



Incubation of technology-based student ventures: The importance of networking and team recruitment

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ABSTRACT

Student entrepreneurship is an important but not well-studied field of research. Student venturing activity is characterized by the lack of experience and expertise among founders, which is a critical barrier in technology-based venturing. Through an in-depth qualitative study of a student venture incubation initiative, the present paper finds that to support student ventures in overcoming this barrier, the recruitment of skilled students with sufficient technical knowledge is the most essential. Several different actors are involved in the process, and the support for student ventures tends to be informal and need-driven rather than structured, formal, and university-prescribed. The multiple actors, both internal and external to the university, are complementary for student venture incubation. This perspective indicates the need for university managers and policy makers to support several multiple actors. Value creation from student entrepreneurship could further be boosted by improved team recruitment activities such as matchmaking events and other networking activities at the university.

1. Introduction

It is widely acknowledged that ‘*science advances and new technology are transformative engines for profound economic change in society*’ [1], and technology transfer describes the process of moving ideas from a laboratory into the marketplace [2]. For technology transfer to succeed, the technology should not only be transferred but also become widely accumulated in society [3]. Hence, technical universities are seeking to improve their technology transfer mechanisms for promoting entrepreneurial activity and venture creation. Mechanisms applied by universities include incubators [4], technology parks [5] as well as providing office space and mentoring to promote development of new ventures based on university technology. Previous research has shown that existing mechanisms are not always sufficiently effective [6], and technical universities thus need to improve their mechanisms for technology utilization and value creation in a broader sense [7]. Jacobsson et al. [8] argue against only counting patents and spin-offs as results of technology transfer, and the present paper builds on the argument that developing support mechanisms for technology-based student ventures is a potentially fruitful avenue for universities to pursue.

Student ventures have been increasingly viewed as important contributors to university entrepreneurship [9–11], and even outnumber

the firms established by university employees at some universities [12]. Student entrepreneurship and student ventures have so far received little scholarly attention [13–15], and student entrepreneurship does differ significantly from the majority of university-based entrepreneurship in some important respects. For example do students not hold the technology expertise that university researchers do, even though students will have a certain level of technical knowledge through their technical education. For instance have engineering students a starting point to engage in technology development and applications. Prospective student entrepreneurs further lack the commercial and entrepreneurial experience held by technology transfer offices (TTOs) or experienced surrogate entrepreneurs [16]. Creating technology-based student ventures is therefore a process that involves developing both technology expertise and entrepreneurial experience simultaneously, which means a rather steep learning curve for the students. Existing support mechanisms for student entrepreneurship do therefore focus heavily on entrepreneurship training through both curricular and extracurricular means, and entrepreneurship education has thus gained interest and popularity within engineering education [17]. Although student entrepreneurs do get some experience through education and training initiatives, the present paper asks how mechanisms at universities could actually support technology-based student ventures beyond

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education and training, leading to the following research question: *Which university incubation activities enable students to contribute to university entrepreneurship through technology-based student ventures?*

This study suggests that support for technology-based student ventures should be informal and need-driven rather than structured, formal, and university-prescribed. Through an in-depth qualitative study, the provision of networking support was found to be the most frequently applied type of support activity for student entrepreneurs to overcome difficult barriers. A novel finding is how team recruitment enabled student ventures to circumvent critical technical challenges. Multiple university-based as well as external actors are essential to the effectiveness of the incubation process. The present paper addressed the suggestions made in recent research that more research should be conducted regarding the design of and support provided in student entrepreneurship ecosystems [11], as well as how university value creation can be considered in a broader sense [7].

The paper is structured as follows: The next section has two parts. First, a review of previous research on university support for student ventures is provided. Section three explains the methods used in this longitudinal dyad-based case study of a student venture incubation initiative at a major Scandinavian university. The in-depth interviews provide both managers' and entrepreneurs' perspectives on the student venture incubation process. The subsequent sections present and discuss the findings and offer conclusions.

