hypothesis H1a). I also argue that, thanks to the power of student networks (Del Giudice et al. (2014), SBIs tenants are more likely than PBIs tenants to develop a "collegial peer" relationship, in the sense of Kram and Isabella (1985). In other words, they are more likely than PBIs tenants to interact on high levels of trust, mutuality, and reciprocity, and therefore they are likely to exploit better the networking benefits unveiled by co-location (Lyons 2000).

I conclusion, I formulate the hypothesis that mentoring and peer-community are more closely related to tenant firms' satisfaction and performance in SBIs than in PBIs.

*H3b: Mentoring and peer-community are more closely related to tenant firm performance/satisfaction in SBIs than in PBIs (in other words, they are more relevant "regular producer" inputs for SBIs tenants than for PBIs tenants).*

Finally, I focus on the "consumer producer" side of the model of interdependent co-production of business assistance. Consistently with Petti (2009), I argue that the entrepreneurial performance curve of BIs tenants is an S-curve (logistic curve, or sigmoid), such that the improvement of performance starts slowly, then increases rapidly, and finally levels off (as the amount of effort by the founding team increases). Student entrepreneurs work only part-time on their entrepreneurial project (they have to attend classes, take exams, etc), ergo they are more likely to be positioned on the steep side of the S-curve. PBIs tenants, on the other hand, work full-time on their entrepreneurial project (and also have a greater amount of cumulated effort/experience), ergo they are more likely to be positioned on the plateau.

This means that the elasticity of tenant firms´ performance with respect to effort put in the entrepreneurial project is greater in SBIs than in PBIs. In other words, I formulate the assumption that the amount of effort put in the entrepreneurial project by the founding team is more closely related to firm performance in SBIs than in PBIs.

*H3c: The amount of effort put in the entrepreneurial project by the founding team ("consumer*

*producer" input) is more closely related to firm performance in SBIs than in PBIs.*

In the next chapters I will discuss how I have investigated the hypotheses through the administration of a questionnaire in both SBIs and PBIs, how I have analyzed the data collected through the questionnaire, and what conclusions I have elaborated.

# 3. RESEARCH METHODOLOGY

## *3.1. Data collection.*

To test the research hypotheses, I employed a field study approach to collect data from the tenants of 2 SBIs and 3 PBIs based in Copenhagen through a questionnaire. Consistent with prior research, SBIs are defined as university-based incubators hosting undergraduate and graduate student entrepreneurs (Hjortsø et al. 2015), and PBIs are defined as for-profit incubators, with either a technology or mixed focus, relying on a different range of business models (Aernoudt 2004). PBIs tenants were used as key respondents for questions associated with the following constructs: entrepreneurship skills development, company performance, and modalities of business assistance by the incubator. SBIs tenants were used as key respondents for questions associated with the following constructs: entrepreneurship skills development, company performance, individual academic performance, and modalities of business assistance by the incubator.

A total of 1,195 surveys were sent to a list of SBIs and PBIs incubatees. The contact information was provided by the incubator directors or derived from secondary data sources (intranets, Web sites, and information boards of the incubators). The phase of data collection occurred within 5 months. In order to increase the response rate, I paid several visits to the five incubators and pitched my research project at two major events hosted by them. A landing page (http://incubator-survey.weebly.com) and a Facebook page were also created, in order to increase the engagement and the awareness of the incubatees about the research objectives.

A total of 361 surveys were returned for a total response rate of 30.2%. The company membership of the respondent was tracked. The survey was considered complete and usable if the survey questions were properly answered, the respondent held a co-founder title, either being tenant or alumnus of the incubator, and the identity of his or her company's was traceable. 135 incomplete or untraceable answers were dropped from the sample, yielding a final sample of 226 usable responses, which represents the final sample size. Out of the 226 responses, 113 (50.0%) are from entrepreneurs hosted by SBIs and 113 (50.0%) from entrepreneurs hosted by PBIs. The total number of companies covered by the survey is 175 – of which 79 (45.1%) are tenants of SBIs and 96 (54.9%) are tenants of PBIs. I obtained responses from a single respondent in 145 (82.9%) of the organizations. In addition, multiple

responses were obtained from 30 of the 175 responding companies (17.1%). I obtained responses from two, three, and four or more co-founders in 22 (12.6%), 5 (2.9%), and 3 (1.7%) of the companies. Only 3 out of 175 (1.7%) companies are alumni companies. Alumni companies are defined as companies that graduated or moved out of the incubator, and therefore are not enrolled in the incubation program anymore. 2 out of 3 considered alumni (66.6%) are still alive and 1 (33.3%) did not survive[4]. The lack of alumni companies captured by the survey reflects the relatively small alumni network of the considered incubators (3 of them were established less than 3 years ago). Moreover, according to incubator directors, 4 out of the 5 considered incubators do not cultivate alumni network or informal relationships/communications with their graduates and former incubatees. Table 3 summarizes the characteristics of the respondents, SBIs and PBIs entrepreneurs, and their companies.

While the response rate to the survey (21.9%) is typical of research involving SBIs and student entrepreneurs as respondents (Alexander 2015), it is nevertheless important to test for nonresponse bias. Nonresponse bias was examined comparing the average measures (via analysis of variance [ANOVA]) for each of the study's constructs between early and late interviewees. This assessment revealed no differences between early and late interviewees.

Table 3. Characteristics of the respondents of the survey

| | SBIs - N (%) | PBIs - N (%) |
|---|---|---|
| Companies | 79 (45.1%) | 96 (54.9%) |
| Entrepreneurs | 113 (50.0%) | 113 (50.0%) |
| Students | 85 (75.2%) | 4 (3.5%) |

The questionnaire contains a number of existing valid instruments for entrepreneurship research that were adapted to the current context. All constructs were measured using multi-item scales. The questionnaire was validated in a two-step process. First, semi-structured interviews were held with the five incubator managers to assess content validity and to gain richer insights into the phenomenon. Second, I tested the survey with five entrepreneurs to collect feedback and qualitatively evaluate the discriminant validity of each of the measured constructs.

[4] Statistics about SBIs tenants' survival rate (which is not the core of my research) are provided by UBI Global every year.

The study's constructs were measured using 20 categorical variables divided into four main groups: (1) sociodemographic variables related to the individual characteristics of the entrepreneurs, (2) company-level variables related to the characteristics and performance of the tenant firms, (3) variables related to the range of support services provided by the incubator, and (4) variables related to the new entrepreneurship skills developed by the incubatees during the incubation program. I provide here a short description of the above mentioned variables.

Sociodemographic variables include: (i) gender, (ii) age, (iii) educational background, (iv) years of prior working experience, and (v) highest degree held by the entrepreneur; another individual characteristic, measured only for student entrepreneurs, is (vi) Grade Point Average (GPA) at university. The measures were specifically derived from the 2014 Graduation Study survey of the University of Copenhagen (UCPH) and contextualized for SBIs and PBIs incubatees. The student GPA was measured according to the Danish 7-point grading scale.

Company-level variables related to firm characteristics include: (i) age and (ii) industry of the company. In addition, variables related to firm performance include: (i) number of paying customers, (ii) amount of monthly sales to the biggest customer, (iii) registered patents (the respondent was asked whether or not his or her company had registered any patents), (iv) perceived impact of incubation on firm performance (ranked by the incubatee on a 7-point scale). The scales were derived from the insights collected through semi-structured interviews with the incubator directors, and validated testing the survey with five incubatees.

The degree of business assistance provided by the incubators was measured as the range of support services provided to the incubatees, and compared with the range of services needed and expected by them when they entered the incubation program. The range of support services was specifically derived from the 2013 NBIA report on US BIs, and includes 12 infrastructure, knowledge, and networking based services:

1. office space;
2. laboratory facilities;
3. mentoring (test of idea feasibility and business model generation);
4. technology assistance;
5. marketing and sales assistance;
6. seed investment;
7. access to a network of external investors;
8. access to a network of external partners or mentors;

9. help and support from internal community of fellow entrepreneurs;
10. links to higher education institutions;
11. legal and tax advisory;
12. accounting services.

The level satisfaction about the services offered by the incubator was also measured on a 7-point scale. Open feedback about the incubation experience was allowed through an optional text entry box. I collected 32 complete and relevant feedback inputs, of whom 15 (46.9%) in SBIs and 17 (53.1%) in PBIs. Other variables related to the incubation process, measured only for student entrepreneurs, are: (i) impact of incubation on study time (respondents were asked to assess whether or not they thought the incubation had pushed them to prolong their studies time of one semester or more) and (ii) perceived impact of incubation on individual employability (chances to find placement on the job market). Finally, both student and nonstudent entrepreneurs were asked to assess the average weekly hours spent working on their entrepreneurial project (inside the incubator facilities).

With respect to new entrepreneurship skills developed by the incubatees during the incubation program, the measures were derived from the 2014 ASTEE[5] survey on youth entrepreneurship for the age group "20 years or older". The respondent was asked to rank, on a 7-point scale, 10 cognitive and non-cognitive entrepreneurship skills that he or she taught he or she had developed during the incubation period.

- SKILL 1: deal with unexpected changes and sudden surprises,
- SKILL 2: read and understand financial statements,
- SKILL 3: generate new ideas and solutions,
- SKILL 4: work under pressure,
- SKILL 5: make the budget for a new project,
- SKILL 6: think outside the box,
- SKILL 7: continue work despite problems,
- SKILL 8: assemble the right team to solve a problem,
- SKILL 9: network (exchange information with others),

[5] ASTEE is "a common European framework for measuring the impact of entrepreneurship education across all formal education levels" (http://asteeproject.eu). The project was co-funded by the EC and the Competitiveness and Innovation Framework Program (CIP) in 2012-2014. The results were published at the ICSB conference in Dublin on 11-14 June 2014.

- SKILL 10: establish new contacts.

The categorization derived from ASTEE is consistent with prior research on entrepreneurship skills acquired through entrepreneurial education (Rosendahl Huber et al. 2012; Oosterbeek et al. 2010).

