

# Factors Enabling Student Start-ups to Commercialise Scientific Research for Demonstrating Social Impact

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**Abstract:** This research highlights contributions of student actors' research commercialisation efforts within the academic entrepreneurship (AE) landscape. Our review of the AE literature shows that the potential inherent in campus-based student enterprise activity has not been fully acknowledged within the AE literature. We argue that student start-ups are a viable means for demonstrating the social impact of scientific research. In this research, the aim is to map the student-led enterprise emergence and development mechanism as a vehicle for facilitating university technology transfer. Through a longitudinal case study design, the focal student enterprise's enacted process to commercialize university generated scientific research is investigated. It is shown how new technology stemming from university research was able to enhance the livelihoods of local fish farmers through the agency of student entrepreneurs. Light is shed on the enabling factors and wider university level arrangements that triggered and subsequently facilitated the case entrepreneurial endeavour. We find that an interplay of both micro- and meso-level factors enabled the case enterprise to achieve both commercial success and demonstrate social impact.

**Keywords:** student start-ups, academic entrepreneurship, social impact, frugal innovation, social innovation, case study, Indonesia

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## 1. Introduction

There is growing interest in universities' third mission and the socio-economic impact that these institutions could deliver through academic entrepreneurship (AE). Based within this premise, we investigate a mechanism within technology transfer theory that is designed to leverage on universities' knowledge capital for promoting *socio-economic development*. We have previously argued that there is a need to extend the concept of 'academic' within the AE discourse to also include 'students' not just academic members of staff (Amry, Ahmad, Lu, 2021). Within this novel broader view, there is an urgent need for research which unpacks the best models and support mechanisms to enhance student entrepreneurship as a part of the AE landscape (Wright, Siegel and Mustar, 2017).

As universities gain traction in the entrepreneurship education arena, students in ever greater numbers are becoming equipped for *entrepreneurship* (Steyaert, 2007). As a result, there has been a gradual rise in the numbers of student start-ups (SSUs) initiated whilst at university or a few years after graduation.

Therefore, to contribute to the question of 'how best can universities demonstrate social impact under their third mission', our aim in this paper is 'to explain how student-led academic entrepreneurialism delivered social impact through university technology-linked venturing activity'. Using Vohora, Wright and Lockett's (2004) 'critical junctures in development of university spin-out companies' as our theoretical lens, we operationalise our aim via the following research question: 'What are the enabling factors that trigger students to commercialise university research output for social impact?'.

The above aim was achieved by undertaking in-depth longitudinal and qualitative case study research which charted the process of a 'student start-up' (SSU) that commercialised university scientific output. We captured both historical data on the focal SSU through archival documents from 2016 onwards and followed the student founders' lived experiences in action for a period of 8 months (between June 2021 – February 2022). Findings shed light on the myriad eco-system actors and arrangements needed to support student-led entrepreneurialism to specifically drive universities' third mission agenda. We offer pathways for augmenting AE theory reliant on a refreshed understanding of how best to demonstrate social impact through student+university+academic-industry partner triads. From a practical standpoint, we provide guidance on students' managerial and resource arrangements for initiating the venturing process that aims to commercialise university research for social impact.

The paper is structured as follows; we start by evaluating research on technology transfer, AE and entrepreneurship education. Next, we explain our methodology and analytical methods. Findings are then presented informed by Vohora, Wright and Lockett's (2004) model of critical junctures followed by a discussion on the main contributions of the research. We conclude by suggesting future research directions along with laying out our limitations.

## **2. Literature review**

### **2.1 University technology transfer, research commercialisation and academic entrepreneurship for socio-economic development**

University technology transfer mechanisms are put in place to facilitate the commercialisation of scientific inventions. In formal technology transfer, a legal aspect of ownership through intellectual property rights (IPR), such as patents, trademarks and trade secrets must exist. However, the process of legally formalising ownership of any technology requires following rigid and strict rules. Which means that there might exist some technology that is 'innovative' but is not qualified for patenting (Abreu and Grinevich, 2013; Belitski, Aginskaja and Marozau, 2019). For example, specific know-how or technical skills, which the owner of such knowledge can leverage for joint or contractual research or consultancy (Abreu and Grinevich, 2013).