2. Literature background

Support for ventures developed by university students is a growing phenomenon in both research and practice [18,19]. Wright et al. [11] developed a framework for mapping university-based initiatives for supporting student ventures. They distinguished between pre-incubation and incubation activities, but the boundaries between entrepreneurship education, extracurricular entrepreneurship initiatives, and other types of activities targeted to students are not entirely clear [9]. Hence, incubation of student ventures could be considered an activity that possibly involve entrepreneurship education programs and/or extracurricular initiatives, in addition to provision of funding, shared office space, or other resources that are traditionally regarded as incubation activities. The purpose of this section is to provide an overview of how the specific context of technology-based student venture support could be considered from two main perspectives found in the literature.

2.1. Education and training perspective: Educating students through student ventures

The literature focusing on students involved in entrepreneurial activities at universities is primarily found in the field of entrepreneurship education [13]. Entrepreneurship education does not fit under a single umbrella, and there are significant differences in entrepreneurship courses and programs offered around the world. While some facilitate the students' development of their own ventures at the *present stage* [20, 21], others provide the students with the requisite knowledge and skills for *future* entrepreneurial endeavors [22–24], and yet others facilitate student engagement, through internships and mentorships, in new ventures that are owned and managed by *external* entrepreneurs [25–27]. In the remainder of this section, the focus is held on programs where students create ventures while they are still students in the program, although programs that facilitate students future (post-graduation) entrepreneurship or contribution to entrepreneurial ventures external to the university could also be argued to be important and fruitful methods of university-driven entrepreneurship and even technology transfer.

The entrepreneurship education programs in which students create their own ventures are commonly referred to as "action-based" entrepreneurship education [28]. Although entrepreneurship education and

new venture support at universities have often been considered individually as separate types of initiatives [9], action-based programs have integrated several ways of facilitating student entrepreneurship [29]. A technology-oriented action-based entrepreneurship education program can be found at the Chalmers University School of Entrepreneurship. The full-time master's program in entrepreneurship also serves as an incubator to facilitate the students' launch of new ventures that are based on the technology provided by the university commercialization office [29,30]. Entrepreneurship education has therefore become increasingly popular in technology-focused education such as engineering education [17] and now involve several different designs and methods to achieve problem-based learning and real-life projects in education [31–33].

Although credit-granting entrepreneurship education courses and programs have been the focus of studies on student entrepreneurship, so-called extracurricular initiatives have been receiving increased attention [34]. Extracurricular initiatives are often similar to entrepreneurship education courses and programs; however, the main difference is that they are voluntary and usually student-led [35,36]. The extracurricular initiatives discussed in scholarly studies does, as with credit-granting entrepreneurship education, cover a broad range of objectives, resources, and actors.

While entrepreneurship education and extracurricular initiatives, and in particular those who fit in the action-based category, do contain incubation activities that support student venture creation, the ventures are mainly a 'learning vehicle' in this vein. Hence, the main support is given to the individual rather than the venture as such. While the primary focus in studies on student entrepreneurship has been given to education, the next sub-section introduces previous research that regard the provision of resources to student ventures.

2.2. Academic entrepreneurship perspective: Resource provision to student ventures

University-based ventures are often characterized as developed at the interface and collaboration between technology expertise (the researchers) and entrepreneurial experience (the business developers employed at the TTO, or surrogate entrepreneurs recruited by the TTO) [16], and commonly referred to as academic entrepreneurship [37]. Hence, the starting point of academic entrepreneurship is that the technology expertise is already in place, but resources and entrepreneurial skills need to be added through the incubation process in order to develop the technology into a viable commercial opportunity. In order to do that, important interrelationships are established between the incubator management, new ventures, alumni ventures, and universities [38], enabling actors involved in academic ventures to increase their market, financial, and also technological knowledge [39]. Additional potential supporters of academic entrepreneurship are the many actors that could exist within an "entrepreneurial ecosystem" at and around the university) [40–42]. Thus, incubation of university-based ventures could be considered a multifaceted, complex, and context-dependent phenomenon [43], where individuals or organizations contribute with complementary resources to the incubation process [44].