*3.2. Background characteristics of the considered BIs.*

I chose to focus on 5 different incubators of mixed types in order to deal with the problem of endogeneity of results, consistently with Phan et al. (2005). With respect to SBIs, I selected one incubator (Innovation Hub) associated with a multi-faculty university (UCPH) and one incubator (Copenhagen School of Entrepreneurship) associated with a specialist university (CBS), in order to achieve a broader understanding of the student incubation phenomenon (Hjortsø et al. 2015). As for PBIs, I selected three incubators (Symbion, DARE2mansion, and Founders), which present significant differences with respect to size and business model. I provide here a description of the characteristics of the five incubators (first the 2 SBIs, then the 3 PBIs).

Copenhagen School of Entrepreneurship (CSE) is the largest SBI in Denmark. It was established by CBS in 2008 in the top three floors of the former Royal Copenhagen Porcelain Factory (completely renovated in 2006 and now part of the CBS Campus). CSE incubates more than 100 startups per year, through a three-step incubation process called "Proof Program". The first two steps "Proof of Idea" and "Proof of Concept" last for three months (the incubatee must prove the viability of concept, through prototyping, engagement of customers and establishment of the first partnerships). If "Proof of Concept" is successfully completed, the incubatee enters the "Proof of Business" step (six extra months for business development)[6].

Innovation Hub was established two years ago as a part of the UCPH Campus and currently hosts approximately 30 startups/teams. Student incubatees must work in the Hub for a minimum of five hours per week; although the incubator does not directly provide funding to its incubatees (as we can appreciate in Figure 3), student entrepreneurs may apply to "UCPH Proof of Concept" to get funding from the university (up to $5,000).

[6] It is worth remarking, by the way, that CSE hosts also businesses that had already achieved revenue generation when they entered in "Proof of Idea": in this case the passage from "Proof of Concept" to "Proof of Business" is more nuanced.

Symbion is the largest PBI in Denmark. It was established in 1986 by six scientists who aimed at creating synergies between business and academia. Targeting healthcare, medtech, IT, and knowledge based entrepreneurial companies, today Symbion is one of the Danish leading "innovation environments" (a status officially recognized by the Danish Ministry of Science), and manages the fund Syddansk Vækstfremme investing in welfare technology companies. With 250 tenants and three different locations in Copenhagen, Symbion mostly relies on a rent-based business model[7], but it may also take a stake in some of the tenant firms (usually participating to the 4th or 5th round of investment), and offers two growth programs to its incubatees.

DARE2mansion was opened in 2013, currently hosts 13 startups, and mainly provides infrastructure-based and basic knowledge-based services to its tenants, as well as growth programs companies through its sister companies DARE2 and Thinkubator. The incubator encourages interactions among co-tenants in several ways: every day the "Mansioners" have lunch together in a cozy café area; they also share a LEGO room (designed to stimulate conversation and creativity), a sofa seating area with football table, and so forth.

Since its foundation in 2013, Founders has hosted 11 startup companies, backing them in a startup studio-like fashion. The tenants receive a first round investment from three investment companies affiliated with Founders, then they are hosted and get business assistance by Founders for one year. The ones that survive (so far 9 out of 11) get a second round investment and usually move out of the facility.

*3.3. Interviews with incubator directors.*

In order to collect also qualitative insights about the incubation phenomenon, I conducted also 5 semi-structured interviews with the directors/managers/CEOs of the considered incubators. The interview questions were designed to help better explain the data findings. The key questions were: (a) what are the selection criteria/entry requirements (if any) of the incubator; (b) what frameworks does the incubator director/program manager use for mentoring; (c) how does the incubator measure success of its incubatees. As for the analysis of the interviews, all the key points were noted according to the interview and case study methods prescribed by Yin (1994).

[7] The prices start at $250 per month for the most basic office space (http://symbion.science).

*3.4. Data Analysis.*

In this section, I present the statistic and econometric models that I employ to analyze the data, using SAS®.

With respect to the first set of hypotheses (systematic differences between SBIs and PBIs on individual characteristics of incubatees, tenant firms, and business assistance services needed/expected/provided to them), I proceed to compute binomial Chi-squared tests (for dummy variables) and multinomial Chi-squared tests (for categorical variables), in order to evaluate the statistical significance of differences between the two categories of tenants (SBIs tenants and PBIs tenants).

With respect to the second hypothesis (*"SBIs tenants are more likely than PBIs tenants to develop new entrepreneurship skills during the incubation period"*), I run a preliminary Factor Analysis on the considered 10 entrepreneurship skills. According to the broken stick model, scree plot, and the analysis of eigenvalues and proportions, I choose to focus on 3 factors. The interpretation of the factors (based on the analysis of the rotated factor loadings) is the following: (1) the first factor (labelled as "traction/entrepreneurial drive") is related to the ability to deal with unexpected changes, generate new ideas, work under pressure, think outside the box, continue work despite problems, and, to a lesser extent, assemble the right team to solve a problem; (2) the second factor (labelled as "networking/social skills") is related to the ability to network and establish new contacts; (3) the third factor (labelled as "finance/accounting skills") is related to the ability to understand financial statements and make the budget for a new project.

Second, I use logit regressions on both the considered entrepreneurship skills and the 3 extracted factors. I also use ordinary least squares (OLS) regressions, as a robustness check the model. I develop a three-step hierarchical model, in order to deal with the problem of omitting determinant explanatory variables (omitted-variable bias), integrating additional controls at each step of the model.

(a) In the first step of the model, I set the dummy variable relative to the type of incubator (SBI or PBI) as the only explanatory variable for entrepreneurship skills (outcome variables).

(b) In the second step of the model, I control for incubation type, age, gender, and prior experience of the incubatee. I construct a table of robustness, comparing the signs obtained via ordered logit and those obtained via OLS regressions.

(c) In the third step of the model, I also control for company membership of the incubatees in order to deal with cluster effects.

With respect to step (c), it is worth remarking that, when the data have a group structure, the assumption of independence of the observations is violated. In this case, there are 226 observations clustered in 175 logical units (tenant firms). Members of the same logical unit (co-founders of the same company) may exhibit similar sociodemographic characteristics, or similar characteristics related to their experience in the incubator. In such case, correlation between clusters of cases may produce underestimation of the standard errors of the regression coefficients, and/or overestimation of significance of the regressors (Cohen et al. 2003).

In order to deal with such cluster effects, I take into account company membership by including as regressors a set of *n-1* dummy variables for *n* companies, as suggested by Hope et al. (2005). As a measure of robustness, I compare the results obtained through this method with those obtained with the mixed effect models suggested by Snijders and Bosker (1999) and Kuss (2002), using the SAS® PHREG/LOGISTIC and NLMIXED procedures.

Steps (a), (b) and (c) of the models are formally expressed here:

(a) $y = \alpha + \beta I + \varepsilon$ ;
(b) $y = \alpha + \beta I + \gamma_1 age + \gamma_2 gen + \gamma_3 exp + \varepsilon$ ;
(c) $y = \alpha + \beta I + \gamma_1 age + \gamma_2 gen + \gamma_3 exp + \sum_{i=1}^{n-1} \tau_i C_i + \varepsilon$ .

Where:

$y$ = entrepreneurship skill developed by the incubatee (ten skills and three factors considered),
$I$ = incubator type (SBI = 1; PBI = 0),
$age$ = age of the incubatee,
$gen$ = gender of the incubatee,
$exp$ = years of prior working experience of the incubatee,
$C_i$ = $n - 1$ dummy variables for $n$ companies,
$\alpha$ = intercept parameter,
$\beta, \gamma_1, \gamma_2, \gamma_3, \tau_1, \ldots, \tau_{n-1}$= slope parameters,

$\varepsilon$ = disturbance.

With respect to the third set of hypotheses (H3a, H3b, H3c), relating to business assistance services in SBIs and PBIs, I use a preliminary Factor Analysis to summarize the 12 business services measured in the survey. According to the broken stick model, scree plot, and analysis of eigenvalues/proportions of explained variance, I select and label the following three factors: (1) mentoring (which is related to mentoring provided by the incubator staff, by the peer-community, and by external mentors reached through the incubator's network); (2) professional services (factor related to marketing & sales assistance, technical assistance, legal and tax advisory); (3) funding (factor related to seed investment by the incubator and access to external investor through the incubator's network). Second, I develop logit models (all the variables related to BIs services are dummy variables) to test H3a, H3b, and H3c.

In order to test H3a *("within SBIs, mentoring and peer-community are more closely related to tenant firm performance/satisfaction than any other business assistance service provided by the incubator"*), I focus on (a) satisfaction about the incubation experience and (b) perceived impact of incubation on firm performance by SBI tenants, as a self-assessed measure of "relevance" of business assistance (according to H1a, SBIs tenants are likely to be concentrated in the lower categories of both number of customers and sales, while the distribution of perceived impact on performance is expected to be more homogenous across different category levels, ergo their association with business assistance modalities may be better appreciated in the regression models).

I use satisfaction score as the outcome variable in a logit model, where I control for: provision of mentoring, professional services, and funding by the incubator; *expectations* about mentoring, professional services, and funding by the tenant firm; age and industry of the tenant firm. Moreover, I use perceived impact on performance in an analogous model, where I control for: provision of mentoring, professional services, and funding by the incubator; *need* for mentoring, professional services, and funding by the tenant firm; age and industry of the tenant firm. Formally:

(a) $satscore = \alpha + \gamma_1 R_1 + \gamma_2 R_2 + \gamma_3 R_3 + \delta_1 E_1 + \delta_2 E_2 + \delta_3 E_3 + \theta c_{age} + \mu c_{ind} + \varepsilon$ ;

(b) $perfimpact = \alpha + \gamma_1 R_1 + \gamma_2 R_2 + \gamma_3 R_3 + \delta_1 N_1 + \delta_2 N_2 + \delta_3 N_3 + \theta c_{age} + \mu c_{ind} + \varepsilon$ .

