Student Surrogate Entrepreneurs: can entrepreneurial education linked to research boost sustainable innovation?

Mats Lundqvist (mats.lundqvist@chalmers.se)
Karen Williams Middleton (karen.williams@chalmers.se)
Chalmers School of Entrepreneurship
Department of Technology Management and Economics
Chalmers University of Technology,
Gothenburg, Sweden

ABSTRACT

This paper investigates students being appointed as surrogate entrepreneurs for early-stage sustainable innovations under the format of an educational course. Entrepreneurship at universities used to be about professors producing inventions that were "taken care of" by technology transfer organizations. However, this approach is not realizing the full potential of a university. Today, therefore, entrepreneurship at universities is more focusing on students and alumni being the main vehicle for impact. While this shift of perspective is promising, this paper wishes to focus attention on students not just developing ideas of their own but actually being appointed to more research-based ideas, as a means of transcending the so-called 'Valley of Death'. Much sustainable innovation arguably gets stuck in this valley. Thus, arranging a course where students engage in early-stage idea development and evaluation makes sense as an approach to cross the valley. The paper examines an early-stage idea development and evaluation course started in 2008, and exemplifies some of the innovative outcomes. The main conclusion of the paper is that such an approach has multiple benefits (learning- and innovation-wise) with relatively limited extra expenses, risks or even opportunity costs. However, from a student perspective, there are concerns of such a course having both traditional and progressive teaching formats. Over the year, many students have expressed concern about one or the other format (either the course being too progressive, uncertain and real-life; or the course being too traditional, requiring readings and lectures). This divergence has made it difficult to obtain high course evaluation scores, even though, as illustrated through student deliverables and examination, new and important knowledge, skills and attitudes have been acquired. The policy implication of the paper is that universities concerned with sustainability should establish similar course models, where students more or less act and learn through being surrogate entrepreneurs for early-stage potentially sustainable innovations.

Keywords: student surrogate entrepreneur, sustainable innovation, knowledge, skills and attitude

INTRODUCTION

Decades of university technology transfer activities have illustrated that university-industry transactions are still mostly about the 'low hanging fruits' – the transfer of research results primarily based on their ability to easily fit into established industries and supply chains. This leaves a large but underdeveloped set of sustainable innovations trapped or stuck within university and in industry R&D departments – the oft called 'Valley of Death' (Auerswald and Branscomb, 2003). Why aren't more sustainable innovations realized? This paper investigates how students can take on entrepreneurial roles and add value to early stage innovation, within an educational course format. Key interests of the paper are to investigate the impact such courses can have, what learning is acquired by the students, and what opportunities and challenges that come when implementing such an approach.

The academic entrepreneur, capable of transforming from one role to the other (i.e. from academic to entrepreneur) is much asked for in innovation policy, but nonetheless remains a scarcity (Grimaldi et al., 2011). Faculty is trained to fulfill a specific professional role addressing primarily the delivery of research and education. Hence, there is both a need and space for new actors to take on entrepreneurial activity within the university, ensuring that key ideas and innovations reach society (Siegel and Wright, 2015). To date, these roles have primarily been appointed to external (to the university) actors such as serial entrepreneurs or industrialists. However, professionals in industry and experienced entrepreneurs rarely have the time and incentive to engage into new early stage technologies. Appointing students to help give birth to early-stage sustainable innovation, from this perspective, makes sense – enter the student surrogate entrepreneur.

Studies have shown that for surrogate entrepreneurs to be effective, they need to be engaged in the early formation of the venture, in the 'Valley of Death' that has to be crossed in order for innovations to reach society. Meyer et al. (2011) (see figure 1) illustrate that this valley is better represented by three gaps, each with their own requirements: scientific evaluation/development, business positioning including value proposition development, and launching involving networking, sales, etc.

