Contextualizing the Notion of an Entrepreneurial University: A Reflective Framework

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Abstract

Developing academic entrepreneurship within a university entails a complex process of change. As internal and external contextual variables make the entrepreneurial journey of each university unique, finding a common "recipe" seems impossible. Therefore, having a reflective framework that allows each university to consider its entrepreneurial strategy and how it translates into more specific organizational measures may offer a path forward. In this paper, we discuss the content, process, and context of entrepreneurship at universities along the dimensions of anticipation, reflexivity, inclusion, and responsiveness. To inform our discussion, we rely upon the findings from the literature and examples from practice. In doing so we contribute to the debate on academic entrepreneurship across different contexts and provide both practical reflection points and future avenues for advancing research.

Keywords: entrepreneurial university; academic entrepreneurship; commercialization; developing economy

Citation: Belousova O., Groen A., Sutormina A. (2024) Contextualizing the Notion of an Entrepreneurial University: A Reflective Framework. *Foresight and STI Governance*, 18(4), pp. 33–50. DOI: 10.17323/2500-2597.2024.4.33.50

Introduction

In recent decades, universities have been facing increasing pressure to become entrepreneurial (Hayter et al., 2018; Yusof, Jain, 2010) and take a leading role in creating entrepreneurial ecosystems (Schaeffer, Matt, 2016). An "entrepreneurial university" is one that effectively fulfills the "third mission" of stimulating economic development alongside education and research (Etzkowitz, 1983) and commercializes its knowledge through collaboration with industries, establishing technology transfer offices, and supporting start-ups, incubators, and science parks (Etzkowitz, 2003; Rothaermel et al., 2007; Tuunainen, 2005; Yusof, Jain, 2010). Yet, despite the decades of efforts, results remain mixed (Huyghe, Knockaert, 2015; Qiu et al., 2023).

While the economic impact of university entrepreneurship on regional and national performance can be significant (Etzkowitz et al., 2000; Schaeffer, Matt, 2016; Tijssen, 2006), the opposite is also true. Local economic, institutional, relational, and political factors influence the emergence and success of new academic ventures (Jevnaker, Misganaw, 2022; Schaeffer, Matt, 2016; Urbano, Guerrero, 2013). Most research even attributes the successful emergence of entrepreneurial universities to the systematic introduction of policies at the national level. For example, the US government's Bayh–Dole Act resulted in such poster ecosystems as Stanford University and the Massachusetts Institute of Technology (MIT). However, these policies have not produced the intended effects in other ecosystems (Mustar, Wright, 2010; Schaeffer, Matt, 2016). Nowadays, along with the classical American entrepreneurial university approach, research identifies other models of institutional development, such as those originating in Israel and China. Therefore, context is instrumental in understanding the development of academic entrepreneurship.

Furthermore, the process of embracing entrepreneurial activities can create tensions within the universities' internal environment. Among them, conflicts between old and new values, as well as between different activities and disciplines, exacerbated by the frequent lack of or inconsistent entrepreneurial role models within the university itself (Philpott et al., 2011; Qiu et al., 2023). The challenges that universities face fostering entrepreneurial cultures can be so profound that some question the place of entrepreneurship in academia altogether (Fuchs et al., 2023).

In this paper, we therefore offer a reflective framework that considers the content, process, and context of developing an entrepreneurial university. First, we adopt the four dimensions of governing responsible innovation: anticipation, reflexivity, inclusion, and responsiveness (Stilgoe et al., 2013). Responsible innovation is a dynamic concept enacted at multiple levels (see Fisher and Rip, 2013), and so is the governance of academic entrepreneurship. Second, to contextualize our analysis we consider the socio-cultural, spatial, and institutional boundaries of academic entrepreneurship (Chepurenko et al., 2024; Högberg, Mitchell, 2023). Both internal contextual variables such as university's history, tradition, resources, and organizational structure, as well as external contextual characteristics of the socio-economic system in which it exists, have a high impact upon its ability and willingness to engage in entrepreneurial activities (Riviezzo et al., 2019). Having the framework that guides reflection on how these internal and external variables impact the capacity of the university to anticipate, reflect, collaborate, and respond to the opportunities and challenges for academic entrepreneurship may have profound theoretical and practical implications. While far from proposing a normative solution, we seek to offer a novel lens on this complex issue and to contribute to the discussion on the embeddedness of entrepreneurship at different organizations and within various contexts (Wigren-Kristoferson et al., 2022).

Academic Entrepreneurship

Managing Academic Entrepreneurship

Academic entrepreneurship encompasses any activity that goes beyond traditional teaching and/or research, it is innovative, demands risk taking, and is associated with additional financial income for the academic entrepreneur and their organization (Abreu, Grinevich, 2013; Klofsten, Jones-Evans, 2000). These activities fall along a spectrum from "soft" to "hard" (Philpott et al., 2011), depending on the level of entrepreneurial sophistication (Klofsten, Jones-Evans, 2000). "Soft" activities include such activities as publications, conferences, consulting, and producing skilled graduates aiming to educate staff, students, and citizens about entrepreneurship, and creating networks with the entrepreneurial ecosystem around the university (Cohen et al., 2002, Philpott et al., 2011). "Hard" activities include patenting, licensing, and spin-off firm formation and are often managed by semi-autonomous technology transfer offices (TTOs) (Yusof, Jain, 2010). TTOs allow the entrepreneurial activity at a university to be concentrated in the hands of a few professionals, not necessarily active in research or education. While effective in stimulating knowledge transfer from universities, the TTO is nevertheless only one of the paths to channel the creations of academic spin-offs (Brantnell, Baraldi, 2022; Sansone et al., 2021). It is increasingly accepted that formal and informal interactions between (institutional) actors determine the development of the entrepreneurial ecosystem (Stam, 2015; Wurth et al., 2022).

Levels of and models for stimulating academic entrepreneurship and fostering entrepreneurial universities vary significantly. Stanford and MIT are well-known examples in the US, yet there is a considerable diversity in the entrepreneurial nature of universities as well. Other "country" models of institutional development include Israel (where the state fund of founda-

tions became the "anchor" founder of private venture funds, which included money from the diaspora) and mainland China (where newly created high-tech and development zones receive state support and include regional ecosystems of universities, businesses, and banks). In Europe, the development of entrepreneurial universities is generally less active and more heterogeneous. Yet here also there are notable exceptions such as Lund University and the Stockholm-Uppsala science cluster in Sweden, the Technical University of Delft and the University of Twente in the Netherlands, and Germany's WHU – Otto Beisheim School of Management and the Munich cluster (Technical University of Munich and Ludwig Maximilian University in Munich). Typically, such a "European model" involves collaboration among multiple universities to create regional clusters of innovative institutions and jointly develop the necessary infrastructure for fostering innovation. Public funding, rather than private investment, often supports these collaborations. These differences stem from varying systems of financing fundamental and applied sciences, with more reliance on public foundations and academies, and the predominance of public universities over private ones, especially in continental Europe.

Context

To contextualize our analysis and adapt the discussion to the development and governance of academic entrepreneurship, we further consider its socio-cultural, spatial, and institutional boundaries (Chepurenko et al., 2024; Högberg, Mitchell, 2023). Indeed, except for China, all the notable examples above stem from the developed economies. Yet, local economic, institutional, relational, and political factors influence the emergence and success of new academic ventures (Jevnaker, Misganaw, 2022; Schaeffer, Matt, 2016; Urbano, Guerrero, 2013).