Where:

$satscore$ = level of satisfaction about the incubation experience by the tenant firm,
$perfimpact$ = perceived impact of incubation on tenant firm's performance,
$R_1$ = provision of mentoring/peer-community support by the SBI,
$R_2$ = provision of professional services by the SBI,
$R_3$ = provision of funding-related services by the SBI,
$E_1$ = expectations about mentoring/peer-community support by the tenant firm,
$E_2$ = expectations about professional services by the tenant firm,
$E_3$ = expectations about funding-related services by the tenant firm,
$N_1$ = need for mentoring/peer-community support by the tenant firm,
$N_2$ = need for professional services by the tenant firm,
$N_3$ = need for funding-related services by the tenant firm,
$C_{age}$ = age (maturity) of the tenant firm,
$C_{ind}$ = industry of the tenant firm,
$\alpha$ = intercept parameter,
$\gamma_1, \gamma_2, \gamma_3, \delta_1, \delta_2, \delta_3, \theta, \mu$ = slope parameters,
$\varepsilon$ = disturbance.

Interestingly enough, not controlling for needs/expectations, company age and company industry might lead to omitted variable bias. Rice (2002) distinguishes different *profiles* of BIs tenants. On the one hand, the "anchor tenants" are mature and financially self-sustained companies, that do not need nor want to engage in the co-production of business assistance. On the other hand, the "Up and Comers" are companies that have significant weaknesses or deficiencies and are ready to engage in co-production to overcome them. Clearly, (a) satisfaction score and (b) perceived impact of incubation on firm performance depend on the *profile* of the tenant firm: for example, an "anchor tenant" will be less sensible than an "up and comer" to SBI business assistance modalities, with (a) and (b) less dependent on service inputs from the incubator. Therefore, needs/expectations (affecting the *profile* of the tenant firm) are included in the model.

With respect to H3b (*"mentoring and peer-community are more closely related to tenant firm performance/satisfaction in SBIs than in PBIs"*), I focus again on (a) satisfaction score

about the incubation experience and (b) perceived impact of incubation on firm performance, extending the analysis to PBIs too. According to H1a, there is a polarization of SBIs (PBIs) in the lower (upper) categories of such performance metrics, while the distribution of perceived impact on performance is expected to be more homogenous across the two categories of incubators, ergo its association with business assistance modalities may be better appreciated in the regression models.

I use satisfaction score as the dependent variable in a logit model, where I control for: incubator type, provision of mentoring, professional services, and funding by the incubator; incubator type interacted with provision of mentoring, professional services, and funding; expectations about mentoring, professional services, and funding by the tenant firm; age, industry, and effort (weekly hours spent by the founding team on the project) of the tenant firm. By interacting incubator type with provision of services, I investigate the comparative relevance of such services in SBIs vs PBIs. By controlling, additionally, for effort by the founding team, I take into account the part-time against full-time employment status of SBIs/PBIs tenants (Table 14). In fact, short against long hours spent inside the incubator may reduce to opportunities for engaging in mentoring sessions or interactions with the peer-community, and thus be negatively associated with satisfaction about incubation (resulting in omitted variable bias in the model).

Table 14. Entrepreneurial effort by the founding team in SBIs and PBIs

| | Student incubators | | Professional incubators | |
|---|---|---|---|---|
| | No. of observations | % | No. of observations | % |
| Weekly hours spent on the project | | | | |
| 0 to 9 | 12 | 18,18 | 15 | 25,42 |
| 10 to 19 | 18 | 27,27 | 3 | 5,08 |
| 20 to 39 | 16 | 24,24 | 21 | 35,59 |
| 40 to 59 | 12 | 18,18 | 15 | 25,42 |
| More than 60 | 8 | 12,12 | 5 | 8,47 |
| Total sample[a] | 66 | 100,00 | 59 | 100,00 |

[a] In the survey, the question was not displayed to the alumni.

I use perceived impact on performance in a logit model, where I control for: incubator type, provision of mentoring, professional services, and funding by the incubator; incubator type interacted with provision of mentoring, professional services, funding; need for mentoring, professional services, and funding by the tenant firm; age, industry and effort of the tenant firm.

Formally:

(a) $satscore = \alpha + \beta I + \gamma_1 R_1 + \gamma_2 R_2 + \gamma_3 R_3 + \pi_1 I * R_1 + \pi_2 I * R_2 + \pi_3 I * R_3 + \delta_1 E_1 + \delta_2 E_2 + \delta_3 E_3 + \theta c_{age} + \mu c_{ind} + \rho time + \varepsilon$ ;

(b) $perfimpact = \alpha + \beta I + \gamma_1 R_1 + \gamma_2 R_2 + \gamma_3 R_3 + \pi_1 I * R_1 + \pi_2 I * R_2 + \pi_3 I * R_3 + \delta_1 N_1 + \delta_2 N_2 + \delta_3 N_3 + \theta c_{age} + \mu c_{ind} + \rho time + \varepsilon$ .

Where:

$satscore$ = level of satisfaction about the incubation experience by the tenant firm,

$perfimpact$ = perceived impact of incubation on tenant firm's performance,

$I$ = incubator type (SBI = 1; PBI = 0),

$R_1$ = provision of mentoring/peer-community support by the SBI,

$R_2$ = provision of professional services by the SBI,

$R_3$ = provision of funding-related services by the SBI,

$E_1$ = expectation about mentoring/peer-community support by the tenant firm,

$E_2$ = expectation about professional services by the tenant firm,

$E_3$ = expectation funding-related services by the tenant firm,

$N_1$ = need for mentoring/peer-community support by the tenant firm,

$N_2$ = need for professional services by the tenant firm,

$N_3$ = need for funding-related services by the tenant firm,

$C_{age}$ = age (maturity) of the tenant firm,

$C_{ind}$ = industry of the tenant firm,

$time$ = effort by the founding team (weekly hours spent by the founding team on the entrepreneurial project),

$\alpha$ = intercept parameter,

$\beta, \gamma_1, \gamma_2, \gamma_3, \delta_1, \delta_2, \delta_3, \theta, \mu, \pi, \rho$ = slope parameters,

$\varepsilon$ = disturbance.

With respect to H3c ("*The amount of effort put in the entrepreneurial project by the founding team is more closely related to firm performance in SBIs than in PBIs"*), I focus on (a) number of customers and (b) amount of sales to the biggest customer of the tenant firm. I

use (a) as the dependent variable in a logit model where I control for: incubator type; effort by the founding team; incubator type interacted with effort; provision of mentoring, professional services, and funding by the incubator; need for mentoring, professional services, and funding by the tenant firm; age (maturity) and industry of the tenant firm. I use (b) as the dependent variable in a logit model with analogous controls. Interacting effort and incubator type, I can investigate the comparative marginal effects of effort on firm performance in SBIs and PBIs. Formally:

(a) $customers = \alpha + \beta I + \gamma_1 R_1 + \gamma_2 R_2 + \gamma_3 R_3 + \delta_1 N_1 + \delta_2 N_2 + \delta_3 N_3 + \theta c_{age} + \mu c_{ind} + \rho time + \varphi I * time + \varepsilon$ ;

(b) $sales = \alpha + \beta I + \gamma_1 R_1 + \gamma_2 R_2 + \gamma_3 R_3 + \delta_1 N_1 + \delta_2 N_2 + \delta_3 N_3 + \theta c_{age} + \mu c_{ind} + \rho time + \varphi I * time + \varepsilon$ .

Where:

$customers$ = number of customers of the tenant firm,
$sales$ = amount of sales to the biggest customer of the tenant firm,
$I$ = incubator type (SBI = 1; PBI = 0),
$R_1$ = provision of mentoring/peer-community support by the SBI,
$R_2$ = provision of professional services by the SBI,
$R_3$ = provision of funding-related services by the SBI,
$N_1$ = need for mentoring/peer-community support by the tenant firm,
$N_2$ = need for professional services by the tenant firm,
$N_3$ = need for funding-related services by the tenant firm,
$C_{age}$ = age (maturity) of the tenant firm,
$C_{ind}$ = industry of the tenant firm,
$time$ = effort by the tenant firm (weekly hours spent working on the entrepreneurial project by the founding team),
$\alpha$ = intercept parameter,
$\beta, \gamma_1, \gamma_2, \gamma_3, \delta_1, \delta_2, \delta_3, \theta, \mu, \rho, \varphi$ = slope parameters,
$\varepsilon$ = disturbance .

# 4. RESULTS AND DISCUSSION

## *4.1. Systematic differences between SBIs and PBIs: characteristics of tenant firms/entrepreneurs.*

This section is devoted to the analysis of the differences between SBIs and PBIs, with respect to the characteristics of incubatees and tenant firms. The aim is to test the hypothesis H1a: *SBIs are more likely to attract early-stage startups managed by young entrepreneurs with little prior experience, while PBIs are more likely to attract growth-stage and mature companies managed by prior experienced entrepreneurs.*

Table 5 summarizes the characteristics of student and non-student incubatees in terms of gender, age, education attainments, educational background, and prior working experience. Overall, the Chi-squared tests show that SBIs incubatees are significantly younger and less experienced (at the 1% level) than PBIs incubatees. First, 84% of SBIs incubatees are aged less than 30 years against less than 23% of PBIs incubatees. Second, with respect to prior working experience, only 33% of SBIs incubatees have more than 5 years of experience against 79% of PBIs incubatees.

The differences between the two categories of incubatees with respect to gender diversity and educational background are not statistically significant. More interestingly, PBIs incubatees are generally more educated (at the 1% level) than SBIs incubatees, as the proportion of individuals with a graduate degree is 52% against 36%. In fact, most student entrepreneurs (45%) are undergraduates.

These evidences support my first hypothesis that systematic differences exist between SBIs and PBIs, with the former ones attracting more young and unexperienced entrepreneurs, and the latter ones attracting more *agé* and prior experienced tenants. These findings suggest that student incubators play a pivotal role in fostering youth entrepreneurship, acting as catalysts for student-sourced entrepreneurial projects.