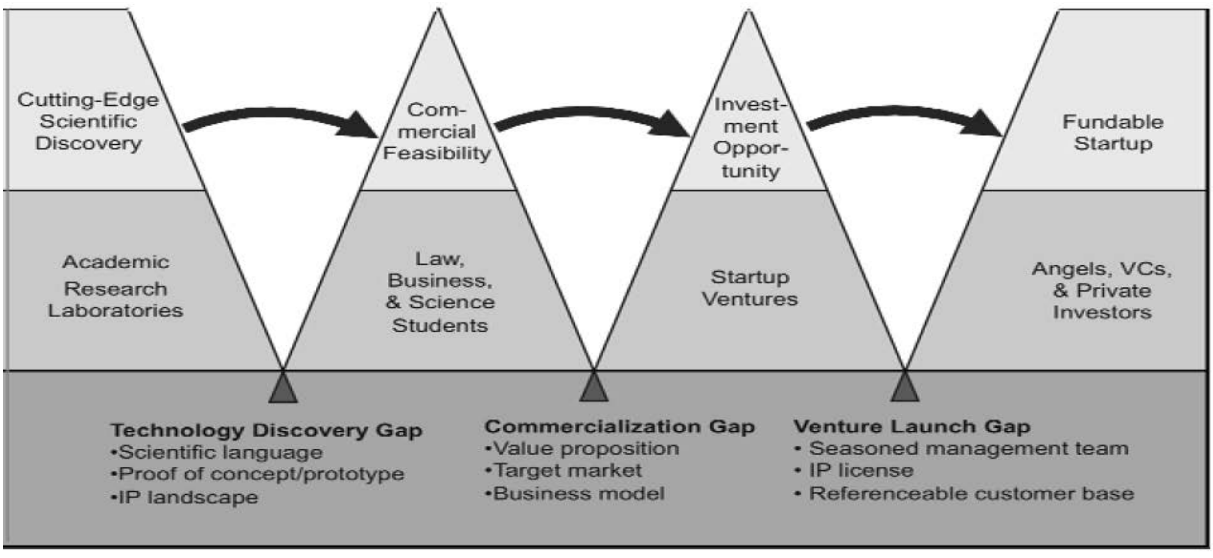

Figure 1. Gaps to transcend in 'the Valley of Death' to bring promising research results to society (Source: Meyer et al, 2011)

Siegel and Wright (2015) (see Table 1) argue that a shift in responsibility of technology transfer from the academic to students, alumni and/or surrogate entrepreneurs can facilitate a more seamless bridging of the three gaps outlined by Meyer et al. (2011). This paper investigates a course in which students are asked to take on the surrogate role of evaluating an early stage innovation, basically then being asked to transcend the first of the three gaps in Figure 1.

The emerging perspective of entrepreneurship at university indicated in Table 1 point at students, alumni and surrogate entrepreneurs playing key roles when universities contribute to sustainable economic, ecologic or social development. This paper not only focuses on students being positioned in the first gap – the technology discovery gap in Figure 1 – but also investigates this in terms of students then acting as surrogate entrepreneurs in the format of a project-based entrepreneurial course. Despite this being within the emerging perspective in Table 1, it is an unconventional approach. Literature has positioned surrogate entrepreneurs as persons with business experience, not students operating under an educational course format.

Theme	Traditional perspective	Emerging perspective
Why	To generate direct financial returns	To provide a wider social and economic benefit to the university ecosystem
What	Academic spin-offs; licensing; patents	Students and alumni start-ups; entrepreneurially equipped students; job creation in the local region or state
Who	Academic faculty and post-docs	Students; alumni; on-campus industry collaborations; surrogate entrepreneurs
How	Technology Transfer Offices; science parks	Accelerators; Entrepreneurship garages; student business plan competitions; collaborative networks with industry and alumni; employee mobility; public-private 'incubators'

Table 1. Traditional and emerging perspectives on how the university takes on entrepreneurial roles (Source: (Siegel and Wright, 2015))

The course under investigation in this paper is a 7,5 HEC, eight week long, elective course in Idea Evaluation which has been run January – March annually since 2008. Each year, approximately 50 students (mainly within the engineering disciplines) are placed in teams of four or five, and connected with early-stage technical ideas (most often presented in the form of potentially patentable invention disclosures). Under a secrecy agreement, the teams are asked to explore the viability of the idea in regards to three main areas: 1) functionality, novelty and freedom to operate; 2) potential future value in terms of societal-, user- and business utilities; and 3) next steps required to verify the idea. Tools, perspectives, counseling and feedback are offered through lectures, workshops and presentation events. Societal utility is emphasized as a key aspect to explore. Situations of use are sought after, from which the idea can make societal impact.