There are indeed studies of support initiatives providing resources for both launch and growth of student ventures, i.e., supporting pre-incubation and incubation activities [11]. Such initiatives do in many ways resemble the support available for academic entrepreneurship. Resources provided include financial support, peer or expert advice and coaching, inspirational and motivational presentations, and competitive environments, e.g., pitching competitions, that challenge the students [45–49]. Support initiatives are often not independent operators and can be elements in university entrepreneurship centers and science parks [50], including for instance teaching, labs, garages, and co-working spaces. Hence, universities may offer students pre-incubation activities, incubation activities, or both [11].

Previous research of support mechanisms for student ventures have presented a broad range of resources that are provided. Guerrero et al. [18] found that informal support, such as role models, had a greater influence than formal support, such as resources or education programs, on student entrepreneurship. Jansen et al. [51] conducted a multiple-case study of student entrepreneurship support at three universities. They found that a broad range of services was offered by enthusiastic and skilled individuals (e.g., professors), academic departments (e.g., education programs), and university-based organizations (e.g., the technology transfer office). In a study of 20 universities in the United Kingdom, Preedy and Jones [35] found that the student ventures were supported through networking events, grants, competitions, space, and other resources that could be offered by several actors connected to the same university. In the action-based entrepreneurship education program at the Chalmers University of Technology [30], an “entrepreneurial community” of coaches, consultants, advisors, and alumni provided support for student entrepreneurship. According to Sjölundh and Wahlbin [52], although the support system for student ventures at Jönköping University was organized around a science park, one of its important characteristics was the business coaches’ ability to connect the university offerings and the student entrepreneurial community to provide an open and simple model for student venture incubation.

In some respects, previous studies of support mechanisms for student ventures seem to assume that the student ventures have the same needs as academic ventures. Thereby, many of the resources provided may be recognized from previous incubator studies [53,54]. However, student ventures are different from TTO-supported ventures is that student ventures hold neither entrepreneurial experience nor technology expertise. A unique characteristic of technology-based student ventures that distinguishes them from TTO-supported ventures may therefore be that initially both technology expertise and entrepreneurial experience are lacking. Previous literature has not sufficiently taken into account that technology-based student ventures may need support that is different from the support provided to academic ventures in general.

3. Methodology

3.1. Research design and case selection

A case study was deemed to be appropriate for conducting an in-depth investigation of how technology-based student ventures are supported [55,56]. The present study built upon the rich empirical data from a student venture incubation initiative at a major Scandinavian technology-oriented university, and the country context is therefore similar to that in Good et al. [57]. A single case with five embedded sub-cases was studied over a one-year period to complement the previous conceptual, quantitative, and qualitative multiple-case studies in the field.

The student venture incubation initiative was selected for the following three reasons: First, the initiative exists at a technical university and its main audience are engineering students in diverse fields such as biotechnology, computer science, advanced physics and mechanical engineering. Second, the initiative included a majority of the actors that were known to support student ventures as introduced in Section 2. This included an entrepreneurship education program, two extracurricular entrepreneurship initiatives, and the incubation activities at the university. An overview of the specific actors is presented in Sub-section 3.2. Third, the authors were given access to the intranet system of the student venture incubation initiative, on which the internal reports and statistics were stored. Most important, the intranet contained undisclosed information about all of the student ventures that had received support since the inception of the initiative, which facilitated the creation of a thorough process for selecting the embedded sub-cases. Hence, the intranet was a source of secondary data used throughout the study.

The embedded sub-cases were five technology-based student ventures that had received support from the student venture incubation initiative. They were selected on the basis of two criteria. First, at the beginning of the longitudinal study, the student ventures had to have already received at least 6 months of support from the initiative, and they needed to have made significant progress during this period. This ensured that the student entrepreneurs were serious about their efforts and that the first round of interviews could cover the history of the support activities. Second, the student ventures had to have faced a number of explicit challenges during the early phase which they also had communicated to their student coaches. Each had experienced technical, marketing and/or commercialization, and recruitment challenges. This criterion increased the likelihood of identifying student ventures’ who had leveraged the resources from diverse actors in the ecosystem. The longitudinal design provided greater insights because it allowed for the observation of a greater variety of support activities as the five student ventures developed over time. The student entrepreneurs who managed the student ventures and the student coaches who facilitated the support activities were interviewed to facilitate the integration of both the ventures/entrepreneurs’ and supporters’ perspectives on the technology-based student venture incubation processes.