Table 5. Characteristics of entrepreneurs: gender, age, education, and prior working experience. Chi-squared tests between the two categories of entrepreneurs (SBI and PBI tenants)

| | **Student incubators** | | **Professional incubators** | |
|---|---|---|---|---|
| | **No. of observations** | **%** | **No. of observations** | **%** |
| Gender | | | | |
| Male | 85 | 75,22 | 81 | 71,68 |
| Female | 28 | 24,78 | 32 | 28,32 |
| Age *** | | | | |
| 18-22 | 16 | 14,16 | 5 | 4,42 |
| 23-25 | 38 | 33,63 | 7 | 6,19 |
| 26-29 | 41 | 36,28 | 14 | 12,39 |
| 30-39 | 16 | 14,16 | 31 | 27,43 |
| 40-49 | 2 | 1,77 | 36 | 31,86 |
| 50+ | 0 | 0,00 | 20 | 17,70 |
| Highest degree *** | | | | |
| High school diploma | 15 | 13,27 | 19 | 16,81 |
| Bachelor's degree | 51 | 45,13 | 21 | 18,58 |
| Master's degree | 4 | 36,29 | 59 | 52,21 |
| Other | 6 | 5,31 | 14 | 12,39 |
| Education | | | | |
| Natural sciences | 6 | 5,31 | 9 | 8,33 |
| Engineering | 23 | 20,35 | 31 | 27,78 |
| Medical sciences | 3 | 2,65 | 4 | 3,70 |
| Agricultural Sciences | 0 | 0,00 | 1 | 0,93 |
| Social sciences | 9 | 7,96 | 5 | 4,63 |
| Humanities | 5 | 4,42 | 9 | 8,33 |
| Business | 59 | 52,21 | 40 | 35,19 |
| Arts and design | 6 | 5,31 | 6 | 5,56 |
| Law | 1 | 0,88 | 1 | 0,93 |
| Other | 1 | 0,88 | 5 | 4,63 |
| Prior working experience *** | | | | |
| Less than 1 year | 10 | 8,85 | 0 | 0,00 |
| 1-3 years | 38 | 33,63 | 7 | 6,54 |
| 3-5 years | 28 | 24,78 | 17 | 14,95 |
| 5-7 years | 23 | 20,35 | 7 | 6,54 |
| 7 years or more | 14 | 12,39 | 81 | 71,96 |
| Total sample | 113 | 100,00 | 113 | 100,00 |

Note: */**/*** indicate significance at the 10%/5%/1% level with respect to the distribution of the marked variables.

With respect to the characteristics of tenant firms, Table 6 shows that SBIs attract more early-stage companies than PBIs: the proportion of tenant firms aged less than one year is significantly (at the 1% level) higher (42% against 14%) in SBIs, while the proportion of growth-stage startups is higher (57% against 3%) in PBIs. With respect to industry focus, instead, the difference between the two categories is not statistically significant.

Table 6. Characteristics of tenant firms: age and industry. Chi-squared tests between the two categories of firms (SBI and PBI tenants)

| | **Student incubators** | | **Professional incubators** | |
|---|---|---|---|---|
| | **No. of observations** | **%** | **No. of observations** | **%** |
| Firm's age *** | | | | |
| Less than 3 months | 5 | 6,67 | 3 | 4,29 |
| 3-12 months | 24 | 35,00 | 7 | 10,00 |
| 1-3 years | 37 | 55,00 | 20 | 28,57 |
| 3+ years | 2 | 3,33 | 40 | 57,14 |
| Firm's industry | | | | |
| ICT | 34 | 50,00 | 31 | 44,29 |
| Biotech | 3 | 4,41 | 7 | 10,00 |
| Life sciences | 1 | 1,47 | 0 | 0,00 |
| Social / environmental | 10 | 14,71 | 9 | 12,86 |
| Other | 20 | 29,41 | 23 | 32,86 |
| Total sample | 68 | 100,00 | 70 | 100,00 |

Note: */**/*** indicate significance at the 10%/5%/1% level with respect to the distribution of the marked variables.

A confirmation of these claims comes from data on Table 7 concerning the economic performance of PBIs and SBIs tenant firms. The two categories of tenant firms under scrutiny show significant differences with respect to the number of paying customers (at the 5% level) and the amount of monthly sales to their biggest customer (at the 1% level). The proportion of startups that do not have any customers yet (e.g. for being in the idea or seed stage) in SBIs is twice the proportion in PBIs (42% against 20%). This evidence supports the hypothesis about SBIs attracting more early-stage companies than PBIs. Moreover, with respect to customer sales, SBIs tenants that do have customers are distributed across the different categories (16% in the 50-999 DKK category; 11% in the 1000-4999 DKK category; and 18% in the 5000+ DKK category). On the other hand, PBIs tenants that do have paying customers are

mostly concentrated (66%) in the upper category of sales per customer (5000+ DKK). Finally, with respect to firm performance, the proportion of patent registrations is significantly higher (at the 10% level) in PBIs than in SBIs.

These results confirm that systematic differences exist between SBIs and PBIs with respect to both: (a) individual characteristics of their incubatees, and (b) characteristics of their tenant firms. Therefore, the first hypothesis is fully supported at significant levels.

Table 7. Performance of tenant firms: registered patents, number of customers and amount of sales to the biggest customer. Chi-squared tests between the two categories of firms (SBI and PBI tenants)

| | **Student incubators** | | **Professional incubators** | |
|---|---|---|---|---|
| | **No. of observations** | **%** | **No. of observations** | **%** |
| Registered patents * | | | | |
| Yes | 3 | 5,26 | 18 | 29,51 |
| No | 54 | 94,74 | 43 | 70,49 |
| Number of customers ** | | | | |
| None | 24 | 42,11 | 12 | 20,37 |
| 1 to 49 | 21 | 36,84 | 21 | 35,19 |
| 50 to 999 | 11 | 19,30 | 19 | 31,48 |
| 1000 or more | 1 | 1,75 | 8 | 12,96 |
| Sales to biggest customer *** | | | | |
| (No customers) | 24 | 42,11 | 13 | 20,75 |
| 0-49 DKK | 2 | 3,51 | 1 | 1,89 |
| 50-999 DKK | 9 | 15,79 | 5 | 7,55 |
| 1000-4999 DKK | 6 | 10,53 | 2 | 3,77 |
| 5000 DKK or more | 16 | 28,07 | 40 | 66,04 |
| Total sample | 57 | 100,00 | 61 | 100,00 |

Note: */**/*** indicate significance at the 10%/5%/1% level with respect to the distribution of the marked variables.

*4.2. Systematic differences between SBIs and PBIs: business assistance services.*

This section is devoted to the analysis of the differences between SBIs and PBIs, with respect to the range of business assistance services they provide. The aim is to test the hypothesis H1b: *SBIs tenants need, expect, and receive more mentoring, advisory, peer-community support, and links to HEIs; no systematic differences exist between SBIs and PBIs with respect to the other business assistance services.*

Table 8 summarizes the characteristics of SBIs and PBIs tenants with respect to the range of business assistance services that they *need* when they enter the incubation program. Overall, results show that SBIs tenants need more mentoring (63% against 19%), peer-community support (69% against 28%), and advisory (53% against 12%) than PBIs tenants. According to the Chi-squared tests, these results are all significant at the 1% level. Other systematic differences (significant at the 5% level) exist with respect to laboratory facilities (6% against 20%) and network external mentors/partners (37% against 12%). Finally, the proportion of tenants that need accounting services is significantly (at the 10% level) higher in SBIs than in PBIs (31% against 14%).

Table 8. Business assistance services needed by BIs tenants: Chi-squared test between the two categories of tenant firms (SBI and PBI tenants)

| | **Student incubators** | | **Professional incubators** | |
|---|---|---|---|---|
| | **No. of observations** | **%** | **No. of observations** | **%** |
| Office space | 62 | 91.18 | 54 | 78.26 |
| Laboratory facilities** | 4 | 5.88 | 14 | 20.29 |
| Mentoring *** | 43 | 63.24 | 13 | 18.84 |
| Technology assistance | 7 | 10.29 | 6 | 8.70 |
| Marketing assistance | 20 | 29.41 | 11 | 15.94 |
| Seed investment | 18 | 26.47 | 12 | 17.39 |
| Network of investors | 20 | 29.41 | 10 | 14.49 |
| Network of mentors/partners** | 25 | 36.76 | 8 | 11.59 |
| Peer-community support*** | 47 | 69.12 | 19 | 27.54 |
| Links to HEIs | 6 | 8.82 | 7 | 10.14 |
| Legal & Tax advisory*** | 36 | 52.94 | 8 | 11.59 |
| Accounting services* | 21 | 30.88 | 10 | 14.49 |
| Total sample | 68 | 100.00 | 69 | 100.00 |

Note: */**/*** indicate significance at the 10%/5%/1% level with respect to the distribution of the marked variables.

Table 9 summarizes the characteristics of SBIs and PBIs tenants with respect to the range of business assistance services that they *expect* to receive when they enter the incubation program.

Overall, Chi-squared tests show that the proportion of tenants that expect mentoring, peer-community support, and advisory is significantly (at the 1% level) higher in SBIs than in PBIs (56% against 13% for mentoring, 59% against 22% for peer-community support, 44% against 7% for advisory). Other systematic differences between SBIs and PBIs exist with respect to laboratory facilities (4% against 19%), network of external partners/mentors (29% against 9%), and seed investment (18% against 14%).

Table 9. Business assistance services expected by BIs tenants: Chi-squared test between the two categories of tenant firms (SBI and PBI tenants)

| | **Student incubators** | | **Professional incubators** | |
|---|---|---|---|---|
| | **No. of observations** | **%** | **No. of observations** | **%** |
| Office space | 53 | 77.94 | 51 | 73.91 |
| Laboratory facilities** | 3 | 4.41 | 13 | 18.84 |
| Mentoring *** | 38 | 55.88 | 9 | 13.04 |
| Technology assistance | 4 | 5.88 | 4 | 5.80 |
| Marketing assistance | 16 | 23.53 | 9 | 13.04 |
| Seed investment* | 12 | 17.65 | 10 | 14.49 |
| Network of investors | 16 | 23.53 | 8 | 11.59 |
| Network of mentors/partners** | 20 | 29.41 | 6 | 8.70 |
| Peer-community support*** | 40 | 58.82 | 15 | 21.74 |
| Links to HEIs | 2 | 2.94 | 6 | 8.70 |
| Legal & Tax advisory*** | 30 | 44.12 | 5 | 7.25 |
| Accounting services | 14 | 20.59 | 6 | 8.70 |
| Total sample | 68 | 100.00 | 69 | 100.00 |

Note: */**/*** indicate significance at the 10%/5%/1% level with respect to the distribution of the marked variables.

