20th Triple Helix Conference

Governing new and traditional partnerships for innovation and development in the post-pandemic world

Florence
Italy

2022

BOOK OF ABSTRACTS

TRIPLEHELIX
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27 JUNE
29 JUNE 2022

TITLE

20th Triple Helix Conference
Governing new and traditional partnerships for innovation and development in the post-pandemic world – Conference Proceedings

BOOK OF ABSTRACTS ORGANIZATION

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PRESENTATION

This book is related to the 20th International Conference of the Triple Helix Association, realized in Florence from the 27th to the 30th of June. The Conference hosted 22 ordinary sessions with 90 presentations corresponding to the abstracts of this book, out of 122 submitted abstracts. Indeed, the 90 abstracts are distributed between 14 sections corresponding to the main themes of discussion. Of course, many presentations touched upon more than one theme.

The Conference's program also hosted panel discussions of 12 special sessions and speeches and debates of 4 plenary sessions and 8 semi-plenary sessions. Materials concerning these other sessions can be retrieved at the Conference's website https://www.triplehelixconference2022.org/. Altogether, the sessions were a meeting ground of outstanding scholars, young researchers, policymakers, and practitioners, who helped illustrate, debate, and go deeper on triple helix concepts and experiences, with a particular focus on 'Governing new and traditional partnerships for innovation and development in the post-pandemic world' – the Conference's title.

The themes more connected to the main title revolve around a couple of frontiers in the reflections and initiatives of the global Triple Helix movement. The first one concerns the contemporary great challenges. The Covid-19 pandemic has profoundly affected the social, environmental, and economic system of the 21st century at the global level, further exacerbating the societal challenges faced by society in the pre-pandemic era. Climate change, social exclusion, and inequality are just a few of the wicked problems that need to be addressed and somehow mitigated, for example through initiatives aiming at the achievement of the sustainable development goals set by the Agenda 2030. The recovery plans from the pandemic impacts that have been prepared and are in a phase of implementation around the world include references to the need to increase innovation processes, and the adoption of system-based approaches to innovation are crucial for successful paths of recovery. Sadly, we must add to the list of global wicked problems those of peaceful international and geopolitical relations. The tragedy of war and troubled international relations interfere in various ways with green transitions and post-pandemic recovery plans and question the foundations, goals, and impacts of quadruple and quintuple helical processes for responsible innovation and social progress.

A second frontier concerns the building of constellations of collaborating partners, traditional and new helical actors, and their governance throughout appropriate collaboration mechanisms to develop novel solutions, manage barriers and difficulties, and reach well-being and sustainability. The variety of possible helical actors is growing. Hybrid features are to be found not only in intermediary organizations that drive innovation partnerships. We know that actors assuming partially the roles of the others are a signal of successful helical processes. The point is that hybrid features develop more and more, driven by different factors again related to the contemporary great challenges. This is quite clear, for example, when considering the relations between innovation partnerships and local and regional development under multi-level institutional frames and flows of material resources and knowledge. Last but not least, it is clearer than ever, under the threats and opportunities of the global scenario, the need of strengthening empirical analyses, comparisons, and evaluations of helical processes of innovation and partnerships within and between the Global North and the Global South.

We hope that you will enjoy the abstracts and contact directly with the authors in order to learn more about the works presented during the THC 2022. A new issue of the Triple Helix Journal is coming with the best papers selected. We invite you to participate at the XXI International Triple Helix Conference that will be hosted by La Salle – Ramon Llull University the last week of June 2023.

Good reading!

Marco Bellandi
2022 Conference Chair

Josep Piqué
THA President

27 JUNE
29 JUNE 2022

THEME 1: THEORETICAL FOUNDATIONS AND METHODOLOGICAL APPROACHES FOR TH RESEARCH

PLACE-BASED EDUCATION FOR REGIONAL DEVELOPMENT IN A TRANSFORMING WORLD

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The Covid-19 pandemic has affected economies and societies at a time of already deep structural transformations, driven by a number of challenges, including climate change and the need to define a new economic model more respectful of the environment, rising inequalities both across and within countries, and the manufacturing revolution, or Industry 4.0, which is creating new industries but also disrupting many existing sectors. In this context, new skills and knowledge are needed, to perform new jobs or old jobs which nature has changed. In addition, the structural transformations affecting industries are also impacting society and culture, and everyday life.