Students are examined through two main assessments: a seven-page idea evaluation report (a group deliverable) and associated oral presentation, and an individual exam testing knowledge and skill acquisition. Since the ideas connected to the student teams are often very different from one another, the teams have to figure out their own way to develop and evaluate the potential innovation, as there is no common standard. Hence, students are faced with the

entrepreneurial method of effectuation (Sarasvathy, 2008) where they embrace uncertainty through drawing from what they have at hand and can access (competencies, networks, relationship to idea provider, etc.) in order to create solutions, which in turn then can be re-examined to iterate even better solutions. The relatively short course format allows for an argumentative packaging of a case and limits the actual verification of any claimed functionality or utility. However, with the delivered idea evaluation as a base, the university technology transfer office and incubator, in dialogue with the idea providers, can often find ways to take the idea forward, including sometimes offering it back to students to continue as surrogate entrepreneurs through a specialized venture creation program (Lundqvist, 2015).

The purpose of this paper is to explore how entrepreneurial education can be linked to research to boost sustainable innovation – allowing students to become surrogate entrepreneurs in the 'Valley of Death'. The following main question will be investigated:

1. *How does the student surrogate entrepreneur doing early-stage innovation differ from other perceptions of students being entrepreneurial in terms of starting a company based upon an own idea?*

2. *How can student surrogate entrepreneurs make a difference for sustainable innovation?*

3. *What are key challenges in doing early stage entrepreneurial idea evaluation in an educational course format?*

The paper is structured as follows. First, literature on student entrepreneurship is examined to better understand and position the current focus on student surrogate entrepreneurs doing early-stage innovation. Secondly, one case from the Idea Evaluation course – Swedish Algae Factory – is offered to describe how students can make a difference for sustainable innovation during and beyond the setting of the course. Finally, drawing from course evaluations and other feedback, opportunities and challenges with the current course are discussed, specifically addressing issues such as what do the students learn, how deal with the variety of ideas, and how should teaching be adapted to fit the unconventional format.

STUDENT ENTREPRENEURSHIP AT UNIVERSITIES

Students taking on entrepreneurial roles while at university have become increasingly common (Kolvereid and Åmo, 2007). The evolution of entrepreneurship education (Finkle et al., 2006, Solomon, 2007) has led to the development of courses and programs which focus on engaging the student in entrepreneurial practice (Neck and Greene, 2011, Neck et al., 2014) or building upon students own independent entrepreneurial activity (extra-curricular) (Pittaway et al., 2015), when the intention is to develop entrepreneurial competency (prepare the individual for future entrepreneurial practice).

However, student entrepreneurship at universities is mostly framed as students developing a business around an idea of their own. Rarely are students seen as entrepreneurial resources capable of also developing ideas stemming from R&D. Even though student entrepreneurs are seen to be more open-minded towards finding alternative ways of securing resources than e.g. faculty and others (Politis et al., 2010) such a capability is not connected with research-based ideas.

But - what if students were asked to develop early-stage sustainable innovations? Newly graduated university students are seen as deficient in the resources, skills and experience required for growing new opportunities (Galloway and Brown, 2002). Connecting students to early-stage ideas could potentially train them deal with this and gain learning by doing (Cope and Watts, 2000) and take on the role of entrepreneur to provide experiential learning of the entrepreneurial process (Gondim and Mutti, 2011, Ramsgaard and Christensen, 2016, Rasmussen and Sørheim, 2006). This then, arguably, would require the student being given relatively free hands to explore any idea and take it to new unforeseen places.

Evidence of students being connected to unrealized ideas from public or private R&D is, however, very scarce. Even the most extreme forms of action-based venture creating entrepreneurship programs primarily rely on students as the idea generators for the future ventures (Lackéus and Williams Middleton, 2015, Lockyer and Adams, 2014). Only rare examples source early stage innovative ideas from the broad entrepreneurial ecosystem associated to the university (Lundqvist, 2015, Lundqvist and Williams Middleton, 2008, Moroz et al., 2007).

If the educational objective is to become entrepreneurial, research argues that critical components should be incorporated into the learning process, such as identity construction (Donnellon et al., 2014, Nielsen and Gartner, 2017), alertness, shrewdness and prudence in the context of action (Johannisson, 2016), and the creation of value as perceived by others (Lackéus, 2016). For entrepreneurial education to provide these competencies, students need to break out of the boundaries the classroom, and arguably outside the boundary of 'student'. The question is, can this be done if students are connected to the ideas of others, as much, or perhaps even more, than when asked to pursue ideas of their own?