Formal technology transfer leading to commercialisation requires an intense multi-stakeholder effort (Carayannis *et al.*, 2018). From a process perspective, considerable resources are required and the presence of supporting mechanisms (institutionalised practices and a particular kind of ecosystem) are essential for universities to execute formal technology transfer. For example, a pre-requisite would be to attract top quality academic faculty (Perkmann *et al.*, 2013) that generates patent-able research outputs, access to research funding (Cunningham *et al.*, 2014; Gosens *et al.*, 2018) and the availability of an entrepreneurial university ecosystem (Autio *et al.*, 2014). Although it is suggested that the potential financial returns from formal technology transfer could be immense (Vinig and Lips, 2015), overall all the required preconditions are unattainable for many universities (Carayannis *et al.*, 2018; Lehmann and Menter, 2018). This is especially the case where universities are geographically located in regions with nascent innovation and entrepreneurial ecosystems, earmarked by institutional voids. These hinder the ability of ecosystem actors to harness knowledge capital from universities (Arocena, Goransson and Sutz, 2018).

In light of the above, debates have emerged on the role of universities in socio-economic development (Arocena, Goransson and Sutz, 2018). A strong focus on the formal routes of technology transfer can stall the creation of new academic outputs targeted towards solving particular societal problems (Guindalini, Verreynne and Kastle, 2021; Cinar and Benneworth, 2020).

Brundenius, Göransson and Carvalho De Mello (2016) highlight a growing interest amongst economists to measure economic growth that can capture *real* progress. They argue that GDP as an indicator of economic growth discounts important other non-economic indicators such as people's wellbeing and environmental sustainability. Contemporary measures for 'growth', such as the United Nation's Sustainable Development Goals, accentuate universities' role in socio-economic development and raise questions on how universities ought to be showcasing impact.

In the past, a university's role in teaching and research was assumed to contribute to economic growth through the supply of human capital that would ultimately increase economic productivity leading to higher GDP. However, owing to the shift in the 'development' paradigm, how universities ought to contribute to society is also being reconceptualized – especially in light of universities' new 'third mission' (Bölling and Eriksson, 2016; Marzocchi, Kitagawa and Sánchez-Barrioluengo, 2019). This shift requires universities to reframe 'academic entrepreneurship' and related activities to become wider-scoped and beyond formal technology transfer, and to include activities that can contribute to newer non-GDP based development paradigms (Amry, Ahmad and Lu, 2021).

### **2.2 Entrepreneurship education and student entrepreneurship**

A growing number of researchers now call for paying more attention to entrepreneurship education owing to its impact on increasing SSUs and how such start-ups are embedded within the wider AE landscape (Wright, Siegel and Mustar, 2017). Such researchers emphasise the need to factor-in entrepreneurship education's

impact when we assess universities' overall contributions to society (Morris and Kuratko, 2014; Edokpolor and Somorin, 2017). For example, entrepreneurship education in developing countries such as Indonesia is encouraged by policy interventions as a way to address the demographic bonus and as a solution to the potential increase in unemployment (Wiratno, 2012). Such interventions are based on the perceived effectiveness of entrepreneurship education to enhance the likelihood of university students transitioning into entrepreneurship, and as a result adding value to the overall economy.

Although studies have shown that there is a significant relationship between entrepreneurship education and entrepreneurship outcomes (Cui and Bell, 2022; Martin, McNally and Kay, 2013), under more careful observation, outcomes vary and 'success' depends on teaching pedagogy and the context within which it is embedded (Rauch and Hulsink, 2015). A study based on US data found that graduate SSU founders, interestingly, do not possess any formal entrepreneurship education attainment such as an MBA or other business degrees. Instead, the campus 'environment' and its ecosystem are the main enablers for new venturing activity (Åstebro, Bazzazian and Braguinsky, 2012). A part of 'campus culture', for example, would be having peers that are collectively primed for entrepreneurship, which positively predisposes students to pursue entrepreneurship (Lerner and Malmendier 2013). Since the influencing and contributing factors to entrepreneurship education provision and 'success' are nuanced (Hayter, Lubynsky and Maroulis, 2017), there are calls for contextualising its delivery to fit-in with the context in which it is embedded and to generate the sort of opportunities that are likely to be pursued (Adekiya and Ibrahim, 2016).