Table 10 summarizes the characteristics of SBIs and PBIs tenants with respect to the range of business assistance services that they receive from the incubator. In order to evaluate the statistical significance of differences between the two categories of tenants, I have proceeded to compute binomial Chi-squared tests.

Overall, results show significant (at the 1% level) differences between SBIs and PBIs with respect to office space (100% of SBIs tenants against 71% of PBIs tenants receive this service), mentoring (50% against 12%), network of external partners/mentors (28% against

6%), peer-community support (72% against 13%), and advisory (41% against 7%). Other differences (significant at the 5% level) exist with respect to lab facilities (7% against 25%), seed investment (4% against 14%), and links to HEIs (7% against 0%).

Table 10. Business assistance services received by BIs tenants: Chi-squared test between the two categories of tenant firms (SBI and PBI tenants)

| | **Student incubators** | | **Professional incubators** | |
|---|---|---|---|---|
| | **No. of observations** | **%** | **No. of observations** | **%** |
| Office space*** | 68 | 100.00 | 49 | 71.01 |
| Laboratory facilities** | 5 | 7.35 | 17 | 24.64 |
| Mentoring *** | 34 | 50.00 | 8 | 11.59 |
| Technology assistance | 5 | 7.35 | 9 | 13.04 |
| Marketing assistance | 11 | 16.18 | 7 | 10.14 |
| Seed investment** | 3 | 4.41 | 10 | 14.49 |
| Network of investors | 12 | 17.65 | 6 | 8.70 |
| Network of mentors/partners*** | 19 | 27.94 | 4 | 5.80 |
| Peer-community support*** | 49 | 72.06 | 12 | 17.39 |
| Links to HEIs** | 5 | 7.35 | 0 | 0.00 |
| Legal & Tax advisory*** | 28 | 41.18 | 5 | 7.25 |
| Accounting services | 15 | 22.06 | 8 | 11.59 |
| Total sample | 68 | 100.00 | 69 | 100.00 |

Note: */**/*** indicate significance at the 10%/5%/1% level with respect to the distribution of the marked variables.

The results from the three Chi-square tests confirm that systematic differences exist between SBIs and PBIs with respect to: (a) business assistance services needed by tenant firms before they enter the incubation program, (b) services expected by tenant firms when they enter the incubator, and (c) services received by tenant firms during the incubation period. In particular, the findings support that SBIs tenants need, expect, and receive more mentoring, peer-community support, and advisory services than PBIs tenants, and that they receive more links to HEIs. However, systematic differences exist also with respect to other business assistance services (in particular: lab facilities, seed investment, and network of external partners/mentors). Therefore, I conclude that H1b is only partially supported.

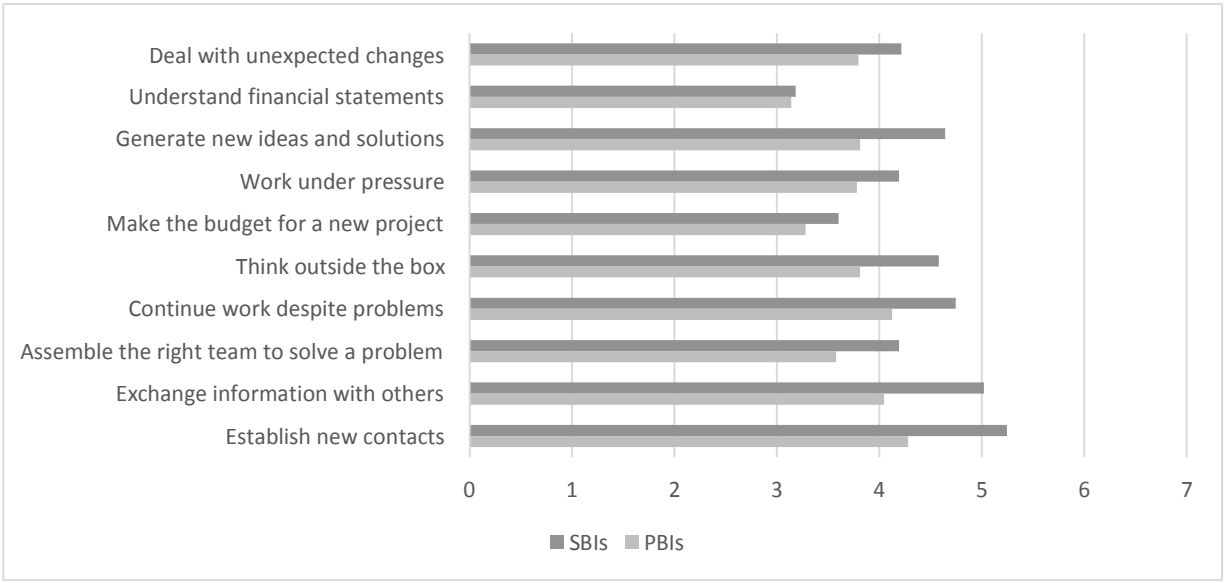
### *4.3. Entrepreneurship skills in SBIs and PBIs.*

This section is devoted to the analysis of the correlation between different incubation programs

(SBI and PBI programs) and the acquisition of new entrepreneurship skills by the incubatees. The aim is to test the second hypothesis: *SBIs tenants are more likely than PBIs tenants to develop new entrepreneurship skills during the incubation time.*

I begin considering the bivariate relationships between entrepreneurship skills and the type of incubation program. Figure 7 compares SBIs incubatees with PBIs incubatees, focusing on self-assessed skills relevant for entrepreneurship. Compared to PBIs tenants, SBIs tenants are generally more likely to develop such skills during the incubation program. This is particular true for networking/social skills ("establish new contacts" and "exchange information with others"), problem-solving skills ("generate new ideas and solutions"), and, to a lesser extent, creativity ("think outside the box"), resilience ("continue work despite problems"), flexibility ("deal with unexpected changes and sudden surprises"), capacity to function under stress ("work under pressure"), and management skills ("assemble the right team to solve a problem"). Both PBIs and SBIs incubatees associate the lowest ranks to financial ("read and understand financial statements") and accounting ("make the budget for a new plan") skills, with the difference between the two categories being minimum.

Figure 7. New entrepreneurship skills acquired by SBIs and PBIs tenants during incubation




The bivariate result in Figure 7 is obviously subject to many caveats. PBIs incubatees are less likely to develop new entrepreneurship skills during the incubation, but are also older, more educated and more experienced than SBIs incubatees. Therefore, they might possess

(some of) the considered entrepreneurship skills before entering the incubator - and thus associate a lower a rank to them, as they were not acquired *ex novo* during the incubation period. To further analyze the relationship between entrepreneurship skills and incubator type, I turn to multivariate models.

Table 11 presents the estimated results of the multi-step regression model described in Chapter 3.4. Column (a) shows the results of the first-step logit model (controlling only incubator type); column (b) the results of the second-step logit model with additional controls (age, gender, and prior experience); column (c) provides a robustness check for the second-step model, obtained with OLS regressions.

Column (a) shows that SBIs incubatees are more likely to acquire problem-solving ("generate new ideas and solutions"), creative ("think outside the box"), social ("exchange information with others", and "establish new contacts"), and management skills ("assemble the right team to solve a problem"), as well as resilience ("continue work despite problems").

However, these results suffer from omitted-variable bias, that leads to an overestimation of their significance level. Controlling for age, gender, and prior experience in column (b) suggests that SBIs are more likely (at the 10% level) than PBIs incubatees to develop only social/networking skills. The association between student incubation and the other entrepreneurship skills is not significant. The robustness of this result is tested by comparison with the regression coefficients in column (c), obtained via OLS regression.

Interestingly enough, the signs of the coefficients change from column (a) to column (b) for most skills (but not for the significant ones). To better understand the negative correlation between student incubation and such skills, we look at Tables 12-12a. Table 12 presents the estimates for the second-step logit model, with respect to all the considered controls. Table 12a presents the results of a logit model with analogous controls, where the outcome variables are 3 factors obtained via Factor Analysis on the initial 10 entrepreneurship skills.

Table 11. Logit (columns a,b) and OLS (column c) regression estimates of the correlation between new entrepreneurship skills acquired by the incubatee and type of incubation program

| **Outcome variables** | **(a) Controls: incubator type (SBI=1; PBI=0)** | **(b) Controls: incubator type, age, gender, prior experience** | **(c) Controls: incubator type, age, gender, prior experience** |
|---|---|---|---|
| *Networking/social skills* | | | |
| Exchange information with others | 0.974*** | 0.650* | 0.620* |
| | (0.291) | (0.379) | (0.371) |
| Establish new contacts | 1.013*** | 0.688* | 0.631* |
| | (0.292) | (0.380) | (0.366) |
| *Traction/entrepreneurial drive* | | | |
| Deal with unexpected changes | 0.400 | -0.273 | -0.254 |
| | (0.284) | (0.377) | (0.381) |
| Generate new ideas and solutions | 0.893*** | 0.099 | 0.050 |
| | (0.291) | (0.377) | (0.351) |
| Work under pressure | 0.410 | -0.409 | -0.361 |
| | (0.285) | (0.378) | (0.380) |
| Think outside the box | 0.831*** | -0.018 | -0.089 |
| | (0.290) | (0.378) | (0.363) |
| Continue work despite problems | 0.592** | -0.402 | -0.438 |
| | (0.286) | (0.379) | (0.374) |
| Assemble the right team to solve a problem | 0.570** | -0.218 | -0.166 |
| | (0.285) | (0.376) | (0.381) |
| *Financial/anaytical skills* | | | |
| Understand financial statements | 0.086 | -0.054 | -0.063 |
| | (0.284) | (0.376) | (0.374) |
| Make the budget for a new project | 0.325 | 0.153 | 0.171 |
| | (0.284) | (0.376) | (0.366) |
| **Number of observations** | 162 | 162 | 162 |

Note: the estimates in each cell come from separate regressions. */**/*** indicate significance at the 10%/5%/1%. Robust standard errors in parentheses.