SURROGATE ENTREPRENEURSHIP

The term surrogate entrepreneur was introduced specifically to the context of commercializing public research and was a reaction to the challenge of asking individuals established in one professional career, to take on a secondary career identity as entrepreneur. Surrogacy has both benefits and limitations (Franklin et al., 2001, Lundqvist, 2014, Radosevich, 1995). In order to be beneficial, surrogates should be seen as a complement rather than replacement to the inventors and technological experts. Timing is important – studies have shown that surrogates need to be engaged in the early formation of the venture if they are to have impact in the venture development.

Surrogacy draws attention to the importance of being relational and team-based. It emphasizes an intersubjective perspective on value creation from day one, and not only as something potentially important more downstream, once students have figured out some idea of their own. This might be an important distinction, since it emphasizes a professional quality (to serve others), differentiating quite a lot from the image of the "self-made" more or less "lone" entrepreneur – starting a business to become independent. Sustainable innovation, especially in early stages, could allow entrepreneurial skills and attitudes of a different kind to develop. Focus then would be more on how to co-create sustainable value with and for others, rather than on demarcating one's own more or less viable business opportunity. The latter might be relevant in later stages, but not necessarily a key issue for most students or promising early-stage innovations.

There is currently a shift of perspective around university entrepreneurship, from professors and established industry partners, to students, alumni and surrogate entrepreneurs to play key entrepreneurial roles (Siegel and Wright, 2015). The latter actors can be the key players at universities to allow the university to contribute to sustainable economic, ecological and social development. However, there is still little evidence around these actors and especially students taking on what used to be left to professors and R&D professionals, i.e. evaluate and propagating potential spillover R&D findings, lacking recipient but still having potential for more sustainable innovation. Before offering insights into the Idea Evaluation course at Chalmers School of Entrepreneurship, an example of how a student in the course became a surrogate entrepreneur is offered.

SWEDIGH ALGAE FACTORY

The start-up Swedish Algae Factory today enables an energy efficient algae biomass production in cold and dark climates. Swedish Algae Factory was incorporated 2015 and has since then been run by Sofie Allert as the lead entrepreneur. She was also in the team evaluating the idea disclosure in the 2013 iteration of the Idea Evaluation course.

Sofie came to the Idea Evaluation course with a background in biochemistry and having done her bachelor thesis in biofuels. When engaging into the Idea Evaluation course, she was doing her second semester in the two year MSc program at Chalmers School of Entrepreneurship, where this course has been mandatory. The idea (disclosure) provided was a research discovery of a professor at University of Gothenburg regarding a specialized algae with promising properties for application in e.g. biofuel, and able to thrive in harsh conditions of colder temperatures and limited sunlight. Algae production for multiple of sustainable uses could, through this discovery, potentially be brought to new contexts, outside the mainly sunny and warm sites commonly used.

Sofie and her team in the Idea Evaluation course were able to build a strong case around key issues such as patentability (including novelty and freedom to operate); situations of use with strong potential for societal, customer and business utility; and point a critical next steps for the discovery to be more verified. After the course, Sofie was matched with another student in her master program and together they continued to develop the business application areas of the algae and business potential of using the algae as a biofuel during their entrepreneurial thesis work. Among other things, they applied for and received verification grants from a Swedish innovation agency. Additional grants required that they obtain co-applicants from industry, which they found. After some time, one of these partners was exchanged for a new industry actor partner providing a wastewater source to facilitate the algae production – a fish production site on the Swedish west coast. This sector was a new area of use for the organic biomass.

After some development attempts within the wastewater and crude oil sectors, Swedish Algae Factory ended up going back to some of the earlier identified application, re-evaluating the silica aspect of the algae. Building from knowledge about the algae's silica structure, Swedish Algae Factory could prove an ability to increase a particular performance criteria of solar cells by 4%. It was not clear until attending an industry fair, that this was a drastic improvement on existing industry standards. Based on this, Swedish Algae Factory currently focuses on solar panels, while over the years, having explored a variety of interesting situations of use, many of which were identified already back in the Idea Evaluation course as evidenced in the student report. Key events of the venture are indicated in Figure 2.