Studies looking into the phenomenon of student entrepreneurship as a body of literature within AE research, have emphasised that entrepreneurship support policies, programmes and empirical research should no longer just focus on faculty (Siegel and Wright, 2015; Hayter, Lubynsky and Maroulis, 2017). Consequently, leading to the assertion that universities' mission in economic development should not be limited to intellectual property commercialisation. As student entrepreneurship rates continue to rise, more empirical work is needed for understanding how these new academic entrepreneur actors create ventures, and in what ways are they able to contribute to a university's third mission agenda.

### **3. Research methodology and theoretical framework**

Our study seeks to explain how student-led academic entrepreneurialism delivers social impact through university technology-linked venturing activity. A unique aspect in this research is our real-time tracking of the venture creation process enacted by student entrepreneurs. To guide our inductive inquiry, we adopt the following research question: "What are the enabling factors that trigger students to commercialise university research output for social impact?"

Using the above guiding question, we focus our attention to the focal case's *entrepreneurial* activity – a term coined by Steyaert (2007); effectively, the process of 'becoming' instead of seeking to explain entrepreneurship in its stable state of being. This will allow the research to "follow a logic of recursivity" (Steyaert, 2007, p. 471) which will enable us to understand the entrepreneurial process situated in the experience of the actors as they are living within it. To answer our research question, we chose an 'extreme' case study (Yin, 2018) that demonstrated the context and the process through which an invention (developed by faculty) was transferred and subsequently commercialised by student entrepreneurs with the explicit goal of socio-economic development. Our case selection rationale meant that we strove to identify a non-traditional case of AE, where students (instead of faculty) were the main actors of research commercialisation, who were embedded with a 'non-mature entrepreneurial ecosystem'. A non-mature entrepreneurial ecosystem is characterised as an environment where innovation intermediaries (such as 'technology transfer offices' and other supporting mechanisms) are weakly connected or non-existent which results in lack of coordination and an inefficient use of resources (Schaeffer and Matt, 2016).

In collecting data, our goal was both to understand the *entrepreneurial* experience and to situate this in a particular context, achieving a contextual explanation of the phenomenon under study (Welch *et al.*, 2011). Therefore, not only the actors' accounts are needed, but also a rich understanding of the context in which the actor's experience is embedded in must be achieved. We map out the *entrepreneurial* process to uncover how venture creation occurs by asking 'what are the activities you actually have to engage overtime to produce it' (Gehman *et al.*, 2018, pg. 289). By adopting this methodology, we were able to analyse the enabling factors, ongoing challenges recursively and in real-time.

Our fieldwork with the SSU commenced in mid-2021. During this period, the start-up was in the final stages of testing their prototype. Our archival data on the SSU, however, dates to 2016 allowing us to chart changes and processual dynamics longitudinally. The limitation of a single case was addressed by performing a longitudinal study, mapping both historical along with real-time events. As a part of our data collection effort occurred during the lockdown owing to the COVID-19 pandemic, primary data was mainly collected through recommended online methods (Salmons, 2016). Our approach followed Pink et al's (2016, p. 3) concept of digital ethnography where "we are often in mediated contact with participants rather than in direct presence".

For data analysis, we converted all digital recordings into textual data. Data was collected via interviews, extant text archives (such as social media captions) and through the creation of memos on non-textual data which included videos, pictures, and virtual meeting observations (Salmons, 2016). Creating a textual database was imperative as it allowed for data coding. Coding was essential for drawing out concepts, properties, and dimensions of emerging categorical themes. Through the principles of constructive grounded theory analysis as outlined by Charmaz (2006), we undertook the recommended three-steps of coding – (a) initial coding, (b) axial coding, and (c) theoretical coding while going back and forth to the literature, anchoring it to our theoretical framework drawn from Vohora, Wright and Lockett's (2004) 'critical junctures in development of university spin-out companies'.