Table 12. Logit regression estimates of the correlation between new entrepreneurship skills acquired by the incubatees and type of incubation program, controlling for gender, age, and prior experience of the incubatees

| **Outcome variables** | **Incubator type (SBI = 1; PBI = 0)** | **Gender** | **Age** | **Prior experience** |
|---|---|---|---|---|
| *Networking/social skills* | | | | |
| Exchange info with others | 0.650* | -0.940*** | -0.274* | 0.088 |
| | (0.379) | (0.345) | (0.152) | (0.161) |
| Establish new contatcts | 0.688* | -0.856** | -0.356** | 0.196 |
| | (0.380) | (0.345) | (0.153) | (0.162) |
| *Traction/entrepreneurial drive* | | | | |
| Deal with unexpected changes | -0.273 | -0.564* | -0.208 | -0.199 |
| | (0.377) | (0.339) | (0.151) | (0.161) |
| Generate new ideas and solutions | 0.099 | -0.335 | -0.322** | -0.176 |
| | (0.377) | (0.338) | (0.153) | (0.162) |
| Work under pressure | -0.409 | 0.039 | -0.239 | -0.235 |
| | (0.378) | (0.337) | (0.152) | (0.162) |
| Think outside the box | -0.018 | -0.376 | -0.410*** | -0.072 |
| | (0.378) | (0.339) | (0.154) | (0.161) |
| Continue work despite problems | -0.402 | -0.368 | -0.491*** | -0.103 |
| | (0.379) | (0.339) | (0.155) | (0.161) |
| Assemble the right t. to solve a pr. | -0.218 | -0.182 | -0.162 | -0.321** |
| | (0.376) | (0.336) | (0.151) | (0.162) |
| *Financial/analytical skills* | | | | |
| Understand financial statements | -0.054 | 0.293 | 0.051 | -0.152 |
| | (0.376) | (0.338) | (0.151) | (0.161) |
| Make the budget for a new project | 0.153 | 0.213 | -0.025 | -0.085 |
| | (0.376) | (0.336) | (0.150) | (0.161) |
| **Number of observations** | | | | 162 |

Note: the estimates in different rows come from separate regressions. */**/*** indicate significance at the 10%/5%/1% level. Robust standard errors in parentheses.

Table 12a. Logit regression estimates (after performing Factor Analysis on entrepreneurship skills) of the correlation between new entrepreneurship skills acquired by the incubatees and type of incubation program, controlling for gender, age, and prior experience of the incubatees

| **Outcome variables** | **Incubator type (SBI = 1; PBI = 0)** | **Gender** | **Age** | **Prior experience** |
|---|---|---|---|---|
| Networking/social skills | 0.929** | -0.735** | -0.238 | 0.242 |
| | (0.375) | (0.331) | (0.148) | (0.158) |
| Traction/entrepreneurial drive | -0.584 | -0.294 | -0.377** | -0.245 |
| | (0.371) | (0.327) | (0.150) | (0.158) |
| Financial/analytical skills | 0.191 | 0.392 | 0.130 | -0.031 |
| | (0.369) | (0.328) | (0.148) | (0.157) |
| **Number of observations** | | | | 162 |

Note: the estimates in different rows come from separate regressions. */**/*** indicate significance at the 10%/5%/1% level. Robust standard errors in parentheses.

We observe in Table 12 that age is negatively associated to most entrepreneurship skills (in particular those related to "traction/entrepreneurial drive"), meaning that the effectiveness of entrepreneurship education decreases with the age of the student/incubatee. This result is consistent with Oosterbeek et al. (2010) and Rosendahl Huber et al. (2012).

The positive correlation between student incubation and social/networking skills in Table 12a may be explained by the higher intensity of peer-community interactions among student entrepreneurs. The second-step results of the logit models are subject, though, to one important caveat. As I argued when describing the three-step hierarchical regression model in Chapter 3.4, although the average number of survey respondents per company is small (1.29), the presence of group structure in the data calls for controlling team membership in the third-step regression model, in order to take into account possible cluster effects. I use both logit regression and fixed effects approach based on OLS to control for cluster effects, and I obtain nonsignificant regression coefficients with respect to all the entrepreneurship skills studied (social/networking skills included).

In conclusion, after controlling also team membership, the models do not support a stronger association between SBI programs (compared to PBI ones), and the acquisition of new entrepreneurship skills by the incubatees. Therefore, the second hypothesis is not supported at the third-step of the logit models.

*4.4. Co-production of business assistance in SBIs and PBIs.*

The aim of this section is to present the results for the third set of hypotheses, concerning the specific dynamics of co-production of business assistance that occur in SBIs and PBIs.

With respect to hypothesis H3a (*"within SBIs, mentoring and peer-community are more closely related to tenant firm performance/satisfaction than any other business assistance service provided by the incubator"*), Table 13 presents the estimated results of two logit regressions, having satisfaction score / perceived impact of incubation on firm performance as the outcome variables, and firm age, firm industry, and business assistance needed/expected/received as the explanatory variables.

Column (a) shows that student entrepreneurs who receive mentoring from the incubator (either individual mentoring by the incubator staff or peer-community mentoring/support) are more satisfied about the incubation program. This result is highly significant at the 1% level.

Neither professional services nor funding services present a significant association with satisfaction of SBIs tenants.

Column (b) shows that student entrepreneurs who receive mentoring, funding and, to a lesser extent, professional services from the incubator are more likely to perceive an impact of the incubation on their firm's performance. In other words, column (b) does not support a *prevailing* association between mentoring and perceived impact on firm performance (as the other services are also important under this regard). Therefore, I conclude that H1a is supported with respect to (a) satisfaction score, but not with respect to (b) perceived impact on performance (because funding-related services are also extremely relevant in this case).

Including also number of customers and amount of sales as outcome variables leads to nonsignificant regression estimates for all the controls related to business assistance modalities. This result is consistent with H1a findings: most SBIs are clustered in the lower categories for both number of customers and sales, while the distribution of satisfaction score and perceived impact on performance is more homogenous, ergo their association with business assistance modalities may be better appreciated in the regression models.

Table 13. Regression estimates of the correlation between business support services and satisfaction/perceived impact on performance *in SBIs only*

| **Control variables** | **(a) Outcome variable: Satisfaction** | **(b) Outcome variable: Impact on performance** |
|---|---|---|
| Mentoring (received) | 0.951*** | 0.893*** |
| | (0.287) | (0.286) |
| Professional services (received) | 0.342 | 0.478* |
| | (0.274) | (0.260) |
| Funding (received) | 0.510 | 1.047*** |
| | (0.317) | (0.317) |
| Mentoring (expected/needed) | -0.137 | -0.336 |
| | (0.223) | (0.264) |
| Professional services (expected/needed) | 0.025 | -0.237 |
| | (0.239) | (0.215) |
| Funding (expected/needed) | 0.019 | -0.521** |
| | (0.215) | (0.253) |
| Company age | 0.433 | 0.198 |
| | (0.381) | (0.385) |
| Company industry | -0.052 | 0.222 |
| | (0.141) | (0.143) |
| **Number of observations** | | 68 |

Note: the estimates in different columns come from separate regressions. Observations are clustered at the company level. */**/*** indicate significance at the 10%/5%/1% level. Robust standard errors in parentheses. Logit regressions having number of customers / amount of sales as outcome variables were performed as well, but they led to nonsignificant estimates for all the control variables related to business assistance.

With respect to H3b (*"Mentoring and peer-community are more closely related to tenant firm performance/satisfaction in SBIs than in PBIs"*), Table 15 presents the estimated results of the logit regressions, having satisfaction score / perceived impact of incubation on firm performance as the outcome variables.

Column (a) shows that the provision of mentoring by the incubator staff / peer-community is more closely related to satisfaction of the incubatee in SBIs than in PBIs. This result is significant at the 1% level. The model does not provide any evidence of a stronger association between satisfaction and provision professional services or funding in SBIs than in PBIs.

Column (b) shows that the provision of mentoring by the incubator staff / peer-community is more closely related to perceived impact on firm performance among SBIs tenants than among PBIs. The model does not provide any evidence of a stronger association between perceived impact on performance and provision of professional services or funding in SBIs than in PBIs.

In conclusion, H2b is fully supported with respect to both satisfaction score and perceived impact on performance. Including also number of customers and amount of sales as outcome variables leads to nonsignificant regression estimates for the explanatory variables related to business assistance and incubator type. This result is consistent with H1a findings: there is a polarization of SBIs (PBIs) in the lower (upper) categories of such performance metrics, while the distribution of satisfaction score and perceived impact on performance is more homogenous across the two categories of incubators, ergo its association with business assistance modalities may be better appreciated in the regression models.

Table 15. Regression estimates of the correlation between business assistance services and satisfaction/perceived impact on performance *in SBIs and PBIs*

| **Control variables** | **(a) Outcome variable: Satisfaction** | **(b) Outcome variable: Impact on performance** |
|---|---|---|
| Incubator type * Mentoring (received) | 1.544* | 2.560*** |
| | (0.936) | (0.947) |
| Incubator type * Professional services (received) | 0.118 | -0.639 |
| | (0.426) | (0.444) |
| Incubator type * Funding (received) | 0.139 | -0.272 |
| | (0.400) | (0.396) |
| Incubator type (SBI = 1; PBI =0) | 1.646** | 3.248*** |
| | (0.737) | (0.791) |
| Mentoring (received) | -0.349 | -1.452* |
| | (0.884) | (0.877) |
| Professional services (received) | 0.475 | 1.001*** |
| | (0.340) | (0.350) |
| Funding (received) | 0.684** | 1.125*** |
| | (0.319) | (0.322) |
| Mentoring (expected/needed) | -0.387 | -0.491** |
| | (0.257) | (0.245) |
| Professional services (expected/needed) | -0.299 | -0.572** |
| | (0.214) | (0.238) |
| Funding (expected/needed) | -0.461** | -0.850*** |
| | (0.234) | (0.265) |
| Company age | 0.346 | 0.396 |
| | (0.272) | (0.277) |
| Company industry | 0.110 | 0.189 |
| | (0.116) | (0.117) |
| Effort by entrepreneurial team | -0.028 | 0.441** |
| | (0.168) | (0.177) |
| **Number of observations** | | 138 |

Note: the estimates in different columns come from separate regressions. Observations are clustered at the company level. */**/*** indicate significance at the 10%/5%/1% level. Robust standard errors in parentheses. Logit regressions having number of customers / amount of sales as outcome variables were performed as well, but they led to nonsignificant estimates for all the control variables related to business assistance.