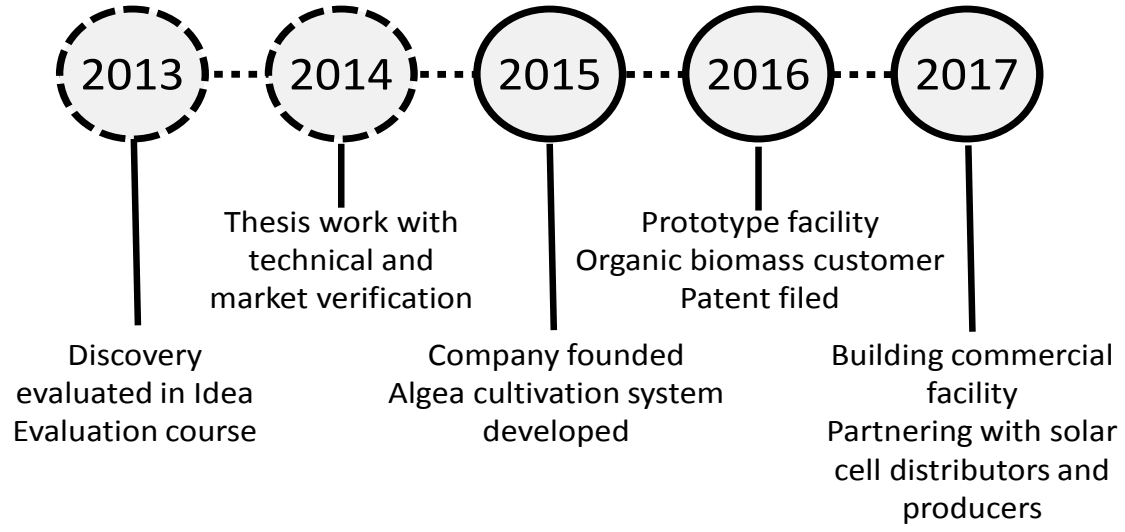

Figure 2. Key events in Swedish Algae Factory.

There are multiple sustainability aspects to the innovation underlying Swedish Algae Factory. The first is an emphasis on natural versus synthetic material/design. Natural design has a key verification advantage, having already been tested as durable and robust, based on centuries of natural evolution. A second aspect involves the sourcing of nitrogen and phosphorous through recycling processes (wastewater) instead of using mined resources. Even though the wastewater treatment application as core business was not viable on its own, Swedish Algae Factory still integrates the treated wastewater into the new production process, though the main focus is now on algae production for solar cell technology. The company has a circular (life-cycle) business model which stems from the algae's own natural life cycle. Finally, while much of the algae-based biofuel industry is struggling with e.g. low prices on both fossil fuels as well as on solar panels, Swedish Algae Factory has managed to identify a new more sustainable business model in the solar industry.

EVALUATING THE IDEA EVALUATION COURSE

Between 2008 and 2017, more than 160 ideas have been evaluated through the Idea Evaluation course. Approximately one-third have university research origins. Ideas also come from independent research institutes, established corporations looking to test early-stage ideas independent of their organizations, or private actors seeking to access resources available through university innovations systems. Over the years, a small set of ideas, including what became Swedish Algae Factory, have continued into second year of the entrepreneurship program and resulted in incorporated ventures through the entrepreneurship program at Chalmers School of Entrepreneurship (other examples include Acosense 2008, Line Robot 2008, Flocazur 2011, Swedish Algae Factory 2013, Revibe 2013, etc.). Many more of the evaluated ideas have advanced further from the Idea Evaluation course through and also far beyond the university innovation system.

The course format has evolved over the years but within the same overall structure. Key features have been the following:

1. One or two real-life recruited ideas appointed to the student teams to evaluate under secrecy agreement.
2. Non-mandatory classroom half-days, twice a week, with a blend of lecturing faculty, guest lectures, workshops, consultations, and peer-learning around the progress of the idea evaluations.
3. Written exams at the end of the course, having questions that address theory, tools and how these have been applied.
4. Mandatory presentations and oppositions of final idea evaluation reports, including submitting a written seven-page report plus greater or less extensive appendices for grading.
5. Grading based upon individual exam (60%) and grading of the idea evaluations done in teams (40%)
6. From 2010, the course has had the anthology Sustainable Business Development (see the more recent version, Alänge and Lundqvist, 2014), written by faculty and alumni around the entrepreneurship program as the main literature.