3.2. Introduction to the case and the embedded sub-cases

The student venture incubation initiative, a commercialization initiative for student ventures at the university, was established in 2014 because of the students’ increasing interest in entrepreneurship. While the employees at the university are obligated to go through the university-owned TTO, students are not. Therefore, the initiative works in parallel with the TTO since the primary focus of the TTO is commercialization projects of researchers and other employees. After five years of operation, the student venture incubation initiative had provided support for more than 300 new venture teams with more than 1000 student entrepreneurs. At the time of this study, approximately 70 student venture teams were being coached by 15 student coaches with entrepreneurial experience gained from the university’s entrepreneurship education program. More than 20 limited companies had been established on the basis of ideas generated by the initiative. Hence, the initiative has proven to be an important contribution to the entrepreneurial activity of the university.

The student venture incubation initiative was organized around the provision of free coaching and support in the venture creation process. Any university student with a business idea was eligible to receive support. The only criterion for becoming part of the incubator is that the student venture team have at least one university student onboard. Although ideas with business goals and/or potential were emphasized, any idea or project was welcome. There are primarily technology-based student ventures in the initiative due to the fact that the university is a technical university. In addition to coaching, the hosting of networking events was one of the student venture incubation initiative’s recurring activities. However, networking events and other similar activities were also the focus of the other actors in the university entrepreneurship ecosystem. Although the initiative had received funding from the university and a major regional energy company, it was managed by students. It was also non-equity-based and there was no direct financial interest from any of the involved actors. Beyond the coaching and some event hosting, the incubation was a collaborative effort of several ecosystem actors.

The procedures for participation in the student venture incubation initiative were as follows: The students submitted their ideas via a simple form on a website. A coordinator, who was an appointed student, received the information and forwarded it to a student coach who was available to provide relevant support for the new student venture. The student coach followed the incubation process; thus, the first meeting with the student entrepreneur or venture team was scheduled. Generally, the student entrepreneurs had had little or no entrepreneurship

Table 1
Overview of actors in the student venture incubation initiative.

Actor & Description	Owner/ Employer	Number of individuals
Student ventures. Each student venture has approximately 2–3 student entrepreneurs.	Students	70 (ventures)
Student coaches and the organization of the student venture incubation initiative, which provides support and organizes the support provided by the actors on the remaining rows of this table.	Students	15 (coaches) +10 (leaders)
Action-based entrepreneurship education program. A two-year full-time M.Sc. entrepreneurship program in which the students create their own ventures as a learning vehicle. See Ollila and Williams-Middleton [30] and Lackeus and Williams Middleton [29].	University	70 (students) +5 (faculty)
Large student organization. Operates at a national level and hosts big (>500 attendees) events to promote innovation and entrepreneurship to students.	Students	Approx. 100 (students)
The largest energy company in the region. Provides funding and specific energy industry expertise for the student venture incubation initiative.	Private	2–5 (employees)
University central administration. Provides the organizational framework for employing student coaches and managing the seed-stage grants provided to the student ventures.	University	2–5 (employees)
University faculty. Technology specialists.	University	Approx.10 (professors)
External experts. Includes lawyers and accountants.	Private	15–20 (individuals)

experience prior to contacting the student venture incubation initiative. The student coaches met bi-weekly to discuss the challenges faced by the ventures that they were coaching. Some of the reasons for the student ventures’ premature exits from the initiative were low perceived market potential, technical infeasibility, and a lack of motivation. Other student ventures were able to employ the student entrepreneurs after their graduation from the university.