With respect to H3c ("*the effort put in the entrepreneurial project by the founding team is more closely related to firm performance in SBIs than in PBIs"*), Table 16 presents the estimated results of the logit regressions, having number of customers and amount of sales as outcome variables. Columns (a) and (b) support a comparatively stronger association between effort by the entrepreneurial team and firm performance in SBIs than in PBIs (this result is significant at the 5% level). Unsurprisingly, company age and company industry are also strongly associated to the of amount sales to biggest customer and the number customers of the

tenant firm (both these metrics are industry-specific and obviously correlated with the level of progression in the startup process). In conclusion, H2c is fully supported with respect to both (a) customers and (b) sales.

Table 16. Regression estimates of the correlation between time spent on project by the founding team and firm performance in SBIs and PBIs

| **Control variables** | **(a) Outcome variable: Nr of Customers** | **(b) Outcome variable: Sales** |
|---|---|---|
| Incubator type * Effort | 0.896** | 0.864** |
| | (0.375) | (0.407) |
| Incubator type (SBI = 1; PBI = 0) | -2.823** | -3.332** |
| | (1.282) | (1.332) |
| Effort | 0.045 | -0.046 |
| | (0.219) | (0.247) |
| Mentoring (received) | -0.007 | 0.262 |
| | (0.324) | (0.352) |
| Professional services (received) | 0.196 | 0.071 |
| | (0.216) | (0.224) |
| Funding (received) | 0.141 | 0.427 |
| | (0.271) | (0.304) |
| Mentoring (needed) | -0.280 | -0.424 |
| | (0.283) | (0.309) |
| Professional services (needed) | 0.218 | 0.021 |
| | (0.263) | (0.280) |
| Funding (needed) | 0.021 | -0.389 |
| | (0.284) | (0.315) |
| Company age | 1.236*** | 0.908*** |
| | (0.326) | (0.326) |
| Company industry | 0.340*** | 0.243* |
| | (0.129) | (0.140) |
| **Number of observations** | | 138 |

Note: the estimates in different columns come from separate regressions. Observations are clustered at the company level. */**/*** indicate significance at the 10%/5%/1% level. Robust standard errors in parentheses.

### *4.5. Semi-structured interviews with SBIs and PBIs directors.*

The interview questions were designed to help better explain the data findings. The key questions were: (a) what are the selection criteria/entry requirements (if any) of the incubator; (b) what frameworks does the incubator director/program manager use for mentoring; (c) how does the incubator measure success of its incubatees.

With respect to point (a), interesting differences were appreciated between each incubator.

In order to enter the incubation program, CSE incubatees have to fill a 25-question survey (regarding their idea, team, business model, customers, partners, and main challenges), which is repeatedly screened by the incubator staff. CSE is open to both student and nonstudent entrepreneurs, independently from their educational background or university. Innovation Hub, on the other hand, accepts only teams where there is at least one student from UCPH. The entry requirements and application processes at PBIs are less formal (there is usually a waiting list for startups that wish to enter the incubator, followed by eventual screening of their application).

With respect to point (b), PBIs directors (who are former managers, business consultants, marketing specialists) reported to rely more on tools derived from experience, rather than on theoretical frameworks for mentoring. The two SBIs directors (both teaching entrepreneurship courses at university) reported, on the other hand, to rely for mentoring/training activities on four main frameworks, including:

- Lean Startup (Ries 2011; Blank 2012);
- Business Model Canvas (Osterwalder et al. 2010);
- Effectual Entrepreneurship (Sarasvathy 2001; Read et al. 2011);
- Persuasion and Pitching (Maxwell et al. 2011; Pollack et al. 2012; Marom et al. 2013; Clark 2008; Chen et al. 2009; Navis et al. 2011).

With respect to point (c), the directors of CSE and Innovation Hub measure success not only in terms of jobs created, or economic/social results obtained by their tenant firms, but also (and particularly) in terms of learning outcome of the incubatees. On the other hand, PBIs directors measure success as: jobs created and funding received, one-year survival rate, and growth performance/scalability of their tenant companies. According to SBIs directors, the most successful incubatees in SBIs are incidentally those that spend more time working on the project. According to PBIs directors, the most successful incubatees in PBIs are those who are able to: (a) twist their company into the direction where consumers are and be agile with respect to customer needs; (b) attract and recruit technical talent.

### *4.6. Discussion of results.*

Results for hypothesis H1b show that a greater amount of mentoring, peer-community support, and advisory is provided in SBIs (matching the greater need of student entrepreneurs for such

services). The orientation of such mentoring, peer-community support, and advisory in SBIs is more educational, rather than commercial, according to the interviews with SBIs directors. Despite the provision of such extra inputs by SBIs programs, and despite their core educational orientation, the results of the models for H2 do not support a comparatively stronger association between SBIs (against PBIs) programs and the acquisition of new entrepreneurship skills by the incubatees. The higher average score on entrepreneurship skills in SBIs (4.36 out of 7 against 3.77 out of 7 in PBIs) may be explained by other factors – in particular the age of the incubatees. Indeed, age is negatively associated to the acquisition of new entrepreneurship skills in both SBIs and PBIs (H2). In other words, the older is the incubatee, the less likely he or she is to acquire new entrepreneurship skills. This result supports previous research by Oosterbeek et al. (2010) and Rosendahl Huber et al. (2012).

If SBIs tenants have not been found to be more likely than PBIs tenants to acquire new entrepreneurship skills, question remains whether SBIs programs are effective *per se* on entrepreneurship skills. The high average score on new entrepreneurship skills acquired in SBIs (4+ out of 7 for all skills except "understand financial statements" and "make the budget for a new project"), might suggest that SBIs programs are actually effective on entrepreneurship skills development, *even if we are at the post-secondary level*. In fact, I am very cautious in deriving this specific conclusion from my study.

I compared two groups of entrepreneurs, both enrolled (or formerly enrolled) in different incubation programs; I did not investigate the evolution of entrepreneurship skills before the start of the program and after its conclusion, nor I considered a control group of off-incubator students (entrepreneurs). Therefore, I feel confident only in stating that my data support a negative correlation between the age and the probability of incubator tenants to acquire new entrepreneurship skills, as well as no correlation between the specific characteristics of the incubation program (SBI or PBI program) and the probability of incubatees to acquire such skills.

Therefore, a central part of the mission, or raison d'etre, of SBIs lays in their greater attractiveness for young/student entrepreneurs. Where both SBIs and PBIs show selective entry criteria, SBIs are able to better match the specific needs and expectations of student entrepreneurs, providing them with more mentoring, advisory services, and peer-community support. The strength of the peer-community plays a crucial role in determining their greater appeal of SBIs on younger entrepreneurs. According to the qualitative open feedback collected

through the survey, several PBIs tenants think that their incubator could provide "more network groups", more "a sense of community", "more networking with external partners" and "events", because "it is just an office; no real social life; nobody comes to the building before 8 and it is empty at 4" and "the network between individuals and startups is maintained by a small number of participants". On the other hand, only 2 SBIs incubatees out of 17 suggest that the incubator should provide more networking opportunities, while the other ones are fully satisfied about the social life inside the incubator.

Such strong peer-community, combined with on-campus location, produces a "legitimation" effect across the university network, stimulating students to consider entrepreneurship as an alternative career opportunity. In this sense, the key role of SBIs is that of acting as catalysts for youth entrepreneurship, and triggering the inner entrepreneurial side that students may be unaware to possess. The words of Sarah-Josephine Hjorth, co-founder of CanopyLab (a match-making platform for NGOs and activists), who recently graduated from CSE's Go Grow program, are extremely interesting under this perspective. Indeed, Sarah thinks that she "was born to be an entrepreneur but, [before entering the incubator, she] didn't know that, like most of [the other participants to the Go Grow program]…".

Mentoring and peer-community have a crucial effect on shaping career aspirations and entrepreneurial awareness, resulting in increased levels of satisfaction, and perceived impact of incubation on: firm performance (H3a) and individual employability (Table 17). In fact, the results for hypotheses H3a and H3b suggest that mentoring and peer-community are the most relevant "regular producer" inputs in SBIs, and also that they are comparatively more relevant inputs in SBIs than in PBIs. In other words, the output elasticity *d* of mentoring and peer-community is higher than the elasticity of any other business assistance service in SBIs, and also it is higher in SBIs than in PBIs.

$$Q = c \times RP^{d} \times CP^{e};$$

The effects of mentoring and peer effects in the process of co-production of business assistance that takes place in SBIs support prior research by Nanda and Sorensen (2010), Kram and Isabella (1985), and Higgins and Kram (2001).

The results for hypothesis H3c suggest that the amount of time spent by the founding team working on the startup project is more closely related to firm performance in

SBIs than in PBIs. In other words, the output elasticity *e* of this "consumer producer" input by tenant firms is greater in SBIs than in PBIs. I conclude that the entrepreneurial performance curve of BIs tenants is S-shaped, with decreasing returns to cumulated effort on the entrepreneurial project. Time is one of the scarcest resources in SBIs (almost one student entrepreneur out of two is working less than 20 hours a week on the project), while most of PBIs incubatees are working full-time on their project. On the one hand, SBIs tenants are more likely to be positioned on the steep side of the curve, enjoying a higher marginal increase on firm performance in response to an increase in the entrepreneurial effort on the project. On the other hand, PBIs tenants are more likely to be positioned on the plateau, with lower marginal returns in performance to entrepreneurial effort.