Course evaluations over the years have varied but in essence there have been the following main issues brought up:

- Classes typically give the course an average score between 3,5 and 4 on a 1 to 5 scale, with 4,1 being the highest and 2,8 being the lowest overall average grade from any class.
- Most, but not all students, appreciate the real-life idea evaluation as the main feature and learning experience in the course.
- Some, but never a majority, of the students express concern and challenges with the uncertainty and idiosyncrasy of working with real-life ideas that are more or less difficult to build a substantial case around.
- Most but not all students express appreciation of learning from the each other in the teams (that are deliberately put together with students having different educational backgrounds) as well as from interacting with the idea providers and others.
- Many students also reflect upon the challenge with such team-learning and stakeholder interaction.
- Many students, but never a majority, express concern with the more traditional aspects of the course such as lectures and individual written exam.
- Some students are uncomfortable with the amount of faculty and guest lecturing offered, while others specifically express appreciation of this.

DISCUSSION

In this paper, our aim has been to investigate the extent to which entrepreneurial education linked to research can boost early-stage sustainable innovation. The empirical context used to address this purpose has been a 7,5 HEC Idea Evaluation course in which very early-stage innovative ideas (invention disclosures) have, since 2008, been connected annually with student teams, who then pursue a role of student surrogate entrepreneur to transform and develop the idea into a more viable opportunity.

Over the years, more than 160 ideas have been evaluated by the student teams operating under a secrecy agreement. With only a few exceptions, the idea providers coming from academia,

industry, startups or being private inventor, have been appreciative or very appreciative of the idea evaluations conducted by the student teams. In the few cases where idea providers were displeased, faculty or TTO/Incubator actors were able settle and resolve any issues.

A subset of ideas evaluated from the course have even been transformed into viable startups within the premise of the Entrepreneurship program at Chalmers School of Entrepreneurship, keeping the students as surrogate entrepreneurs all through the Valley of Death. The vast majority of ideas, however, have given the idea providers more insight and knowledge what to do next and also, in many cases, around patentability as well as new and more sustainable areas of use for the early-stage idea. They have then been able to take steps themselves or in collaboration with the variety of actors helping such ideas forward at the university and in the region.

All students attending the course gain entrepreneurial experiences in terms of having to effectuate under uncertainty and develop skills in how to package early-stage technical ideas in ways more attractive to existing as well as new and potential stakeholders. Apart from more traditional declarative knowledge about tools and perspectives, they also gain skills in taking entrepreneurial action as well as develop attitudes towards how they want to contribute to more hands-on sustainable development.

A main conclusion of the paper is that students appointed the role of surrogate entrepreneurs in the format of the Idea Evaluation course has a lot of positive effects, and few – if any – negative effects. Stakeholders connected to the course are almost all happier with the idea being evaluated in a creative and entrepreneurial way than not having utilized this idea evaluation opportunity. Given the early stage of the ideas provided, and the lack of time and alternative agency around the idea, there is also reason to conclude that there is no alternative cost to the idea provider (or towards the idea).

The students themselves are not displaying a homogenous appreciation of the course, however. Over the years, there has been a continuous challenge to please all students sufficiently to end up in high course evaluation scores. There has consistently been two factions: those who favor the more progressive side (running a project by themselves) and who then have criticized the traditional side (readings, lectures, etc.); and those who have had the opposite critique (disliking project uncertainties and not liking external guest lecturers from practice, etc.). These students have asked for more predictable and structured ways of acquiring more or less pre-specified knowledge in the course. Perhaps this is a price to pay if universities want to also have entrepreneurial skill and attitude training without abandoning the need to acquire and demonstrate (through exams) established knowledge.

However, currently, the course is again being revised with most of the traditional lecturing recorded and published on the web (so called flipped class room) as well as emphasis even more put on skills training through peer learning and counseling. Whether this will increase student scores of the course is to be seen. However, regardless of that type of student feedback coming immediately after the course, the overall impression is positive. At least, students having taken the course and then continued into the entrepreneurship program consistently express gratitude towards this type of real-life, learning through creating (sustainable) value for others entrepreneurial pedagogy. So, perhaps universities with missions to contribute to sustainable development should dare to launch similar initiatives, while being aware of the difficulty of students being more appreciative of either the traditional or the more progressive teaching format, when in fact a main point should be to bridge between the two (Lackéus et al., 2016).