The institutional environment of developing economies is often characterized by less developed and more fragile institutional infrastructure, unclear, inconsistent, or even inadequate government policies, disjointed infrastructure, and limited funding options (Manimala, Wasdani, 2015). These conditions lead to the poorer quality of entrepreneurial ideas that are biased toward necessity more than opportunity (Reynolds et al., 2003). In a context where entrepreneurial activities are more focused on necessity rather than opportunity, the boundaries for academic entrepreneurship need to be reconsidered from those of more established and prominent ecosystems (Chepurenko et al., 2024). Furthermore, Guerrero and Urbano (2017) suggest that along with the poor infrastructure and limited resources, entrepreneurs in developing countries may also face "dark institutional conditions" that include bureaucracy, taxes, lack of support, informal market dynamics, and even extortion by organized criminal groups. Recent evidence suggests that these conditions can pervade both the general economy and the university environment. For example, Chepurenko et al. (2024) describe how a university's administration appropriated the products and findings developed by one of the research groups in collaboration with students and industrial partners (p. 141). On the other hand, in some developing economies, such as India, China, or Brazil, the significant economic growth and market potential allow for opportunity-based entrepreneurship. For example, India is mentioned as the most rapidly growing entrepreneurial ecosystem by the World Economic Forum (2014), with 10,000 startups and 10 billion USD of investments in startups in 2015 alone[1].

Can and should we be talking about entrepreneurial university development and academic entrepreneurship stimulation in the context of a developing economy? To what extent are entrepreneurial ecosystems of developing economies unique? We assume that there are principles of responsible development and will develop a four-dimensional lens for this based on the work of Stilgoe et al. (2013).

The Four Dimensions of Responsible Governance at Academic Universities

Based on Stilgoe et al. (2013), we propose conceptualizing the governance of entrepreneurial universities through the lenses of anticipation, responsiveness, reflexivity, and inclusion. Originally developed to understand governing complex innovation processes in public spaces, this framework offers potential for analyzing entrepreneurial university settings (Fuchs et al., 2023).

Within the original framework, anticipation involves systematic thinking to foresee, comprehend, and shape desirable futures by aligning resources toward them (Stilgoe et al., 2013; Te Kulve, Rip, 2011). Reflexivity, at the level of institutional practice, means holding a mirror up to one's own activities, commitments, and assumptions (Stilgoe et al., 2013). Inclusion stands for engagement with stakeholders and the wider public, i.e., including lay members on scientific advisory committees, and employing hybrid mechanisms that attempt to diversify the inputs to and delivery of governance (Stilgoe et al., 2013). Finally, responsiveness requires adapting to emerging knowledge, perspectives, views, and norms, necessitating the ability to adjust course in response to changing stakeholder values and circumstances.

The dimensions of the framework "*do not float freely but must connect as an integrated whole*" (Stilgoe et al., 2013). They may both be mutually reinforcing and in tension with one another, generating conflicts. For

[1] https://www.statista.com/statistics/631967/share-of-startups-by-city-india/, accessed 16.02.2024.

example, anticipation can encourage wider inclusion, but may restrain responsiveness due to prior commitments (Stilgoe et al., 2013). In the coming sections we will introduce the dimensions in their application to the governance of entrepreneurial universities, followed by a discussion on the interdependence of these dimensions.

Anticipation

Successful anticipation requires understanding of the dynamics that shape technological futures in order to prioritize resource distribution toward the relevant areas of technological development, the provision of autonomy and slack resource pockets for experimentation, and an explicit recognition of the complexities and uncertainties of science and society's co-evolution (Stilgoe et al., 2013).

Anticipation in a University Context

In the context of a university this is often formulated in strategic documents, delineating the vision of the future the university sees and aims to engage with. For example, the University of Twente (UT) in their Shaping 2030 document states: "*In 2030, we will be living in a digitally mature society – an open world that continues to change. Those involved in creating and managing technologies will have new responsibilities, serving society sustainably as developers, analysts and improvers. … Many people will come to us for guidance: to learn what the future of technology means for society, and what the future of mankind requires from technology*."[2] Anticipation of the future should also be manifesting in the investments in identified directions, such as investments in R&D budgets as well as laboratory facilities and infrastructure for specific scientific disciplines. As such, the University of Groningen (UG) has just completed construction of 64,000 m^2 "Feringa building" that can house 1,400 students, 850 staff members, and 3 km of laboratory tables "*to continue contributing to important international research in fields such as chemical engineering, nanotechnology, material research and astronomy*"[3]. Meanwhile, the Moscow Institute of Physics and Technology (MIPT) committed itself in its development strategy to improving the campus, developing cross-disciplinary areas, and more than double the R&D budget aiming to enter the top 10 of the global ranking in physical sciences, the top 25 in computer science and mathematics, as well as take a leading position in the ranking of "entrepreneurial" universities in Russia. Furthermore, to address the complex challenges in society, these universities committed to the Sustainable Development Goals (SDG) mission (MIPT) by, creating interdisciplinary institutes focusing on societal transition areas (UG) and ensuring that SDGs serve as a guiding principle for at least 30% of the education and research, and that the university itself becomes a sustainable organization (UT). Hence, anticipation helps formulate the core positioning and development strategy of the university: how it sees the future and whether it aims to engage entrepreneurship in it.

Factors Stimulating the Anticipation of Innovation and Entrepreneurship

Anticipation prompts researchers and organizations to consider contingencies, reflect on what is known, what is likely, what is plausible, and what is possible (Stilgoe et al., 2013). Anticipation involves systematic thinking aimed at increasing resilience, while revealing new opportunities for innovation and the shaping agendas for socially robust risk research. Anticipatory processes need to be "*well-timed so that they are early enough to be constructive but late enough to be meaningful*" (Rogers-Hayden, Pidgeon, 2007; Stilgoe et al., 2013). Indeed, as Rip and Groen (2001) show, socio-technical development is a multi-level process over time in which technologies evolve from proving a principle that works in niches, to accepted as one of the regimes for certain functions up to becoming the dominant technology in a societal context. Anticipating which new knowledge to develop and "bet on" as a university to stimulate commercialization is therefore a difficult and uncertain process: "*whether expectations for new technologies will materialize, how they might be integrated into value chains, which regulatory measures may obtain, and the nature of broader societal acceptance*" (Te Kulve, Rip, 2011). Hence, universities need to act in anticipation of novel technological developments that require strong foresight capabilities of their top management and the scientific excellence of their staff that would inform the strategic foresight. Research highlights that scientific excellence is also a necessary first condition for successful industry-science links. In its turn, it depends upon the critical mass of faculty generating world-class research and the presence of star scientists (Clarysse et al., 2011; Colombo et al., 2010; O'Shea et al., 2005). Debackere and Veugelers (2005) further argue that industrial partners seek competence in both short-term R&D and in long-term strategic research.

Yet, in the context of universities, scientific excellence is connected to the competence of generating new original findings and approaches (Debackere, Veugelers, 2005). With the rapid advancement of AI tools, anticipation in scientific research is taking on new meanings. AI's capability to analyze complex biological, chemical, or physical processes at scales not accessible through experiments opens novel opportunities for discovery and application across traditional disciplinary boundaries (Wang et al., 2023). Incorporating AI in science (AI4Science) could lead to a less defined disciplinary

[2] https://www.utwente.nl/en/service-portal/topics/shaping2030/#embedding-shaping2030-in-teams, accessed 19.07.2024.
[3] https://www.rug.nl/groundbreakingwork/projects/feringa_building/?lang=en, accessed 05.06.2024.

focuses and faster technological development. It may also reshape research labs, increasing investments in computational scientists, methods, and cloud services, and fostering novel partnerships to support this progress (Wang et al., 2023).