There is a close link between education, development and growth. A socially and economically sustainable development is based on the ability to organise people's skills, manual skills and critical judgement, and to transform them into value added, which is the true wealth of a community (Bianchi, 2021). Freedom and equality are the foundations of a growth based on the full deployment of those skills, abilities and capabilities, with which all citizens participate in the "wealth of the nation", especially in the current context of multiple and complex challenges.

Many studies have shown the importance of human capital as a factor of growth, at national and regional levels. This factor explains growth differences across regions (Cheshire and Magrini, 2000; Fingleton, 2004; Di Liberto, 2008, López-Bazo and Moreno, 2012). Education is important to a region's economy because school quality favours labour market productivity and earnings, which may have a positive impact on economic growth by favouring the multiplier effect (Chatterji, 1998; Bhatta and Lobo, 2000), and by improving firm creation within the region (Johnson and Parker, 1996; Kangasharju, 2000). Higher education institutions have an extensive role in the development of new industries, as highlighted by many studies on technological transfer and spinoffs (e.g. Grimaldi et al., 2020; Trippl et al., 2015). The importance of education has been highlighted particularly for the development of less developed regions. For instance, returns to education are higher in less-developed regions, both in terms of employment and wage increases (López-Bazo & Moreno, 2012; Di Liberto, 2008).

In addition, there is increasing evidence that education systems should be tailored to regional conditions and development level (Brasington, 2000), in other words, should be place-based. The studies of the OECD Directorate for Education and Skills show that countries with more decentralised education system where education is place-based have better results in terms of effective skill development.

This is particularly important in times of deep structural changes and multiple crises. Sustainable growth and development, from both an environmental and social points of view, require new technologies, new products and production processes. The transition to sustainable growth path requires new skills and knowledge, and education system have to be adapted or transformed for this to happen. For instance, Norwegian vocational education institutions and regional innovation systems have been shown to co-evolve with emerging technologies in terms of changed knowledge demand in industry, and this has prompted new education programmes (Lund & Karlsen, 2019).

This paper explores how place-based education systems can favour the transition to sustainable growth paths and how. In particular, it shows how the triple helix model can be broadened to encompass the whole educational system in order to favour regional inclusive development.

This work is realised within the UNESCO Chair project "Education, Growth and Equality" headed by Patrizio Bianchi at the University of Ferrara.

TRIPLE HELIX 'INFORMED' INDUSTRIAL TRANSFORMATIONS: THREE EXAMPLES IN AMERICAN HISTORY

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Three times in history an American president has successfully engineered a strategic development policy framework to meet an existential challenge consistent with triple helix thinking. The first was to build a production system to manufacture arms to defend the nation against the military threat of Great Britain; the second was to build and consolidate a socially inclusive industrial order based on democratic principles, free enterprise and science-based agriculture under threat from breakaway states and spread of slavery; the third was to create an industrial production system with the innovation capabilities to convert existing and drive new industries to supply the arms and technologies to win World War II.

President Roosevelt's Arsenal of Democracy strategy was to leverage American mass production with the creation of entirely new technologies and sectors. He created a public administrative apparatus and executive agencies to design and craft/institute a triangular policy framework, later described as a triple helix (Etzkowitz, 2002), coordinating governmental, academic and industrial spheres to leverage the distinctive capabilities of each for rapid and strategic industrial innovation and production. But it was not the first.

A century and half before, President Thomas Jefferson orchestrated the establishment of America's first engineering program by founding the US Army West Point Academy (McDonald 2004).[1] It led to the *codification of the new engineering principles* into a curriculum by which engineers could be educated en masse. West Point's engineering curriculum significantly influenced the creation of subsequent engineering departments at Cornell, Harvard, Yale, and other colleges.[2] For the first half of the 19th century West Point graduates were responsible for engineering the bulk of the nation's early railway lines, bridges, harbors and roads (McMaster 1951: 6; Endler 1998: 12; Brubacher & Rudy 1997).