Basing on this findings, I provide best practices and managerial "tips" for the SBI director, who aims at maximizing tenant firms' performance. Previous research like Gibson and Wiggins (2003) suggests that BIs managers must focus on five dimensions in order to succeed: (1) establish clear metrics for measuring success, (2) provide entrepreneurial leadership, (3) develop and deliver effective support services to tenant firms, (4) develop rational selection criteria, and (5) ensure that tenant firms have access to the necessary human and financial resources. I focus here on points (3), (4), and (5).

In order to maximize the aggregate output of tenant firms, SBIs should focus on the business assistance modalities with the highest output elasticity (mentoring and peer-community, or "passive environmental intervention"), and provide more of them to the tenants that present the highest potential output elasticity (those spending more time working on the project). I summarize these findings in the matrix below – which is consistent with the matrix of tenant types by Rice & Matthews (1995) and Rice (2002).

Figure 8. Business assistance optimization in SBIs according to maturity and effort of tenant firms.

| | | MATURITY | |
|---|---|---|---|
| | | H | L |
| EFFORT | H | **REACTIVE** ***EPISODIC*** | **PROACTIVE** ***CONTINUAL*** |
| | L | **REACTIVE** ***EPISODIC*** | **PROACTIVE** ***EPISODIC*** |

SBIs tenants are more likely to be positioned on the left side of the matrix (earlier-stage ventures). PBIs tenants are more likely to be positioned on the right side of the matrix (mature companies). The intensity of the entrepreneurial effort (amount of time spent working on the project by the founding team) is represented on the vertical axis, and increases with the output elasticity of the "consumer producer input".

According to the student entrepreneurs interviewed in the survey, SBIs should develop "a better process to match companies and mentors". SBIs mentors may increase the aggregate output of business assistance by selectively providing more supervision to the companies that commit to a greater entrepreneurial effort, providing, on the other hand, an episodic (rather than continual) supervision to the student entrepreneurs that work less than 15 hours per week on their project. As a matter of fact, some student entrepreneurs consider their startup more as a "hobby", and thus commit for a very limited amount of time to it (sometimes as little as 5 hours per week). The chances of project survival are small in this case, ergo an episodic style of mentoring is preferred. In this way, the SBIs staff can allocate more time to supervising the highest potential companies.

PBIs mentors should adopt a more reactive/episodic, rather than proactive, approach to mentoring. As a matter of fact, PBIs tenants are usually financially self-sustained and engaging in the most advanced stages of business development. Therefore, they are less in need for inputs from the incubator, which should be limited to address temporary crises on an episodic basis.

These findings are confirmed by the open feedback collected from SBIs tenants through the survey. Student entrepreneurs feel that their incubator could provide them with more mentoring, especially in the sales/digital marketing area, more investor pitch training, as well as regular workshops/events involving business angels and other investors. The lack of access to external investors through the incubator channels still reflects one of the greatest weaknesses of Copenhagen's SBIs: startup funding. Many incubatees (especially from SBIs) complain about the lack of support when it comes to find investors. At the university level, certain policies could be addressed to overcome the lack of funding provided to the startups co-founded by students. One proposed solution in the open feedback section of my survey is the promotion of "entrepreneurial scholarships" awarded to the most promising teams of student entrepreneurs in the incubator.

If the student enrollment status of SBIs tenants mitigates the risk of creating (direct)

unemployment, and, on the contrary, most student entrepreneurs even feel that the incubation has positively affected their employability (Table 17), student entrepreneurship may bear another kind of risk. If the proportion of school drop-outs in Danish SBIs is equal to zero, 42% of the considered SBIs tenants think that the incubation program has incentivized them to prolong their studies (Table 18). For HEIs, this is of course an "auto-goal". Student entrepreneurs have to attend classes, get grades, write a thesis, and, hopefully, graduate from university. Combining academic deadlines with business development deadlines may result into time management issues. A partial solution to this problem (now being implemented by Danish universities and SBIs) is to recognize curricular status to SBI enrollment, i.e. granting academic credits to the students sitting in the university's SBI. For example, CBS has started in 2016 to grant 7.5 ECTS to those students who work in a startup incubated by CSE.

Table 17. Characteristics of student incubatees: perceived impact of incubation on employability

| | **Average score** |
|---|---|
| Perceived impact of incubation on individual employability | 5.06 out of 7 |

Table 18. Characteristics of student incubatees: Grade Point Average (GPA) and perceived impact of incubation on study time

| | **No. of observations** | **%** |
|---|---|---|
| Students Grade Point Average (GPA) | | |
| Less than 4.0[a] | 0 | 0,00 |
| 4.0-6.9[b] | 12 | 18,60 |
| 7.0-9.9[c] | 45 | 67,44 |
| 10.0 or more[d] | 9 | 13,95 |
| Incubation increased study time | | |
| Yes | 28 | 42,42 |
| No | 38 | 57,58 |
| Total sample | 66 | 100,00 |

[a] Equivalent ECTS mark: E or F.
[b] Equivalent ECTS mark: D.
[c] Equivalent ECTS mark: C.
[d] Equivalent ECTS mark: A or B.

In conclusion, I argue that SBIs vs. PBIs should:

(a) aim at attracting high potential entrepreneurial talents (the younger the better), who ideally show inner entrepreneurial skills (as there is no evidence about the effectiveness of

post-secondary entrepreneurial education on fostering the acquisition *ex novo* of entrepreneurship skills);

(b) provide them with mentoring & training services, and build a strong community inside the incubator (because SBIs tenants can particularly benefit from such inputs);

(c) target the business assistance inputs to those teams who spend more time on the entrepreneurial project (but not too much! – student entrepreneurs should be prevented from over-prolonging their study time).

### *4.7. Limitations and avenues for future research.*

The main limitation of this study lies in the subjective evaluation provided by the entrepreneurs about the skills they think they have developed working in the incubator (even if a standard and well tested measuring tool – the ASTEE list of cognitive and non-cognitive skills – was employed). On the one hand, the methodology used – the administration of a questionnaire to the incubatees – has allowed statistical and econometric analysis on a dataset made of 226 complete and usable observations. On the other hand, other data collection methods, such as semi-structured interviews *à la* Eisenhardt (1994) and Yin (1994), may allow more in-depth understanding of the processes of entrepreneurial education carried out by SBIs, even if on a much smaller sample.

An additional limitation of this study is instant data collection. The questionnaire captured an instant picture of a dynamic process of business assistance. Therefore, it was only possible to compare between entrepreneurs enrolled on different incubation programs, with different missions and characteristics, and not to evaluate the whole effect of student incubation, measuring entrepreneurship skills before and after the "treatment". Future research could try to capture the dynamics of student incubation over a prolonged period (e.g. the length of the incubation program) and measure learning outcome at the moment of graduation, using matching techniques to assess the impact of the program ex post.

In broader terms, SBIs are an emerging phenomenon that could be investigated under multiple perspectives: at the student entrepreneur level, trying to understand the individual dynamics related to entrepreneurial skills and intentions development; at the tenant firm level, trying to understand the role of SBIs as resource and legitimation networks, and their impact on firm survival; at the incubator/university level, trying to understand the process of institutionalization of SBIs in HEIs.

# CONCLUSIONS

My research has focused on the characteristics of student incubators (SBIs), their role in fostering youth entrepreneurship and providing student entrepreneurs with new entrepreneurship skills. In the lack of previous literature about student incubators, I developed three set of hypotheses by analogy with prior research on entrepreneurship education programs, mentoring, peer effects, and co-production of business assistance in BIs.

First, I formulated the hypothesis that systematic differences exist between student and professional incubators with respect to both the individual characteristics of incubatees and tenant firms, and the range of business assistance services needed/expected/received by the incubatees. In particular, I formulated the hypothesis that student incubators act as catalysts for youth entrepreneurship, and provide more mentoring services and peer-community support, while professional incubators attract more senior experienced entrepreneurs.

Second, I formulated the hypothesis that SBIs tenants, thanks to a strong educational, rather than commercial, orientation of student incubators, are more likely than PBIs tenants to develop new entrepreneurship skills during incubation.

Finally, I investigated the dynamics of the business assistance process in student incubators, in search for managerial "tips" and best practices to provide to the incubator director. In particular, I formulated the hypothesis that mentoring and peer-community support are the key services for SBIs tenants.

I surveyed 5 business incubators (2 SBIs and 3 PBIs) based in Copenhagen. I used a questionnaire to reach a total of 1,195 entrepreneurs over a period of five months, from which I collected 226 complete and usable surveys. I also engaged in five semi-structured interviews with the managers of the considered incubators, in order to get richer insights in the phenomenon. In order to analyze the data and investigate the research questions, I used both statistical and econometric tools – Chi-squared tests, factor analyses, logit regressions and clustering models.

With respect to the distinctive business assistance modalities of student incubators, I found that SBIs tenants need, expect, and then receive, more mentoring, advisory services, and peer-community support than PBIs tenants. This is a first original contribution to the literature about student incubators (which is still in its infancy).

Despite the greater amount of mentoring and entrepreneurial training provided to student

entrepreneurs, I did not find evidence that SBIs tenants are more likely than PBIs tenants to acquire new entrepreneurship skills. I found, instead, that the age of the incubatees is negatively correlated to entrepreneurship skills acquired during incubation. This result supports previous findings about EET programs, extending their relevance also to incubation programs.

With respect to the third set of hypotheses (dynamics of business assistance in SBIs against PBIs), I found that the performance of SBIs tenant firms is more closely related than the performance of PBIs tenant firms to the "regular producer" (mentoring, peer-community support) and "consumer producer" (entrepreneurial effort by the incubatee) inputs in the co-production business assistance. In other words, I found that SBIs tenants are more dependent than PBIs tenants on the business assistance relation that they engage with the incubator. I used these results to draw a model for the optimization of business assistance inputs by student incubators' mentors. I concluded by highlighting some avenues about future research on student incubation – a relatively new phenomenon that needs to be further investigated.

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