### 3.1 Case organisation

The case chosen was an aquaculture technology-based start-up founded in 2017 and was formally registered as a limited company in 2019 under its current name. The product commercialised was based on Microbubble Generator (MBG) technology invented by a faculty member of a public university in Indonesia. Although the technology was invented by faculty, the initial idea of commercialisation came from a group of undergraduate students who were a part of the research team led by the faculty-inventor. These students subsequently mobilised resources to form a start-up, targeting small-holder fish farmers as potential users without directly involving faculty in the start-up creation process. This start-up has undergone several iterations in terms of team composition, technology, product, and design developments since 2017 to 2020 to achieve product-market fit (see figure 1). In the first quarter of 2021 their official product was launched and sold to its intended target users.

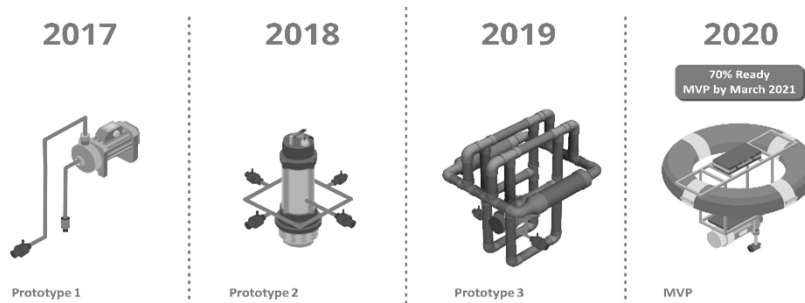


Figure 1: MBG Design Iteration (author's archive provided by the case organisation)

### 3.2 Theoretical framework: Critical venture creation junctures

Findings are presented using Vohora, Wright and Lockett's (2004) model of 'critical junctures' (p. 150) – which emerged from research on university-based spin-out companies. Their conceptual model is well aligned with the ethos of our study as they hold the view of non-linearity in the venture creation process. The model focusses on the critical moments that are either contributing or challenging the *entrepreneuring* process during venture creation. The critical junctures model creates a starting analytical lens to understand SSUs as a research commercialisation mechanism.

According to their framework (see Figure 2), the phases that an academic spin-off would go through consist of (1) opportunity framing; (2) pre-organisation; (3) re-orientation; and (4) sustainable returns. These different phases consist of various actions enabling the crossing of *critical junctures* leading to the subsequent phases. These junctures are: (1) Opportunity recognition, (2) Entrepreneurial Commitment (3) Threshold of Credibility and (4) Threshold of Sustainability.

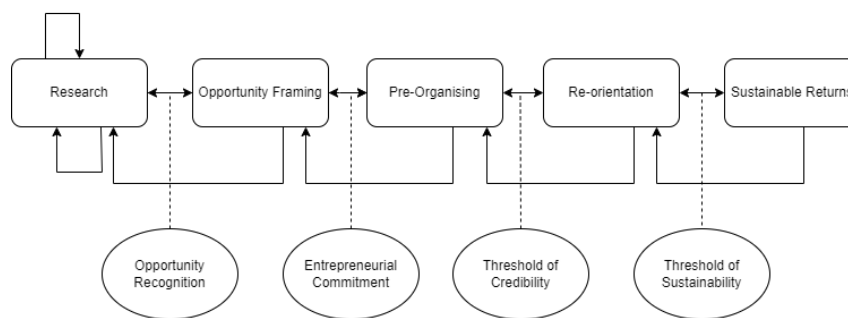


Figure 2: Critical Junctures by Vohora, Wright and Lockett (2004)

## 4. Findings and analysis

### 4.1 Universitas Gadjah Mada – A pro-social and developmental university culture

Universitas Gadjah Mada (UGM) is one of the 4,621 higher education institutions (HEI) in Indonesia (PDDIKTI, 2019). UGM's mission is to carry out education, research, and community service as well as the preservation and development of beneficial knowledge for the community.

UGM frames their identity around the notion of 'development' and encourages their students and staff to uphold pro-social values. This is evident by (1) their student induction programme to ensure that new students understand UGM's developmental agenda and their role in society; and, (2) the curriculum is designed to encourage students to actively engage in services to the community through especially allocated government funding for research that generates community service-type activities. UGM delivers university-wide programmes that facilitate direct student interaction with underserved or marginalized communities spread across Indonesia. Some of their programmes embody the spirit of development and are classed as a form of 'community service'.