President Jefferson's implicit triple helix mindset had a second, complementary policy with a defining impact. Jefferson championed the principle of interchangeability, the organizing idea of the emergent 'American system of manufacturing' as an alternative to the UK's 'craft' production system (Best 1990: Ch. 1). First implemented at the US government armory in Springfield, Massachusetts it entailed the introduction of product engineering as a methodology for breaking down every part into its requisite productive activities and subjecting each activity to simplification, elimination, improvement and/or mechanization.[3] The government armory's procurement program fostered the creation of the world's first machine tool industry district based on the diffusion of precision engineering practices itself a precondition for standardization and the later emergence and diffusion of mass production methods. The creation of the US Land Grant university system by President Lincoln with the passage of the Morrill Act of 1862 created an agricultural and an engineering university in nearly every state. It brought science and engineering to agriculture and established the partnership between agricultural colleges, the U.S. Department of Agriculture, and farmers, providing an extension service to every county in America combined with a national system of experiment stations.

It would be hard to overstate how much the Morrill Act contributed to a process that transformed American capitalism. The establishment in every state of an engineering university and an agricultural university empowered state governments to pursue development policy frameworks that localized America's science and technology infrastructure. In the words of Julia Wrigley (1986: 169):

> US corporate leaders promoted university training for engineers and helped design courses of study that produced the types of trained men they wanted; state governments obliged by underwriting vast expansions of the university system.[4]

[2]Congress formally authorized the establishment and funding of the United States Military Academy on 16 March 1802.
[3]See "A School for the Nation. West Point in the Making of America." Smithsonian National Museum of American History. http://americanhistory.si.edu/westpoint/history_1a.html. Retrieved 26 November 2016.
[4]The emergent principle of product engineering can be found in the first chapter of Adam Smith's *The Wealth of Nations* (see Chapter 4 above). It was, as if, turned into government policy in the Springfield Armory three decades later.
[5]In Britain the universities moved only very hesitantly into engineering education (Sanderson, 1972: 39-46).

But it was the external threat posed by the AXIS dictatorships to America that gave President Roosevelt the political legitimacy to create within the White House the executive governance powers heretofore the preserve of corporate cartels and monopoly banks. The nation's military defence as will ill-prepared for the challenge, but Roosevelt's economic policy agenda was not.
To address German's huge technology lead in weapon systems (*NYTimes*, cited in Zachary: 1999: 158), President Roosevelt created and put MIT's Vannevar Bush in charge of the Office of Scientific Research and Development (OSRD) in May 1941.

Massive resources were committed to create America's advanced technology weapons industry. Between 1941 and 1945, the OSRD directed 30,000 researchers and oversaw development of some 200 innovative weapons, including sonar, radar, the proximity fuse, amphibious vehicles, and the Norden bombsight, all considered critical in winning the war (Etzkowitz 2002; Zachary 1999). Total federal R&D expenditures increased over 15 times (in 1930 dollars) from $83.2 million in 1940 to $1,313.6 million in 1945 (Mowery and Rosenberg 1993: 39-40). It culminated in the creation of new enterprises and sectors, and the nation's first high tech industrial district in the Boston area triple helix brilliantly described by Henry Etzkowitz. It is the paradigm case.

The high-tech enterprises that emerged in the Greater Boston area are not conventional SMEs. These are companies that focus on technology development, but they also coordinate extended innovation process chains which can include direct and indirect access to government-funded and university-conducted basic research. In this way, the inter-organizational relations organized within and by each firm is a microeconomic variant of the triple helix of triangular inter-relations involving industry, academia, and government, established to design, develop, and create technologically advanced weapons during World War II.

My research purpose is to draw implications for locating triple helix innovation dynamics within a capability-informed, macroeconomics policy agenda to the inequality and climate change challenges of our times.

FACULTY'S MOTIVATION TO PARTICIPATE IN UNIVERSITY-INDUSTRY COLLABORATION-- EMPIRICAL ANALYSIS FROM CHINESE UNIVERSITIES

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China proposes to implement the innovation-driven development strategy. The implementation of the innovation-driven development strategy requires the full play of the innovation capabilities and cooperative innovation capabilities of various scientific and technological innovation entities in the whole society. As the "axis" institutions of knowledge innovation, universities have increasingly become an important force for the improvement of national and regional scientific and technological innovation capabilities. Among them, university- industry collaboration is one of the key paths for universities to play this important force. Although China's university-industry collaboration has achieved certain achievements, the results are not satisfactory. How to effectively promote university-industry collaboration has always been an important topic in the field of theoretical research. Previous studies have mostly explored the university-industry collaboration relationship from the medium and macro levels of enterprises, universities, and government, ignoring the research on the specific bearer of university-industry collaboration— the faculty.Existing studies have found that the production and differences in the benefits of many university-industry collaboration are closely related to the faculty, and individual faculty have an important impact on university-industry collaboration. This research starts with the "motivation" that can best reflect the initiative of faculty, tries to explore the motivation of faculty to participate in university-industry collaboration, and then puts forward countermeasures and suggestions to promote university-industry collaboration from the "motivation" level of individual faculty.