Furthermore, anticipation requires infrastructural investments (Robinson et al., 2007). Strong science infrastructure allows, when in place and with enough capacity, for a variety of further work and product development (Robinson et al., 2007). If a university is considering engaging in an entrepreneurial mission and commercializing its knowledge, it needs to formulate not only the areas of development, but also, whether the infrastructure they invest in will be available for joint exploration and exploitation with industry, for strategic research, technology development, and maybe also product development. Sharing facilities, equipment, and skilled staff with partners in the ecosystem may be seen as a commitment to the entrepreneurial mission. Yet, it may also be a way to finance the envisioned future. For example, MESA+ at the UT is the largest nanotechnology institute in the Netherlands. They allow up to one third of their labs to be used by startups. Offering this facility led to dozens of startups. Furthermore, although the startups pay only a marginal rate of use per hour, this amounts to an important contribution to the costs of the labs.

Among the sources of funding for universities, there is government financing for long-term oriented fundamental research, industry contract research and collaborative R&D projects, as well as the competition-based public financing (Debackere, Veugelers, 2005). Endowment funds occupy a special place. Endowments are funds or assets donated to universities (or other institutions) to provide ongoing financial support. These assets are typically invested, and the returns are used to fulfill the organization's mission or support specific programs in perpetuity. Among the 20 wealthiest universities, the median endowment was a crisp $17.1 billion, increasing by an average of 1.9%. Only three institutions in the top 20 broke the 2023 average gain of 7.7%: the University of California system, John Hopkins University, and Duke University. John Hopkins had by far the highest jump at about 28%, and the UC system came behind with an almost 15% uptick[4]. This means that the university needs to be open to these different funding and collaboration activities, and be able to support the individual labs and scientists in obtaining, administrating, and reporting on these funds and activities.

Anticipation in the Context of Developing Economies

Anticipation requires a significant ability to invest in the future. However, in the context of developing economies, the absence of strong formal institutional mechanisms makes it challenging to safeguard investments. Here, more informal, trust-based connections can be relied upon, and a more distributed approach to funding may need to be considered. Business groups, as well as family businesses may be considered in the face of institutional voids and corresponding market failures in developing economies (Cao, Shi, 2021; Khanna, Palepu, 2000). For example, the Thapar Institute for Engineering and Technology (TIET) in northern India was founded in 1956 by the Thapar family to stimulate education, research, and the modernization of industry in the Indian Punjab. Nowadays this not-for-profit private university is teaching a few thousand engineers per year, conducts research that is often geared toward societal needs, and engages with the local ecosystem. It is also actively collaborating with leading international universities to contemporize education and research at a high speed. In India, TIET is ranked 20th among engineering institutions, and 22nd overall,[5] making it an example of how family endowment, reputation, and networks can provide stability and focus in a developing economy.

Furthermore, although the endowment system stems from US practice, we see this mechanism making a difference in the developing context as well. For example, there are more than 300 endowment funds in Russia.[6] Most endowments are created and operate in the interests of educational institutions of higher education (125 endowment funds). Endowments are also used in other social spheres, such as healthcare, social protection (support), science, culture, art, sports, and so on. The largest endowment funds in Russia are universities, as centers of strategic thinking and intellectual capital. An interesting example is the endowment fund of MIPT formed through alumni donations. Created in 2014, it has since become an important instrument in the strategic development of the university, amounting to more than $1 million offered by 780 people and targeting developmental programs, including student entrepreneurship. Furthermore, at MIPT, two funds have been created with the participation of major businessmen from among graduates: the ASH-NU Foundation and the Phystech.Pro Fund. Currently, the capital of the funds is 2 billion rubles; by 2030 it is planned to increase it to 100 billion rubles. Both funds are engaged in bringing MIPT's scientific developments to the market.[7]

Such "alternative" mechanisms of investments may counterbalance the impact of the otherwise crucial government support (Cao, Shi, 2021; Lazzeretti, Tavoletti, 2005). As government support is determined by the national development roadmaps, it may interfere with the anticipation at a more local and university level of development.

[4] https://universitybusiness.com/the-top-20-university-endowments-of-2023/, accessed 24.05.2024.
[5] https://www.nirfindia.org/2023/Ranking.html, accessed 09.01.2024.
[6] https://minobrnauki.gov.ru/about/deps/dep/funds/, accessed 23.05.2024.
[7] https://minobrnauki.gov.ru/press-center/news/novosti-ministerstva/82068/, accessed 23.05.2024.

Reflexivity

The second dimension, reflexivity, means holding a mirror up to one's own activities, commitments, and assumptions (Stilgoe et al., 2013). Building actors' and institutions' reflexivity means rethinking the conceptions about the division of labor within science and innovation (Swierstra, Rip, 2007). For academic entrepreneurship, this translates into asking a question about academic identity on an individual level, discussing the evaluation criteria on the level of the research group and institution, as well as establishing the prominence of entrepreneurship in the overall strategy of the university.

Entrepreneurial University Strategy

Universities can promote commercialization efforts by integrating entrepreneurial goals into their strategies and missions (Huyghe, Knockaert, 2015) and determining how exactly the knowledge generated within their walls is serving the society: whether "simply" made public, or pro-actively used to foster startups (Baglieri et al., 2018; Schaeffer, Matt, 2016). For example, between 1984 and 2009 UT had labeled itself as "The Entrepreneurial University". In all ranking efforts made in the Netherlands to establish the most entrepreneurial university UT has always held first place. Even today, after changing its motto to "High Tech. Human Touch" in 2009, entrepreneurship is one of the core themes of its mission. "Entrepreneur", "entrepreneurship" or "entrepreneurial" keywords are seen 29 times on the 16-page Shaping 2030 document. As a comparison, UG mentions entrepreneurship only five times across the 41 pages of its strategic plan for 2021-2026, it does so mostly in the context of fostering an "entrepreneurial spirit". This is also a notable change in the strategy of the university: back in 2016, the yearly report mentioned entrepreneurship 47 times, having the theme of knowledge valorization through commercialization and startup creation as its core strategy. The new strategy, however, established the role of the university in the advancement of complex societal transitions as a co-creator of impact in a broader sense. This resulted in the creation of four interdisciplinary schools focused on societal challenges and transitions as new value creating units were established between the 11 existing faculties. It also led to the closing of the entrepreneurship center as an integral unit of engaged scholarship (Van de Ven, 2007) that taught, researched, and stimulated entrepreneurship, transferring the support function to the Impact organization and dispersing education and research across faculties. The support function of academic entrepreneurship was then outsourced to other ecosystem partners.

University leaders, therefore, should be clear on the centrality and type of entrepreneurial strategy within the university to be able to establish its place and role in the organization. Coherence and coordination within the entrepreneurial university policy is directly related to the strategy and management structure of the university entrepreneurship support system/university entrepreneurship infrastructure. Lack of coherence within the entrepreneurial university policy can be detrimental to achieving functional links with not only industrial partners (Meissner et al., 2022), but also with internal stakeholders. In this context, primary attention is paid to the leader, the formal head of the entrepreneurship support infrastructure, who holds the position of either vice-rector or department head. The position of the university regarding its role in the commercialization process needs to be further operationalized through the organizational structures, the distribution of roles, as well as rewards and reinforcements.