UGM's community service ethos differs markedly from the concept of 'community engagement' as is known and practiced in the developed world. Community service entails 'giving back', instead of 'extracting from' communities for the purpose of socio-economic development. It is recognised that the university as an institution has a privileged status that can socially and economically uplift and empower communities through their services and activities.

### 4.2 The critical junctures

In this section, the *entrepreneurial* process of the aquaculture technology start-up will be outlined. This start-up was formally launched in 2019 by undergraduate student founders. This section is presented to follow the student team's '*entrepreneurial*' attempts. The sub-sections below present the outcomes of this process mapping exercise using the vocabulary and conventions of Vohora, Wright and Lockett's (2004) critical junctures framework.

#### 4.2.1 Availability and access to research output

A member of staff and their research team from the Centre of Energy Studies at UGM invented a technology labelled the 'Microbubble Generator' (MBG). Through an aerator, the MBG improved oxygen saturation levels using tiny bubbles, enhancing water quality and, thereby, improving aquatic life's growth. The initial application of the technology was for industrial water waste treatment, funded by the Ministry of Higher Education, Research and Technology (at the time) under the Appropriate Technology scheme. Nevertheless, the technology was not intended for commercialisation and instead was seen as a 'community service' application for showcasing research impact.

During the initial stage, to identify the technology's use case, the academic inventor collaborated with academics from the Faculty of Agriculture and became involved in a company CSR (Corporate Social Responsibility) project. In this project, they sought to investigate whether the MBG could be used to solve a problem that agriculture researchers had previously identified: low levels of fish harvest yield and its link to poor pond water quality. The data generated through this funded project fed into the problem validation phase. However, as the intended

research objectives were achieved, after the project's termination, the MBG apparatus and equipment were shelved, without any further commercialisation attempts.

#### *4.2.2 1st Juncture: Opportunity recognition to opportunity framing*

During the above CSR-funded project, the academics involved included several undergraduates, hiring them as research interns and analysts. This followed a cultural norm where the intention was to provide a learning opportunity so students could gain skills and experience through a real-life project outside of their normal curriculum. It was a non-institutionalised rule but was understood by all faculty members at UGM. Students too understood that to be chosen by faculty to take part in such projects was a matter of privilege, whilst being perfectly aware that their involvement would not be a part of any structured assessment or included in their credit points.

This 'culture' within UGM cultivated a certain kind of attitude that led students being pump primed to actively engage in external projects with their tutors. This unwritten rule became key for the opportunity recognition juncture for the commercialisation of the MBG technology. The students involved in the project showcased enterprising behaviours that led to the framing of both a 'commercial opportunity' and an ability to generate 'social impact'. Student interns and research assistants spotted a market gap for a technology for small-holder fish farmers that would uplift their livelihood. Hence, UGM's pro-social ethos, unwritten rules about student engagement in real world projects and students' own enterprising behaviours triggered the start of the *identification* and *framing* of both the 'commercial' and the 'social upliftment' opportunity that the focal technology presented.

#### *4.2.3 2nd Juncture: Entrepreneurial commitment to pre-organization*

After the student founders identified the commercial opportunity as part of their work experience in the CSR-funded project, they needed to seek permission to further develop the technology for commercial use. During this phase, the academic inventor bypassed the university's TTO as the student team did not pay any licensing fees under an agreement to modify or use the MBG technology. As the student founders had built a good relational foundation with the inventor, within an education-for-the-sake-of-education mindset, they were allowed to continue further research and development without any formal contractual arrangement. Despite though, the academic inventor continued to provide mentoring support. Once commitment was achieved, the process moved on to the next phase where resource mobilization needed to occur.

#### *4.2.4 3rd Juncture: Threshold of credibility to re-orientation*

To pass this juncture, mobilising knowledge and capabilities are required as pathways to venture creation for research commercialisation. In the focal case, founders needed to form a sub-team to validate their idea. Founders comprised a group of friends that were previously involved in an SSU competition, where they pitched the MBG's potential for aquaculture. Our evidence showed that competitions of various types became key in mobilising resources in terms of formulating not only the viability of the technology, but also teams' capabilities.