The actors in the student venture incubation initiative are presented based on the descriptions provided in the secondary data and the longitudinal study. An overview is provided in Table 1. In accordance with Good et al. [57], the table includes information about the owners of the actors and the approximate number of individuals from each actor or group of actors that were involved in the student venture incubation initiative. The student coaches in the student venture incubation initiative often organized the support provided by the other seven actors. It must be noted that the university TTO was not an actor. The initiative operated parallel to the TTO because the students’ intellectual property was not owned by the university.

The technology-based student ventures that were selected for the embedded sub-cases were developing and providing software services to connect users through digital platforms. The software-based student ventures, which typically followed a rapid development process, often used the initiative’s many resources and participated in its activities during the data collection period for the present study. Hence, they were deemed very appropriate for the present study. An overview of the student ventures is provided in Table 2. The names of the new ventures have been anonymized. Upon selection of the five ventures, the study recruited the student coach participants.

3.3. Longitudinal data collection and analysis

The student venture incubation initiative’s intranet was used for accessing the key performance reports and documents that mapped the involvement of the actors that provided support. For example, one of the documents outlined the actors’ structuring of the relationships among the initiative, the TTO, and the seed-funding regimes. The intranet data provided a solid basis for background information and an overview of the student venture incubation initiative, as summarized in Section 3.2. Also, the information available through the intranet provided secondary data, allowing for triangulation of research findings to increase the robustness of the study [58].

As was previously mentioned, the present study integrated managers’ and entrepreneurs’ perspectives. Three rounds of semi-structured interviews were conducted with five student coach–student entrepreneur dyads over a one-year period. Thus, the main unit of analysis was the dyads, which, together with the intranet data, provided an understanding of the student venture incubation initiative. Because two of the student coaches were each in charge of two of the student ventures, the

total number of interviews was 24: 5 student entrepreneurs at 3 timepoints and 3 student coaches at 3 timepoints. The interview guide addressed the incubation process by including questions about the process up to that point (e.g., resource access, challenges, and communication and collaboration with the actors in the university entrepreneurship ecosystem) and the development status of each new venture. Two versions of the interview guide, one for the student coaches and another for the student entrepreneurs, were used to address the perspectives of each group of interviewees on the same topics. Each interview was recorded and transcribed, and notes were taken by one of the authors in real time.

Previous studies, as presented in Section 2, guided the development of the coding scheme for the interview data. From there, the coding categories were inductively developed throughout the course of the study. The interview data were used for improving the coding categories abductively. The first-order categories comprised the activities and resources that the student entrepreneurs received, developed, or participated in. Many categories emerged because they represented how and by whom the resource had been provided. The second-order coding connected the first-order coding to the categories for the incubation mechanisms offered by the actors. The transcribed interview data were coded using the NVivo 11 software. Throughout the coding process, triangulation with the secondary data from the intranet was done by analyzing the interview data in relation to the notes which coaches had made about the five technology-based student ventures during their time in the initiative. The coding and analysis were performed by each of the authors, and disagreements were discussed to ensure the rigor of the study.

4. Findings

This section presents the findings of the analysis of the longitudinal data from the five student coach–student entrepreneur dyads, and is organized by three sub-sections representing the three major types of support activities found.

Table 2
Coaches and entrepreneurs who were interviewed.

Student Ventures/Student Entrepreneurs	Student Coaches
Student venture: “ SocialPlatform ” App matching students and work	Student Coach 1
Student venture: “ ChallengeFriends ” Social platform for sharing dilemmas	
Student venture: “ DrawingApp ” Social platform for drawing graphics on pictures	Student Coach 2
Student venture: “ MultiplayerGame ” Multi-player computer games	
Student venture: “ AnalysisExchange ” Two-sided online platform for stock market analyses	Student Coach 3