Entrepreneurial Structures and Functions

To be a strong player on the knowledge market, a university should exploit the complementarities between teaching, basic research, and applied research (Debackere, Veugelers, 2005). Yet, universities find themselves at a curious crossroads: the prevailing share of income comes from educational activities, reputation, and status – from its research, and only a relatively small share of income or recognition comes from innovative entrepreneurial activities.

Traditionally, universities are considered to have an advantage in generating new technology, hence the role of universities was to develop technologies at a commercially feasible level and then transfer them to industrial partners in order to develop a business using those technologies (Takata et al., 2022). This perspective has given rise to TTOs' early activities targeted at connecting universities and industry (Debackere, Veugelers, 2005). While such centralized staff of experienced technology transfer offices manage the IP, contract and training issues are instrumental (Brantnell, Baraldi, 2022; Debackere, Veugelers, 2005), both for the role (Jevnaker, Misganaw, 2022) and business models (Baglieri et al., 2018) of TTOs, which have been redefined over the years (Takata et al., 2022). Several studies highlight that some TTOs consider their job to be funneling resources for research, while others focus on publishing and distributing that research; some TTOs support aspiring academic entrepreneurs while others act as CEOs instead (Baglieri et al., 2018; Brantnell, Baraldi, 2022; Jevnaker, Misganaw, 2022).

Other organizational arrangements have also been shown to impact the academic spin-off process, such as university startup incubators that often develop from an infrastructure supplier to a full support structure for competency development and access to markets and finance (Bruneel et al., 2012). University practice-oriented entrepreneurial education, business plan competitions, co-working spaces, and startup seed funds may facilitate the transition between knowledge generation and commercialization through an academic spin-off (Sansone et al., 2021; Shirokova et al.,

2018). If universities embrace the dispersed approach to stimulating academic entrepreneurship, they need to develop a portfolio of support services that complement each other and form a logical pipeline channeling entrepreneurial initiatives from different levels of the organization as well as focusing on different stages of technology and entrepreneurial readiness (Bruneel et al., 2012; Costa et al., 2020; Kirwan et al., 2006).

Becoming an entrepreneurial university, hence, shapes the dominant conception regarding "who" should be an academic entrepreneur – is it the student, the PhD candidate, the staff, or the actors out in the broader ecosystem of the university? For example, UG states in their mission that they aim to foster an entrepreneurial spirit –focusing on entrepreneurial education. MIPT takes a similar stand and invests in supporting a student technology park and business incubator. Yet, UT emphasizes the staff becoming academic social entrepreneurs. Not being at the center of a university's emphasis on entrepreneurial efforts does not mean "being excluded from entrepreneurship". For example, Chepurenko et al. (2024) show that universities that still operate as "an educational institution" or exclusively as a "fundamental research-oriented institution", find that entrepreneurial efforts may take on a deviant shape resulting in such types of entrepreneurs as silent investors, hybrid, and even destructive entrepreneurs. However, incentives and acknowledgement play a significant role. We mentioned earlier that UT labeled itself in the 1980s as an entrepreneurial university, allowing for and supporting reflexivity to anticipate entrepreneurial activities connected to an academic career. According to several studies (e.g. Clark, 1998; Lazzeretti, Tavoletti, 2005), this is an example of a highly entrepreneurial[8] and academically excellent[9] university that developed in a relatively underprivileged region since its start in 1961. Thus, the centrality of the entrepreneurial mission and its subsequent implementation through organizational structures, mechanisms, and performance indicators is of critical importance for the emergence of entrepreneurial university.

Entrepreneurial Academic Identity

Embracing entrepreneurial identity and having to add the norms and values of businesses to the already often conflicting roles of educators and researchers is a complex process as well (Giunti, Duberley, 2023). It is common to draw a distinction between "traditional" and "entrepreneurial" researchers – those who engage in collaboration with industry and have possibly started their own company. However, this dichotomy misrepresents the wide variety of perspectives on our campuses (Freel et al., 2019). Giunti and Duberley (2023) studied different types of academic entrepreneurs. They found that experience with entrepreneurship was one of the important distinguishing factors between those who did not consider entrepreneurship at all and those who successfully integrated it into their activities. It therefore requires business competency to understand the meaning of becoming an academic entrepreneur. One's attitude toward entrepreneurship was the other significant factor. However, attitude should not be understood as simply positive or negative. Giunti and Duberley (2023) showed that attitude could include curiosity as well as pragmatism, especially if included in the evaluation criteria for promotion.

Yet, the primary evaluation tools for promotion criterion for scholars continues to be research excellence with quantitative metrics (citation metrics, numbers of publications, or the amount of funding secured) being the dominant mode of evaluation (Fuchs et al., 2023). While research excellence can support anticipation, the research excellence-oriented academic career ladder assessed in terms of top journal publications is known to adversely affect academic entrepreneurial initiatives (Qiu et al., 2023). Thus, despite the crucial role of knowledge transfer in contributing to society in the missions of universities, and repeated calls for alignment between individual and organizational incentives for entrepreneurship in the last 20 years (e.g. Debackere, Veugelers, 2005), the KPIs for academic work lag behind.

While some universities incorporate educational career tracks, specific "commercialization" career tracks with incentives for researchers to get involved in joint projects with industrial partners – be they financial or in the form of performance evaluation indicators – are frequently absent or superficial (Qiu et al., 2023). To avoid potential conflicts of interest between being active in a spin off and being an academic, some universities even actively limit the scope of the academic participation in the startups and restrict the ownership one could have in the resulting company. Such conditions represent high opportunity costs for scientists, given that they miss both the time (or timeliness) for research and the ability to participate in the exploitation and value capturing stages of their intellectual property. Yet, several studies point to the risk that advanced knowledge-based ideas may fade away if the idea is separated from the creator or researcher (Jevnaker, Misganaw, 2022; Rasmussen, Borch, 2006), making it important for the overall result that the researcher stays involved in the invention.

Reflexivity in a the Context of a Developing Economy

While reflexivity requires embracing a specific identity and its systematic implementation across the different levels of the organization, developing economies are

[8] https://www.utwente.nl/business/meest-ondernemende-universiteit/, accessed 07.12.2023.
[9] https://www.timeshighereducation.com/world-university-rankings/university-twente, accessed 07.12.2023.

often characterized as dynamic and less predictable environments. If such environments require frequent and inconsistent changes in the strategy and, as a result, shifts in the structure and culture of the organization, this can be highly destructive for the motivation and trust of the actors previously involved in the entrepreneurship activities. Yet, the research also shows that in immature ecosystems, a university can trigger dynamics that lead to the concentration of the links among the ecosystem actors by becoming a hub organization (Schaeffer, Matt, 2016). Thus, a university can act as an anchor in a turbulent environment. In hierarchical structures, when entrepreneurship is among the direct tasks and responsibilities of the rector, who understands its strategic value and place in the overall development strategy of the university, results can be achieved more rapidly. For example, in 2014, the rector of the National Research University ITMO, Vladimir Vasiliev, included a transition to an entrepreneurial development model in the university's development strategy. Over the course of five years, an ecosystem of entrepreneurship was formed. The university became the leader of the federal project "5-100" in terms of the volume of R&D work per academic staff member, new international scientific laboratories, new science-intensive faculties and departments were created together with industrial partners, the research and teaching staff of the university was updated, and the education system at the university was transformed. However, when the university CEO does not see the value in entrepreneurship, there are plenty of opportunities to dismiss it, because, according to one academic entrepreneurship expert: "*The university in its essence, and this is stated in the charter, is an educational organization. The focus here is on education. … there is no focus on entrepreneurship. This means that the university devotes little attention, effort, and [money] to entrepreneurial activities*" (Chepurenko et al., 2024). Hence, in weaker institutional frameworks the role of the university leadership in establishing and maintaining the entrepreneurial identity of the university can be more pronounced.