The case analysis shows that for SSUs to commercialise university research, student business competitions are relevant not just to validate particular value propositions (Stolz, 2020), but also as a way to mobilise resource capabilities to pass the juncture of 'threshold of credibility'. This then allowed the student founders to start the re-orientation phase of research commercialisation in terms of capability needs, further validation and anticipating future resource requirements and mobilisation needs.

#### *4.2.5 4th Juncture: Threshold of sustainability to sustainable returns*

Testing the commercial viability of the technology was crucial for ensuring a steady demand for the end-product. Four iterations were required for the main technology to reach a level of commercial 'maturity' from the initial research undertaken by the lead inventor (see Figure 1). Tests as a part of these iterations were conducted in the field through the cooperation of local fish farmers.

In this phase, the SSU required a close co-creative working partnership with the target beneficiaries. As the founders had a specific customer group in mind, there was a need to precisely understand how and in what way the technology might be used by target end-users. This was only possible because channels of communication were opened much earlier with the target fish farmer community through relationship building measures

initiated during the earlier CSR-funded stage. Further governmental funding created opportunities to validate the technology's value proposition. As the target users experienced the benefits of the technology first-hand, an incentive in the form of government subsidies became fundamental in securing access to their ponds. These were to be used as 'living labs' to constantly test and monitor the prototype.

The above co-creation process resulted in a product that utilized affordable materials which were easily available locally, and in alignment with frugal innovation concepts (Weyrauch and Herstatt, 2017). It was also important that the device's cost was kept at a level that fell within the end users' willingness-to-pay (Ali, Acton and Bhatt, 2019). These aspects led to an overall value proposition that could meet the threshold of the venture's dual-purpose sustainability criteria, where both commercial returns were achieved alongside the delivery of social impact.

## **5. Discussion**

Based on our findings, it can be determined that several pre-conditions are essential for students to become focal actors in commercialising university scientific output and transferring technology to societal actors/communities. We found that exposure to socio-economic development concepts and community-motivated research is a foundational basis for the recognition of potential commercialisation opportunities that generate affirmative student action. We also found that student entrepreneurs would be much more likely to take part in a research commercialisation project if they were first actively engaged with their tutors in extra-curricular and related research projects. Such projects lead to experiential learning, which increases students' level of confidence and imparts essential intangible enterprise skills augmenting their competence in *entrepreneurship*. Although, past research has suggested that student project-based and experiential learning is a major factor in enhancing entrepreneurship behaviour (Sukavejworakit, 2018), we find that an element of action-oriented pedagogy that facilitates direct involvement with grassroots communities is also imperative for igniting student pro-social behaviour. Such behaviour is a precursor for framing opportunities to solve societal problems.

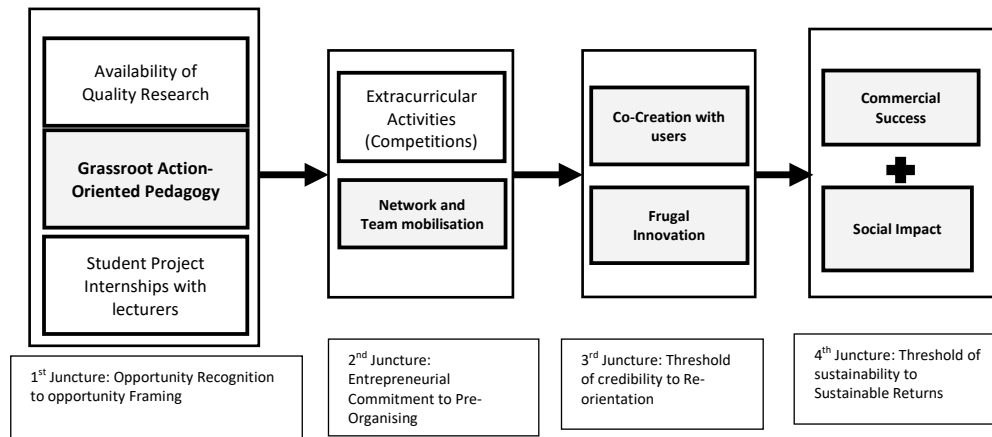
Past empirical research in entrepreneurship education area has identified the value of student competitions, arguing that these positively influence student *entrepreneurship* capabilities by augmenting their enterprising behaviours (Stolz, 2020). Student competitions are a way for students to iterate a value proposition leading to a viable business model. However, in this research it was found that students use competitions to not only test and iterate their value propositions, but also to attract and mobilize team members that share similar characteristics and long-term goals. Thus, competitions serve as a critical juncture to evaluate student teams' entrepreneurial commitment.