4.1. Guiding the entrepreneurial process

Coaching was the core of the support provided by the student venture incubation initiative. The student coaches were not experts, but as students in the action-based entrepreneurship education program, they had experienced the process of starting a new venture themselves. Coaches contributed to the student ventures by sharing their personal experiences from venturing and coaching other projects, as well as the knowledge and skills they had gained from their entrepreneurship education program. Coaching took place in meetings that were held at the university or online (e.g., social media and email) every 2–3 weeks. One student coach stated that the initial focus was to test the feasibility of creating a good product or service. If this was possible, the coach increased the focus on the business activities, including market research and targeting. Up to that point, commercialization might not have been the core focus of the new venture. The student entrepreneur in Social-Platform stated: *“In the beginning, we knew nothing ... and she [Student Coach 1] suggested we should do a market survey.”*

The student venture incubation initiative also facilitated how student entrepreneurs could learn from the process of other student ventures in the initiative. Again, coaching was a central activity to make this happen. Through biweekly meetings, coaches updated their knowledge of the various ventures in the initiative, and coaches connected student ventures with other student ventures which targeted similar markets or experienced similar challenges. The coaches highly encouraged the student entrepreneurs to connect with other student entrepreneurs or incubation actors, as exemplified by Student Coach 1: *“And I informed [her] about the event and suggested she should pitch there. It worked out really well!”* The events organized by the student incubator also served as opportunities for the new ventures to receive feedback from potential users and customers. Interestingly, because the coaches were also students in an action-based entrepreneurship education program (see Table 1 in Section 3.2), they further engaged in connecting student ventures in the initiative with the student ventures in the action-based entrepreneurship education program. Hence, the student entrepreneurs often learned from the marketing approaches of many other university ventures.

4.2. Providing financial resources

The data indicate that the hub or core of the student venture incubation initiative was the coaches, who ensured that the actors' support could provide value to the student ventures. An important way of direct resource provision was the up to €2500 in seed funding for non-marketing activities. As was previously mentioned, this originated from the yearly financing from the regional energy company. The day-to-day grant process was managed by the students in the initiative and supported by the infrastructure already used by the finance division and the management group of the university's vice rector for innovation. Although €2500 in soft funding is a small amount of money, it was nevertheless crucial for the student teams that wished to invest in a new venture but had few or no personal financial resources. The financial support was used mainly for the physical assets that were necessary for product, service, or technology development such as software licenses or access to digital platforms such as App Store or Google Play. The coaches offered the teams guidance on what they should apply for and how they should apply. The manager of AnalysisExchange explained: *“He [Student Coach 3] provided suggestions about how the process should be ... He also looked through our [soft-funding] application.”* The role of the student coaches was thus to advise the ventures about the appropriate tools and solutions and the relevant events. The student coaches knew the procedures for obtaining seed funding grants; thus, they could guide the student entrepreneurs through the application process for the grants or any of the national soft-funding opportunities. The other soft-funding opportunities were €10,000–€100,000 per student venture and therefore relevant for the later stages in the development of the ventures. In

contrast to most traditional incubators, did the student venture incubation initiative not provide office space for the student ventures. However, the coaching sessions and the events organized by the initiative were held in the space in which the action-based entrepreneurship education program was housed.

4.3. Networking support for student entrepreneurs

Networking was the most prominent type of support and was centered largely around the facilitation of the acquisition of human resources. The student entrepreneur in DrawingApp explained how the venture found its designer: *“We got our designer at a matchmaking event since our coach sent us a list of [the] attendees.”* The student entrepreneurs needed to recruit team members with the requisite competence. This was illustrated by the student entrepreneur in DrawingApp: *“The idea may be as good as it gets, but if nobody can do something about it, nothing will happen.”* As was asserted by the student entrepreneur in MultiplayerGame, it was also important that the team members have the mindset and motivation necessary for participation in the development of a student venture that could pay only a small salary or, in some cases, no salary: *“When we started receiving money and it starts being serious, we simply have to cut people. We cannot have anyone not taking this as seriously as the others.”* The student ventures also became increasingly capable of acting independently and accessing resources. For example, the student entrepreneur in AnalysisExchange described the hiring process for a programmer: *“I thought about learning programming ourselves, but found that it was a better option to find someone with the skills. In the end, we found someone through another new venture which was part of the action-based entrepreneurship education program.”*