Inclusion

Inclusion stands for engagement with stakeholders and members of the wider public who actively contribute to the joint development of governance (Stilgoe et al., 2013). In the context of a university, Clark (1998) called it "an expanded developmental periphery" referring to the way a university interacts with its environment, the type of organizational units and means, and the programs a university implements for those interactions. Indeed, as the previous sections have already described, an entrepreneurial university relies not only upon internal resources but also co-develops technological futures together with industry, the government, and other societal partners (Etzkowitz et al., 2000; Goldstein, 2010; Schmitz et al., 2017).

Ecosystem Perspective

Traditionally, an entrepreneurial university's developmental periphery was depicted through the notion of the Triple Helix model of university-industry-government relations. This model tries to capture the dynamics of both communication and organization by introducing the notion of an overlay of exchange relations that feeds back into the institutional arrangements (Leydesdorff, Meyer, 2003). The phenomenon of the triple helix system has been recognized widely (Sunitiyoso et al., 2012).

The modern understanding of the network of actors involved in the process of academic entrepreneurship has shifted towards an ecosystem perspective. The entrepreneurial ecosystem includes not only a top-class university, but also the presence of large firms and start-ups, top-level human resources at all start-up stages, venture capital, and the extensive participation of the government in shaping science and technology and an entrepreneurial culture (Matt, Schaeffer, 2018; O'Shea et al., 2007). A recent Dutch study shows that top entrepreneurial ecosystems can differ significantly (Hendricksen et al., 2024). For instance, Eindhoven, ranked among the top five regions, has strong industry players like ASML, Philips, VDL, and JUMBO. It also benefits from the presence of the Technical University of Eindhoven and several universities of applied sciences, along with strong public sector connections. On the other hand, Groningen, also in the top five regions, has smaller businesses or local branches of larger firms. However, it still ranks high due to its large university, a university of applied sciences, a major university hospital, and a substantial IT cluster mainly consisting of SMEs. Additionally, Groningen has well-established government networks, which contribute to its strong entrepreneurial ecosystem (Hendricksen et al., 2024). These two examples show that the mirror to use for reflexivity can be multi-faceted. Whatever the profile of the ecosystem, it is the access to critical expertise, networks, and knowledge (O'Shea et al., 2005; Saxenian, 1994) that stimulates voluntary and involuntary knowledge spillovers that favor open innovation strategies and generate fruitful opportunities for entrepreneurs to engage in value co-creation and participate in established industries (Nambisan et al., 2018). Knowledge infrastructure at the regional level is therefore of utmost importance: knowledge spillovers are spatially concentrated, benefiting entrepreneurial individuals and firms within close proximity to other actors (Crowley, Jordan, 2021). Robinson et al. (2007) describe two main routes of development of such infrastructure: co-creation or co-location. The first, the co-creation route, builds upon interrelated and interdependent networks, where technological opportunities and platforms are developed by being available at the same time. Usually, these are new and emerging fields far from technological finesse powered by the strong anticipation capacity of the knowledge-centered institutions. The second approach builds upon co-localized facilities and

scientific and technological competencies (geographic concentration), where the technology platforms are expansions of existing facilities that emerge around a university and later attract small and large companies (Robinson et al., 2007). Such networks are not limited to active commercialization partners only. An interesting example is the Wetsus – an excellence center for Water Technology in Leeuwarden in theNetherlands. This institute integrates societal partners and science as a core organizational principle. Wetsus organizes research themes that include groups of firms, professors from various universities, and central government support. Research is co-funded by firms, public research funds, and basic government support. Wetsus operates 12 research programs involving 60 PhD students, about 100 firms, and nearly 40 universities. Since 2007, it has engaged 48 professors, overseen 314 PhD projects, and produced 101 patents in sustainable water technologies. Many of these patents are commercialized through partner firms. To foster entrepreneurship, Wetsus encourages PhD students and professors to start businesses and collaborate with regional entrepreneurship support organizations.

Interactions, connections, and knowledge flows lie at the heart of ecosystems of innovation and entrepreneurship, where local and regional elements shape the aggregate capabilities of agents (Schaeffer et al., 2021). Informal contacts and human capital flows are ways of exchanging knowledge between enterprises and public research, which are more difficult to quantify, yet extremely important and often act as a catalyst for instigating further formal contacts. This once again highlights the necessity of spatial proximity in entrepreneurial ecosystems and not only based on the level of communication flows, but also through the multiplexity of the relationships necessary to build strong ties within the community leading to mutual trust (Burt, 2000). Yet, it should also be noted that a rich diversity of actors each pursuing their own institutional logic creates conditions for multiple divergences of interests and potential conflicts (Borah, Ellwood, 2022). Overall, the generation and diffusion of innovations, as well as entrepreneurial activity, are shaped by the local infrastructure, its externalities, specialized services, and levels of trust involved in the relationships between agents (Matt, Schaeffer, 2018).

Entrepreneurial Ecosystems in Developing Economies

In developing economies, entrepreneurial ecosystems are often characterized by a lack of good entrepreneurship support organizations and weak or small private institutions, yet they include the central role played by the government as the primary resource provider, together with foreign actors, and/or powerful established firms (Cao, Shi, 2021). For example, it is the government that acted as the main designer and coordinator for Chinese Silicon Valley (Li et al., 2017) as well as the industrial districts in Wenzhou, China (Liu et al., 2013). Similarly, in Russia, Skolkovo University was created with the prominent involvement of the presidential office and foreign contacts from MIT advising how to develop an entrepreneurial technical university (Chekanov, 2022). Yet, as McCarthy et al. (2014) argue, the early attempts of Russian government support for entrepreneurship failed to move beyond the stage of "idea creation" resulting in the tradition of "incomplete innovation" with a lack of support from informal cultural-cognitive institutions such as a culture that supports innovation and entrepreneurship.