CONCLUSIONS AND FUTURE RESEARCH

The purpose of this paper has been to answer if and how students as surrogate entrepreneurs can contribute to early-stage sustainable innovation. The main conclusion is that students can gain important knowledge, skills and attitudes, while also enable more sustainable innovations to at least survive the first (of allegedly three) gaps in the 'Valley of Death'. The course format also enables more peer learning among students and other stakeholders. This would not have been possible if the early-stage ideas had been dealt with in a case-by-case matter by e.g. a technology transfer office. Also, the scarcity of other potential surrogate entrepreneurs in these early and close to research stages, motivates the use of students. There is little if any alternative cost to committing students to early-stage ideas, which otherwise risk being 'shelved'. The main benefit of committing students is that the ideas are given more agency, new and additional stakeholders, and are attributed with more values. The added values are on the technical side (patentability, freedom to operate, etc.), the utility-side (societal, customer and some business utility established) and in regards to next steps to take (future action).

The student surrogate entrepreneur dealing with early-stage innovation is a role far from the main perceptions of students being entrepreneurial. In the current case the focus is on formulating and communicating value to others around the idea – to the idea provider, within the team, to others in the course setting, and to any new stakeholders included in the idea evaluation. Such value is both about long-term societal utility as well as what to do here and now. It is, however, not about setting up a new business and communicating how to execute such a business through a business plan. The latter type of entrepreneurial activity has perhaps been too monopolized by business schools and others when teaching entrepreneurship. Apart from such activity (business planning) rarely being operationalized (i.e. it is just about writing a business plan, no doing or creating business), it also misses out the learning that the course presented in this paper offers when it comes to effectuating with deep idea provider competencies, among other things.

Society as well as university students, arguably benefit a lot from attempts like the current course, where deep but difficult to translate R&D-based knowledge is potentially progressed into more realizable and communicable forms. Admittedly, the course only bridges (or only partly bridges) one of many gaps in a 'Valley of Death'. However, if only a few of these sustainable innovations end up transcending the Valley, then why should not this educational format of student surrogate entrepreneurs doing sustainable-innovation become more mainstream university practice?

The current paper draws from one setting and only provides one example of a startup enabled by a specific educational format. There is reason to study more broad and systematic attempts by universities to position students into entrepreneurial roles under curricular or extra-curricular formats. Such further studies should apply a broader view of what being entrepreneurial entails, allowing all types of assignments where there is no clear solution but rather a potentially interesting starting point (such as an early-stage research results) to allow for some type of learning-by-creating-value-for-others approach.

REFERENCES

Alänge, S. & Lundqvist, M. (2014), *Sustainable Business Development: Frameworks for Idea Evaluation and Cases of Realized Ideas,* Chalmers University of Technology, Göteborg, Sweden.

Auerswald, P. E. & Branscomb, L. M. (2003), Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States. *Journal of Technology Transfer,* Vol.28, No.3/4, pp.227-239.

Cope, J. & Watts, G. (2000), Learning by doing: An exploration of experience, critical incidents and reflection in entrepreneurial learning. *International Journal of Entrepreneurial Behaviour & Research,* Vol.6, No.3, pp.104-124.

Donnellon, A., Ollila, S. & Williams Middleton, K. (2014), Constructing Entrepreneurial Identity in Entrepreneurship Education. *International Journal of Management Education,* Vol.12, No.3, pp.490-499.

Finkle, T. A., Kuratko, D. F. & Goldsby, M. G. (2006), An Examination of Entrepreneurship Centers in the United States: A National Survey. *Journal of Small Business Management,* Vol.44, No.2, pp.184-206.

Franklin, S., Wright, M. & Lockett, A. (2001), Academic and surrogate entrepreneurs in university spinout companies. *Journal of Technology Transfer,* Vol.26, No.1-2, pp.127-141.

Galloway, L. & Brown, W. (2002), Entrepreneurship education at the university: a driver in the creation of high growth firms? *Education + Training,* Vol.44, No.8/9, pp.398-405.

Gondim, S. M. G. & Mutti, C. (2011), Affections in learning situations: a study of an entrepreneurship skills development course. *Journal of Workplace Learning,* Vol.23, No.3, pp.195-208.

Grimaldi, R., Kenney, M., Siegel, D. & Wright, M. (2011), 30 years after Bayh-Dole: Reassessing academic entrepreneurship. *Research Policy,* Vol.40, No.8, pp.1045-1057.