The student coaches developed relationships with faculty who could serve as experts. Many of the university professors were aware of the student venture incubation initiative; thus, making the initial contacts easier. Student Coach 3 usually mediated the contacts between the student entrepreneurs and professors in the following way: *“If they [the new venture], for example, needed information about a specific topic, I found an expert on that topic at the university and suggested they should talk to him or her ... Sometimes I called the professor first and asked if it was okay to put them in contact, and sometimes, I just gave his contact information to the new venture.”* Networking was also used to support the student ventures through the provision of access to specialized knowledge, such as legal and regulatory advice, that was external to the university. The student entrepreneur in ChallengeFriends recalled an example of legal support that had been facilitated by the student coach: *“We got access to a written agreement that the coach used in his new venture and based ours on that.”* If a legal question was complex, the coach could refer the team to specialists or experts, and in many cases, the coach also made the initial contact between the team and the specialists or experts.

In addition to facilitating recruitment and access to university and external experts, the student coaches provided support to the ventures for which they were *not* responsible, and they shared their experiences. This often occurred at the networking events hosted by the student venture incubation initiative. When asked about skills acquisition, the new venture managers tended to credit the coaches and other venture managers as being sources of knowledge and inspiration. One such example was provided by the student entrepreneur in MultiplayerGame: *“They [the student entrepreneurs] provide a lot of feedback. If you talk about your idea, they will bring on new ideas on top of that.”* Thus, in addition to the coaching appointments, the actors' social interactions were important forms of support that was facilitated by the student venture incubation initiative. Many of these interactions happened in the action-based entrepreneurship education program. The student entrepreneur in AnalysisExchange stated: *“He [the coach] introduced us to his classmates [in the action-based entrepreneurship education program], so we got to know them.”* This informal social interaction further influenced the actors' other interactions. Student Coach 3 observed: *“... and you become friends ... and the communication becomes more informal from then on.”*

The new ventures also interacted on Facebook. The student entrepreneur in DrawingApp stated: *"I am part of the Facebook groups and get invitations for all sorts of events."* The student entrepreneurs gradually became more active in using, combining, and developing their networks and leverage from the social arena provided by the incubator.

5. Discussion

The analysis highlighted some interesting findings which extend upon existing studies of incubation and technology transfer at universities [4,5,7]. A notable finding was that networking support involved a majority of the actors in the student venture incubation initiative. Several challenges in the entrepreneurial process, including human resource needs, technical difficulties, and legal issues, was addressed through facilitating the contact between the technology-based student ventures and other actors at the university. Many challenges of the technology-based student ventures that were brought forward in the interviews were related to the development of technical solutions rather than just the entrepreneurial process, and whereas the student entrepreneurs initially aimed to resolve the technical challenges themselves, their coaches instead facilitated them in recruiting team members with the appropriate skills to eventually resolve the technical challenges. Therefore, a novel finding of the present paper is that technical challenges are translated into team recruitment challenges and resolved accordingly. The importance of bringing the right competence to the entrepreneurial team in student ventures is a topic that so far has been neglected in the literature. Through their networking and recruitment efforts, the technology-based student ventures could effectively circumvent the technical barriers and proceed with their commercialization process [1,6]. Hence, the present paper shows how team recruitment support can be a fruitful way of facilitating student entrepreneurship and ensure that students contribute to university entrepreneurial outputs [3].

A second notable finding was that only the seed funding and the student coach–student entrepreneur dyadic relationships were formalized activities. Most of the other relationships and interactions were informal, confirming the findings of previous studies of university entrepreneurship [18]. This contrasts the fact that support for academic entrepreneurship is often formal in nature [8]. The many interactions and interdependencies among the actors in facilitating the incubation of student ventures suggest that the processes integrated with and were interdependent upon each other [54].