Government involvement and funding may also impact entrepreneurial university development through national "development roadmaps". For instance, in 2021, Russia initiated the "University Technological Entrepreneurship Platform" to promote technological entrepreneurship among students, the university community, and investors. The project aims to introduce 30,000 technology entrepreneurs into the economy by 2030, all of whom are ready to launch new businesses. Objectives include involving students in technological entrepreneurship, creating a system for commercializing intellectual activity, and enhancing investment attractiveness in the research and development sector by establishing an entrepreneurial platform for startups. In 2023, 15 pilot startup studios were created, with plans to expand to 50 by 2030. The "Student Startup" grant support also provides up to 1 million rubles per project from the Foundation for Assistance to Small Innovative Enterprises (FASIE). Another state program, "Startup as a Diploma" has been implemented since 2021 at 40 Russian universities to involve talented students in developing the technological entrepreneurship ecosystem and supporting early-stage businesses. The final qualifying work is a real-life business project created by a student or team. In 2024, the Department of Technological Project Management at MIPT, co-financed by the Russian Venture Company, defended its first nine diplomas in the form of startups.[10]

These programs illustrate national policy commercialization efforts oriented toward student startups, potentially increasing support for student entrepreneurship even without deeply embedding this activity in the culture and identity of specific institutions. They also demonstrate some fundamental shortcomings of bureaucratic logic in nurturing academic entrepreneurship. For instance, they attempt to invest in the "supply" of academic entrepreneurship without any considerations for the role of the "demand" side (single business angels, a weak venture industry, low demand from the big industry actors for startups, etc.). Furthermore, developments initiated from the top down may lack consistency in their implementation. The volumes of allocated resources and the support program itself are such that they allow for fulfilling the plan in terms of quantity, involving the maximum number of universi-

[10] https://rvc-mipt.ru/chair/news/pervye-so-startap-kak-diplom-v-mipt/, accessed 17.06.2024.

ties, but at the same time with minimal funding, which does not allow for deep systemic work to implement educational programs in the field of entrepreneurship. For example, the state support framework defines the KPIs for entrepreneurship training in terms of thousands of students. To achieve such a scale of impact within the allocated budget, universities resort to one-day training sessions in entrepreneurship. However, these training sessions often create a misleading perception of how easily entrepreneurial skills can be acquired. The courses tend to be entertainment-oriented and are frequently led by instructors with inadequate qualifications. To boost attendance, organizers might cancel regular university classes to encourage students to participate in the training sessions, or they may offer additional incentives to motivate attendance.

Grant support programs from the Innovation Assistance Fund offer financial incentives that are particularly effective in regions with lower income levels compared to capital cities. Students compete for substantial grants, typically around 1 million rubles, but must establish a legal entity to qualify. This requirement can hinder the early stages of a startup, where forming a company might slow down the initial business launch. University startup studios globally are known for rapidly testing business ideas and fostering the mass creation of new companies within academic settings. The Russian Ministry of Science and Higher Education's 2022 initiative aimed to replicate this model, allowing for the systematic development of high-tech startups in material-based industries. However, implementing such a program in Russia faces challenges due to the lack of venture capital, experienced entrepreneurs, and successful venture exits required to support this venture financing-based model. Russian university startup studios, after one-and-a-half to two years, show mixed results. Some encourage collaboration with businesses, while others veer towards later-stage investments with minimal student involvement, resembling a holding model more than a venture model. State involvement in these studios, instead of being a co-investor, adds instead a bureaucratic layer that complicates approvals and introduces non-entrepreneurial management into startup operations. These conditions place a disproportionate amount of responsibility on the founders, outweighing the resources and benefits they receive. In addition, the main element that distinguishes a startup studio from a classic fund is missing - this is a mechanism for growing startups, which often simply does not exist. The most promising studios involve industrial partners who invest resources and expertise, fostering the growth of university-based startups. This partnership model offers a hopeful pathway for enhancing academic entrepreneurship, although substantial improvements are still needed in the broader framework.

Hence, although necessary, top-down government-led activities alone are not sufficient to build a sustainable innovation ecosystem (McCarthy et al., 2014). This is illustrated in one of the interviews in Russia: "*It seems as if all the elements are there, all the names are correct, managers have been appointed, KPIs have been formed, structures have been created (incubators, accelerators, startup studios and others), but they are not working or are extremely ineffective*" (Chepurenko et al., 2024). Indeed, behind the formal outline of an ecosystem structure, lies a myriad of informal contacts, gatekeeping processes, and industry-science networks on a personal base (Debackere, Veugelers, 2005). Together, these relations form an integrated entrepreneurial culture (Clark, 1998): an atmosphere of entrepreneurship and innovation that permeates every layer of the university and the organizations in the ecosystem.

To create this culture, companies may consider establishing their presence at the university not only on a project (e.g. PhD, product or technology development) basis, but in a rather more lasting manner. Consider the cooperation format between higher education institutions and industry, such as a "base" or "corporate" department. A corporate department is a structural unit within a university, initiated by a commercial organization or research institute. The first corporate departments were established at the MIPT in 1946. Unlike more established industrial departments, a corporate department is often located at an enterprise and facilitates cooperation between a university and a specific company or research institute, with the cooperation's scope individually defined. MIPT, the Higher School of Economics (HSE), and other universities have several dozen corporate departments. For example, the corporate department of the Russian Venture Company, established at MIPT in 2011, initially aimed to provide business education to MIPT students within a science and technology master's program. This program complemented their academic knowledge, enabling them to work effectively at the intersection of technology and business. The Russian Venture Company, as a development institution in the Russian Federation, focuses on training personnel for the venture market, including specialists and analysts for venture funds, which the company helped establish. Since the creation of the Russian Venture Company's corporate department, 264 master's students have been trained. These graduates work in various fields such as research and development, strategic and technological development, venture fund activities, technology startups, science, and consulting, both in Russia and globally.

Furthermore, the networked structure of the ecosystem incorporates an increasing number of international collaborations. As such, the Wetsus network actively works with China. Similarly, TIET is one of the first in India to invest in NVIDIA's latest units and build supercomputing capacity for AI development. This places them among the forerunners of AI technology adoption, along with, for example, UG that is also investing in the latest technology to serve as an AI hub, supported by EU, national, regional, and international businesses. Many universities foresee significant opportunities in AI technology and are collaborating

with various stakeholders to realize these opportunities. This brings us to the discussion on the responsiveness of entrepreneurial universities toward changing circumstances in the ecosystems.

Responsiveness

Responsible innovation requires the capacity to change the shape or direction of activities in response to stakeholder and public values and changing circumstances (Stilgoe et al., 2013). For responsible innovation to be responsive, it cannot overlook recent developments in society and policy at large. This may include nurturing transitions that advance complex solutions to the "grand challenges" (Lund Declaration, 2009), building upon environmental shocks such as Covid-19, which-brought changes to all spheres of life (Belousova et al., 2021), and overcoming the destruction brought on by military conflicts (Chepurenko et al., 2024). An analysis of ongoing societal and technological developments is necessary as well as some reduction of the complexity. Yet, as Kulve and Rip (2011) argue, this reduction of complexity "*needs to be open-ended to take the fluidity of the situation into account and to avoid biases regarding (the selection of) particular options*". To do so, it is important to "act locally, but think globally". For example, some universities are located in regions with particularly strong industries. As mentioned above, this goes for the region Eindhoven with their big partner AMSL. However, for ASML, TU-Eindhoven is not enough, and they actively work with other universities all over the world. TU-Eindhoven may also be very well connected to other partners elsewhere. One might also consider the University of Stavanger. Located in an oil and gas region, their strong collaboration with the leading company Equinor is not surprising. However, they actively collaborate internationally to explore other contexts.