Additionally, to ensure social impact, the process of co-creation with identified end-users early on is key for determining commercial viability leading to dual mission success. Findings show that the outcome of any end-user co-creation process must lead to 'frugal innovation'. Specifically, the target technology and value proposition need to be affordable with materials readily available to ensure product-market fit to improve adoption levels with target beneficiaries.

Through passing the critical factors highlighted in Figure 3, the case SSU has demonstrated how it can achieve both commercial success alongside delivering social impact. The necessary pre-conditions that led the target SSU to mobilize would be useful for other universities to create within their own campus-based entrepreneurial eco-systems to showcase progress on their third missions, in other words, a focus on education for its own sake (Wright, 2014). Such showcasing of social impact can also potentially solve the tension generated by the question on whether or not universities should profit from publicly-funded research (Tyler, 2013; Bölling and Eriksson, 2016; Cinar and Benneworth, 2020). Additionally, social impact showcasing could also potentially resolve the identity tension between academics as academics and academic entrepreneurs (Jain, George and Maltarich, 2009) that has been cited as a major inhibitor of research commercialisation.

Therefore, by pump priming students and using the correct formulation of pedagogy, it is likely that research commercialisation and technology transfer's focal actors could be student entrepreneurs, working to solve the academic – entrepreneur identity dilemma and somewhat alleviating the responsibility solely lying with academics to commercialise their research outputs.

We found that the existence of an effective working TTO was not necessarily a major contributing factor in successful commercialising of university scientific outputs. Hence, universities that are in non-mature entrepreneurial ecosystems with institutional voids with an absent or redundant TTO can still showcase progress on their third missions through commercialising research outputs for societal change. Here, even though the university might not reap financial rewards as a result of commercialisation success, they will still be able to augment their reputation, leading to indirect benefits such as increases in student intake and amount of research funding that can be captured (Abreu *et al.*, 2016).



**Figure 3:** Enabling factors and critical junctures of SSU for research commercialisation

## 6. Conclusion

Our research endeavour started by an enquiry on how student entrepreneurship fits within the AE landscape. We followed an SSU's venture creation process as they commercialized a university research output outside of, and unimpacted by, conventional 'technology transfer' support mechanisms and enabling factors found in research universities embedded in mature ecosystems. Our contributions are both theoretical and practical. Theoretically, we contribute to the AE literature by extending the number of recognised actors involved in research commercializing, thereby, providing agency to students as focal research commercialisation agents, especially for social impact. Using critical junctures as a theoretical framework, we uncover some of essential enabling 'pre-conditions' for the success of student-led research commercialisation.

Practical implications point to the need for an action-oriented pedagogy that has been shown to be a major contributing factor for facilitating student entrepreneurship targeted to solving societal problems. Overall, we provide an initial framework on how best to encourage student-led research commercialisation activities that can achieve both commercial and social impact.

Nevertheless, the study has several limitations. As all qualitative research, it is not our intention to provide analytical generalisations, but instead to shed light on an emerging phenomenon within the AE landscape. Given the nature of our single case study, further research would be needed to arrive at robust theoretical generalisations.

Future research should investigate other SSU processes that aim to commercialise university scientific output in different contexts. Another interesting avenue is to look more closely at the action-based pedagogy in entrepreneurship education. We found that for students to internalize key intangible enterprise skills, there is a need to go beyond the classroom and even outside the boundaries of host universities. It would be useful to study whether simulation-based pedagogy and role play by exposing students with real-life scenarios might deliver the same impact as action-oriented pedagogy (fieldwork-based).

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