Johannisson, B. (2016), Limits to and prospects of entrepreneurship education in the academic context. *Entrepreneurship & Regional Development*, pp.1-21.

Kolvereid, L. & Åmo, B. W. (2007), Entrepreneurship among graduates from business schools: A Norwegian case. *In:* Fayolle, A. (ed.) *Handbook of Research in Entrepreneurship Education Vol 2: Contextual perspetives.* Edward Elgar, Cheltenham, UK, pp.207-218.

Lackéus, M. (2016), A 'value' and 'economics' grounded analysis of six value creation based entrepreneurial education initiatives. *ECSB Entrepreneurship Education (3E) Conference.* Leeds, UK.

Lackéus, M., Lundqvist, M. & Williams Middleton, K. (2016), Bridging the traditional-progressive education rift through entrepreneurship. *International Journal of Entrepreneurial Behavior & Research,* Vol.22, No.6, pp.777-803.

Lackéus, M. & Williams Middleton, K. (2015), Venture Creation Programs: bridging entrepreneurship education and technology transfer. *Education + Training,* Vol.57, No.1, pp.48-73.

Lockyer, J. & Adams, N. Venture Creation Programmes: Causation or Effectuation? *European Conference on Innovation and Entrepreneurship, 2014*, Academic Conferences International Limited, pp.287.

Lundqvist, M. (2015), Chalmers. *In:* Foss, L. & Gibson, D. (eds.) *The Entrepreneurial University: Context and Institutional Change.* Routledge, New York, NY USA, pp.113-130.

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

Lundqvist, M. A. (2014), The importance of surrogate entrepreneurship for incubated Swedish technology ventures. *Technovation,* Vol.34, No.2, pp.93-100.

Meyer, A. D., Aten, K., Krause, A. J., Metzger, M. L. & Holloway, S. S. (2011), Creating a university technology commercialisation programme: confronting conflicts between learning, discovery and commercialisation goals. *International Journal of Entrepreneurship and Innovation Management,* Vol.13, No.2, pp.179-198.

Moroz, P., Hindle, K. & Anderson, R. B. (2007), Exploring the linkages between university technology transfer and entrepreneurship education programs: attitudes and perceptions amongst

entrepreneurship academics. *International AGSE Entrepreneurship Research Exchange.* Brisbane, Australia.

Neck, H. M. & Greene, P. G. (2011), Entrepreneurship Education: Known Worlds and New Frontiers. *Journal of Small Business Management,* Vol.49, No.1, pp.55-70.

Neck, H. M., Greene, P. G. & Brush, C. G. (2014), *Teaching entrepreneurship: A practice-based approach,* Edward Elgar Publishing, Cheltenham, UK.

Nielsen, S. L. & Gartner, W. B. (2017), Am I a student and/or entrepreneur? Multiple identities in student entrepreneurship. *Education + Training,* Vol.59, No.2, pp.135-154.

Pittaway, L. A., Gazzard, J., Shore, A. & Williamson, T. (2015), Student clubs: experiences in entrepreneurial learning. *Entrepreneurship & Regional Development*, pp.1-27.

Politis, D., Winborg, J. & Lindholm Dahlstrand, Å. (2010), Exploring the resource logic of student entrepreneurs. *International Small Business Journal*, pp.1-25.

Radosevich, R. (1995), A model for entrepreneurial spin-offs from public technology sources. *International Journal of Technology Management,* Vol.10, No.7/8, pp.879-893.

Ramsgaard, M. B. & Christensen, M. E. (2016), Interplay of entrepreneurial learning forms: a case study of experiential learning settings. *Innovations in Education and Teaching International*, pp.1-10.

Rasmussen, E. & Sørheim, R. (2006), Action-based entrepreneurship education. *Technovation,* Vol.26, No.2, pp.185-194.

Sarasvathy, S. D. (2008), *Effectuation: Elements of Entrepreneurial Expertise,* Edward Elgar, Cheltenham, UK.

Siegel, D. & Wright, M. (2015), Academic Entrepreneurship: Time for a Rethink? *British Journal of Management,* Vol.26, No.4, pp.582-595.

Solomon, G. (2007), An examination of entrepreneurship education in the United States. *Journal of Small Business and Enterprise Development,* Vol.14, No.2, pp.168-182.