The topic of responsiveness also naturally invites a reflection on the managerial approaches and the role of dynamic capabilities in academia (Klofsten et al., 2019). Managers, including university management, who face business environments challenged by volatility, uncertainty, complexity, and ambiguity cannot simply be efficient administrators if their organizations are to remain viable (Heaton et al., 2020). To address rapidly changing environments, organizations need to integrate, build, and reconfigure internal and external competencies, or, in other words, they need dynamic capabilities (Teece et al., 1997). Rasmussen and Borch (2006) suggest four categories of dynamic capabilities for entrepreneurial universities: capabilities that stimulate the exploration of new paths while reducing the path dependency of earlier strategic adaptation and resource bundling; capabilities to explore and map new valuable resources and complementary competences; capabilities that balance the present and the future interests of the organizational stakeholders, not the least protecting the new commercialization process from counteracting interests within the university organization; and, finally, they must possess the capabilities that reconfigure the available resources into a suitable exploitative pattern and link them together into a commercial venture.

As a reflexivity "muscle", strong dynamic capabilities govern a university's survival and growth. As Heaton et al. (2020) put it: "*Without adequate sensing capabilities, universities will be behind the curve in identifying opportunities of creating value for both their institutions and their constituents. For public universities, effectively seizing new entrepreneurial opportunities can generate nonstate funds that can be used to support disciplines, departments, programs, and activities that have limited potential to be self-funding. To take up their expanded roles, universities need to transform. Successful university leaders must provide the context for change.*"

Responsiveness in the Developing Context

In the developing contexts with their inherently more dynamic and less predictable environments, responsiveness may become one of the key dimensions of the development of an entrepreneurial university. Here, entrepreneurial development mechanisms like bricolage (Baker, Nelson, 2005) may be very important as improvisation and the need to make do with resources at hand are often the only way to start a business in such environment. Furthermore, as universities in developing economies are often more reliant on government support, there is a risk here that the university's involvement in the development of academic entrepreneurship may come down to only embracing some of the instruments sponsored by the government or achieving the more general KPIs set by the government rather than focusing on the immediate needs of the local ecosystems. With the strong presence of the government, the intermediary managers need to combine roles and skills at the interface of being a quasi-government official while assuming market-building activities (Cao, Shi, 2021). In such in multiple agency relationships embedded in different institutional logics, role and agency conflicts are also more likely to occur (Borah, Ellwood, 2022; Macho-Stadler et al., 2007). The capabilities of balancing the historic values and objectives of the academic research community with the new more commercially oriented focus is crucial for the entrepreneurial university (McCarthy et al., 2014).

Responsiveness requires not only navigating political changes, but technological trends as well. With the acceleration of technological change, the capacity of the TTO officers for scouting promising innovations may become overstretched. Having entrepreneurial activities "dispersed" (Birkinshaw, 1997) throughout the university may offer a solution by legitimizing more actors across the organization, such as students and staff, to be involved in entrepreneurial activities. It is, however, likely that coming from the lesser developed entrepreneurship ecosystem, the university is not involved beyond the proof-of-concept stage and an occasional product development, hence not having the

necessary business development competence among the staff – or in the surrounding ecosystem. It is, therefore, critical that the university defines its own roadmap of engaging different layers of the organization in entrepreneurship. For example, TIET started with the overall strategy of contemporizing their education by including entrepreneurship in the engineering curriculum of their students. To do so, they also educated 30 engineering faculty members in entrepreneurship through their international network, making them ambassadors for entrepreneurship across all programs and faculties. These faculty are both teaching the introductory entrepreneurship course as well as leading the Entrepreneurship Development Cell helping develop early-stage student and faculty startups. As the theme gained more traction, the university leadership also introduced the PhD student and faculty entrepreneurship courses and reinforced startup support through investing in co-creation and a VentureLab (business accelerator) space open for all students and faculty, as well as for external portfolio startups. It needs to be noted that this development has been going on for about 10 years and it is expected to continue for at least five years before a relatively stable situation is reached. Connections to alumni, government, local, and regional ecosystem partners are necessary to enable this ongoing development.

Integration and Tensions among the Dimensions

The discussion above examines the different mechanisms of governing an entrepreneurial university and contextualizes the discussion within the framework of developing economies. Finding a proper balance in managing the dimensions is central to making academic entrepreneurship governance possible. For this reason, institutional commitment to a strategic policy framework that integrates all four dimensions is vital. Yet, the analysis also identifies tensions and challenges.

A university's competitive advantage lies in its ability to produce top-class research, both fundamental and applied (Debackere, Veugelers, 2005). This has traditionally given research universities an edge in developing industry ties. However, a university's competitiveness is not solely determined by fundamental research, except when in competition with other universities for the funding of such research. In entrepreneurial contexts, market trajectories can vary significantly, necessitating a contextualized analysis. The discipline also influences competition strategies. For example, engineering often allows for shorter collaborations compared to physics or chemistry. Yet, this can change. For instance, in 2012, a scientific director of a nanoscience institute in The Netherlands claimed nanoscience had less commercialization potential than nanotechnology (Bruneel et al., 2012). Today, professors in nanoscience and nanotechnology win awards for both applied and fundamental research. Molecular precision medicine, for example, uses nanoscience for targeted drug delivery and nanotechnology for cancer distribution measurement. The same nanoscience institute has a new leader, and she is a member of a national "Top sector" industry committee and leads large grants in collaboration with industry such as the world's leading lithography company ASML. This institute now is actively involved in creating startups. This is an example of scientific excellence (anticipation) combined with responsiveness to the emerging scientific applications.

This, however, requires a strong reflexive perspective that includes entrepreneurship as part of the identity of the university, the department, and the scientist. For example, a UT nano-technology professor Albert van den Berg, Dutch Spinoza prize winner, author of dozens of patents and the inspiration behind multiple startups says[11]: "*The motivation for our research was both found in scientific questions and health- and sustainability related challenges.*"[12] This shows the importance of anticipation, reflexivity, and responsiveness working together: attracting and retaining top-class faculty capable of creating breakthrough research, translating it into industrial applications, and being willing and able to engage in commercialization through a startup journey. Planning for societal impact (e.g. through stressing the need for transitions outlined in the SDGs as opposed to expectations of short-term results) may be instrumental here. Yet, as the previous discussion shows, the dominant focus on assessing research excellence through the number and rank of publications may have detrimental effect upon engagement in the commercialization of university knowledge. Hence, research excellence may stimulate strong anticipation, but also lead to a reluctance to embrace an entrepreneurial identity.

Furthermore, efforts to increase the entrepreneurial spirit of a university often require funding and infrastructure that no university can derive from the first stream (student fees) money alone – and this is when inclusion "feeds" anticipation. We may even talk about a reinforcing spiral of development, where the first investment from either public or private investments can create interest in the expansion of infrastructural capacities, attracting more partners and allowing for broader development. Different origins (public or private) may require different management capabilities and have different trajectories of development (e.g., whether private partners join a government-financed technology program may differ according to country and grant conditions).

Inclusion may also be instrumental in creating a responsive system, especially if the potential for anticipation is limited. An example of distributed responsibility and co-creation is the creation of focused interdisciplinary research institutes where collaboration

[11] https://www.nwo.nl/en/node/38875, accessed 20.12.2023.
[12] https://www.utwente.nl/en/research/researchers/featured-scientists/berg/#nano-research-for-personalised-medicine, accessed 20.12.2023.

between universities and industry is maintained and enhanced, such as Wetsus which is recognized as a top-level institute warranting long-term government support as well.[13] Another example is UG offering scholarships for researchers to do work in the interdisciplinary Schools for Science & Society, named after famous Groningen scholars: energy transition and climate adaptation (Wubbo Ockels); healthy ageing (Aletta Jacobs); digital society, technology and artificial intelligence (Jantina Tammes); and sustainable development (Rudolf Agricola).[14] Setting up these schools as collaborative units outside the disciplinary schools is an interesting development to further research on its effect upon inclusiveness and anticipation of this university. Entrepreneurial ecosystems generate unique interactions in the sense that entrepreneurs do not gravitate toward entrepreneurial ecosystems in order to "learn the ropes" of a given industry or technology (Cao, Shi, 2021), but rather, they do so to become more effective in organizing their ventures for start-up and scale-up (Spigel, 2016). Depending on the strength of the entrepreneurial identity, culture and competence within the university, it is possible that the ecosystem around it will be functioning differently.