Among the more traditional types of support found in the student venture incubation initiative was provision of seed funding and, to some degree, access to physical space. While the seed funding was found essential to be able to produce prototypes, access to physical space was not found to be as important as the team recruitment in the process of the technology-based entrepreneurial ventures. This is further reflected in the amounts granted, as it is not sufficient for continuous salaries. Rather, the student ventures were able to recruit team members which proved to be the essential resources for their venture creation efforts. This confirms the previous research that find physical space and direct provision of tangible resources to be less articulated as a type of support for student venture incubation than for business incubation in general [51].

The difference in the student coaches' and student entrepreneurs' knowledge was likely to be smaller than in most incubators. Nevertheless, the student coaches were sufficiently informed to be able to add value to the ventures. Importantly, their knowledge was sufficient for providing the networking support. Hence, at the core of the incubation process was a student community characterized by informal relationships and interactions. The important point made in the present paper is that such informal interactions must be deliberately facilitated and do not just occur due to co-location of the student ventures. Hence, the present paper contributes to the field by pinpointing the content of interactions as compared to how previous studies focused primarily on

how ecosystems to support entrepreneurs are managed at an overarching level [9,57]. The present study provides insights into student entrepreneurs' needs as the triggers for networking and interactions. Hence, the present paper contributes with insight into activities which can facilitate university-based value creation in a broader sense [7].

Last, the present paper also presents an example of leveraging an action-based entrepreneurship education program as one of several components in supporting technology-based student ventures at the university. The knowledge, skills, networks, and other complementary resources held by the entrepreneurship education program were made available because of the informal and integrative nature of the student venture incubation initiative.

6. Conclusions

The present paper built on the significance of and growing interest in student entrepreneurship: an important research area that has not yet received a great deal of attention [13,14,15]. While student venturing ecosystems have been previously explained [11] and applied in examinations of university entrepreneurship ecosystems [9,57], the literature has not taken into regard the specific context that technology-based student ventures represent. The present in-depth longitudinal case study of a student venture incubation initiative at a major Scandinavian university integrated several perspectives in order to address university incubation activities that enable students to contribute to university entrepreneurship through technology-based student ventures.

The findings of the present paper support previous studies regarding the participation of multiple actors in student venture incubation, which is in harmony with the student venturing ecosystem framework by Wright et al. [11]. The present paper extends the previous research by demonstrating that the support for student ventures could be informal and need-driven rather than formalized and prescribed. Hence, the present paper extends upon previous research on how technology-based student ventures can contribute to value creation from universities [7], and for technology to become accumulated in society [3]. Networking was found to be the most frequently used type of support. In the situations in which direct support, e.g., financing, could have been applied, networking was more efficient for providing the necessary resources. Boh et al. [15] advocated for a broader view of the role of the actors in an entrepreneurial ecosystem as facilitators of technology transfer. The present study has described the provision of new venture support to students outside the formal entrepreneurship education programs. The student venture incubation initiative worked in parallel with the university TTO. This confirms the findings of Good et al. [57] that the student-oriented components in university entrepreneurial ecosystems were often independent organizations representing an additional way of value creation from universities [7].

This study has implications for university entrepreneurship policies. First of all, there are many actors involved, implying that all of the involved actors, and not just a single actor, should be supported. Also, the present paper brings forward the importance of team recruitment for technology-based student ventures. Therefore, (technical) universities could focus more on facilitating the process of recruiting skilled students into technology-based student ventures. While there is a lot of education and training going on in the support initiatives, both within engineering and entrepreneurship, student entrepreneurship could be boosted by improved team recruitment activities such as matchmaking events and other networking activities. Networking is the most important type of support found in this study.

The findings suggest several avenues for future research. The present paper case study focused on one student venture incubation initiative and the study might have been influenced by contextual factors. Comparisons of similar initiatives in other geographical locations could provide valuable insights. The findings also indicate that the actors' social relationships were an essential component of the student-driven incubator, and an interesting area for further research would be the

investigation of the facilitating factors in the creation of such a community and the development of the internal informal interactions.

CRedit authorship contribution statement

Dag Håkon Haneberg: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Project administration. **Lise Aaboen:** Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Project administration.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.techsoc.2020.101402>.

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