There is, therefore, a certain interdependency across the dimensions: due to a lack of anticipation, lacking financial resources from the university may be compensated through the inclusion mechanisms, while the lack of identity as an "entrepreneur" may be stimulated though the mobilization of responsiveness and anticipation of impact. Through engagement in entrepreneurial projects at the ecosystem level, university staff may have an opportunity to develop their capabilities and formulate their own attitude toward entrepreneurship, making it more likely for them to consider entrepreneurial activities in the future.

Discussion and Conclusion

Decades of efforts to include entrepreneurship as a third mission of universities have revealed many unresolved tensions (Qiu et al., 2023). In our examples, as well as in the literature, we see that this is not only so in developing economies – in countries such as Brazil, Russia, India, or China. In so-called developed economies like the Netherlands and elsewhere in Europe and America such variance and tensions occur in the realization of the third mission as well.

Answering questions that ensure anticipation, reflexivity, inclusion, and responsiveness in the decision-making processes of university strategy can help resolve some of them. However, these four dimensions of responsible academic entrepreneurship development need to be supplemented with theories on their respective content, such as entrepreneurship theories and models. Further exploration is needed to understand how these dimensions can guide university development, considering the multi-level characteristics of socio-technological developments (Rip, Groen, 2001). Furthermore, we showed that certain institutional and cultural issues may lead to dysfunctional processes in building the third mission. Not reflecting on these dysfunctional processes while developing policy will likely lead to failure of that policy.

Anticipation helps formulate the core positioning and development strategy of the university: how it sees the future and how it aims to engage in it. To effectively integrate entrepreneurship, universities should answer the policy questions that allow them to anticipate future technological developments: What areas are going to receive priority consideration and what resources can be devoted to their development? Which resources are becoming available? What is the horizon of planning? Which actors other than the university can gain benefits from this development in a legitimate way? Can these actors be involved in the process of university? If the answer is positive, this may lead to the institutional entrepreneurship of the university in its ecosystem.

Reflexivity requires asking questions regarding the centrality, type, and agents of entrepreneurial activities within the university. Are there sufficient opportunities to engage in applied research and eventually the application of the research and seeing that it makes its way onto the market? Did the university leadership ensure a portfolio of career opportunities across research, education, and commercialization? Do these criteria reflect the university strategy and policy? Are they aligned at the individual, department, and strategy levels? Oftentimes, academic entrepreneurship is evaluated using such indicators as the number of spin-offs and their performance indicators, such as sales or employment generated (Qiu et al., 2023). Yet, such evaluations are only properly reflecting the role of the academic institutions that are fully engaged in the commercialization process (Takata et al., 2022). Meanwhile, majority of the academic institutions will find themselves on the spectrum between the development of technology and participation in product development (Robinson et al., 2007). To develop the ability and willingness to act entrepreneurially, several activities forming a logical chain of events supporting the growing capabilities of the participants are needed (Costa et al., 2020) and must be evaluated separately.

Inclusion in its turn ensures shared agency and responsibility for the different stages of the technology, product, and business development required to commercialize the knowledge with the partners outside of the university walls. The high number of stakeholders within and around the university may represent a challenge as soon as resources are moved from one activity to another (Rasmussen, Borch, 2006). Hence, there is a need

[13] https://www.wetsus.nl, accessed 08.01.2024.
[14] http://www.rug.nl/about-ug/latest-news/news/archief2023/nieuwsberichten/1115-beurzen-rug-schools-uef?lang=en, accessed 09.01.2024.

for the clear integration of the different mechanisms of supporting entrepreneurship across the different stages of development (e.g., education, co-working spaces, incubators, lab facilities). The larger part of product and business development responsibilities lie on the shoulders of the ecosystem that is created around the universities. For the possibility of young startups to find their way toward the market, it is important that the ecosystem partners take active role in co-developing the technology toward the later readiness stages and its market introduction, even if the market is not in direct proximity (Fischer et al., 2022). In the specific processes of high-tech business development we see tensions (Groen et al., 2008), which may partly relate to the university. The question is, therefore, whether that can be compensated for by the entrepreneurship support officers of the where the ideas originated. Reflexivity and inclusion are key here: what part of the commercialization process is the university responsible for and how does it engage partners to take steps within and outside the university? How does the university navigate and stimulate these relationships? What sharing of value is to be expected for the university?

Finally, responsiveness makes the management ask questions about the sets of capabilities that are needed to manage both traditional and commercialization activities. In the context of a developing economy, it sometimes seems to be possible to jump generations of development. See the example of TIET – an Indian university collaborating with a globally leading company, NVDIA. This seems to allow the university to use the existing capabilities of staff in interactions with ecosystem partners and build stronger capabilities directly for research at the level of Industry 5.0, jumping over Industry 3.0 and 4.0, which took decades to evolve in developed countries.

In a developing economy, responsiveness is crucial for navigating both technological and political challenges. This requires strong leadership at the university itself and of the university in its local ecosystem. However, there are instances where university professors and leaders, despite adhering to accepted entrepreneurship principles, must concede significant benefits to the ruling elite of the country. This often occurs through the development of the university's third mission in a weak institutional framework that permits such dysfunctional processes.

The compensation effect can also be observed across the dimensions: the lack of financial or anticipation resources from the university may be compensated through the inclusiveness mechanisms, while the lack of an identity as an "entrepreneur" may be stimulated though the mobilization of responsiveness and attention to impact.

The current paper provides a framework that stimulates reflection on the functioning and governance of entrepreneurial universities, especially in the context of developing countries. This effort is not prescriptive or normative. Rather, we constructively inform an emerging debate on academic entrepreneurship across different contexts (Wigren-Kristoferson et al., 2022). Our framework draws upon the insights and experiences of responsibility and innovation as well as socio-technical theories and concepts (Stilgoe et al., 2013). Responsible innovation will inevitably be a dynamic concept implemented at multiple levels (Fisher, Rip, 2013), and so is the governance of academic entrepreneurship. While far from encompassing the whole literature, we rather seek to highlight and accentuate the issue of the embeddedness of entrepreneurship in different organizations and contexts. Seeing these processes through the lens of anticipation, reflexivity, inclusion, and responsiveness can help guide the needed alignment. Our analysis reveals that understanding the unique context of each university is critical in both developing and developed economies. While general mechanisms exist, their application varies significantly at a specific level. Recognizing examples of equifinality is crucial for advancing theory. The complexity of these processes allows for the same theoretical mechanisms to produce different outcomes in various situations. Meanwhile, different combinations of these mechanisms can lead to similar results, each providing a unique explanation for the observed outcomes. As such we call for further development of the complexity theory of social systems to better understand the equifinal pathways that generate socially productive entrepreneurial universities.

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