This study used a combination of in-depth interviews and questionnaires. In-depth interviews were conducted with faculty from Zhejiang University, Nanjing University, Southeast University, Shanghai Jiaotong University, Tongji University, etc. A total of 32 full-time faculty were interviewed in this study. These faculty come from the disciplines of information, machinery, automobile, chemistry, chemical industry, environment, materials, civil engineering, etc. The selected faculty have rich practice and knowledge in university-industry collaboration. On the basis of in-depth analysis of the interview data, a questionnaire was designed. The respondents of the questionnaire were faculty with strong academic research ability and rich experience in university-industry collaboration. In this study, paper questionnaires were sent, tracked and recovered one-to-one by mail. A total of 125 questionnaires were recovered, 104 were valid questionnaires, and the questionnaire effectiveness rate was 83.2%. The scale uses a 7-level Likert scale.

Through the question "What is your motivation for participating in the university-industry collaboration?", the interviewed faculty were asked about their motivation for participating in the university-industry collaboration, and their answers were transcribed into texts, and the texts were coded with the help of Nvivo software using the content analysis method, and finally concluded that the interviewed faculty talked about six types of motivation.
(1) Promote research.
(2) Get funding.
(3) Enhance honor.
(4) Cultivate students.
(5) Fulfill social responsibility.
(6) Pursue interest.

Combined with the results of existing research and interviews, this study designed items with 32 measurement variables. By adopting the method of factor analysis, six motivations for faculty' participation in university-industry collaboration are obtained, which are: Promote research, Get funding, Enhance honor, Cultivate students, Fulfill social responsibility, Pursue interest.

According to the results of factor analysis, different items are classified into six motivation factors, and the scores of each sample on the six motivations can be obtained by arithmetic average, and finally the scores of all samples in each motivation are calculated and averaged, the average score of all samples in each motivation can be obtained. It can be found that there are certain differences in the motivation of Chinese university faculty to participate in university-industry collaboration. The highest score is "fulfil social responsibility", with a score of 5.81; the second is "cultivate students", with a score of 5.51; the third is "get funding". Funding," scored 5.30; fourth, "promote research," scored 4.92; fifth, "enhance honor," scored 4.06; and last, "pursue interest," scoring 4.03. This shows that the motivation of Chinese university faculty to participate in university-industry collaboration is mainly reflected in fulfilling social responsibilities, cultivating students, and obtaining funds, while promotion of research, promotion of honor, and pursuit of interests are lower-level motivations.

According to the research conclusions, countermeasures and suggestions will be put forward from the level of relationship support, competency and autonomy.

Keywords: faculty; industry-university collaboration; motivation.

A COMPREHENSIVE MODEL FOR INNOVATION ECOSYSTEMS

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Researches on innovation ecosystems are mostly approached from the point of view of institution-oriented aspects, which typically focus on the structural elements of innovation systems. However, this perspective has limitations to describe a really functioning innovation system, as it does not take into account its complex nature of dynamics and the functional features.

Based on relevant researches, the complex dynamic, non-hierarchical systems are not only about finding the right composition of system elements, but also about understanding their relationships and interactions. In this concept, the question is not purely of defining the system frame and its boundaries, but of offering conditions for self-organization of the actors as the system is based on multiple interactions behaviours.

The authors run researches on relevant model of innovation ecosystems based on complexity theory principles. The purpose of the paper is to present a comprehensive innovation ecosystem model as a tool to understand and analyse such systems. This kind of perspective, based on complexity theory, takes into account not only the structural and the complex but also the dynamic feature of the innovation ecosystems. The basis of the presented model is the triple helix approach that establishes the basis structural elements through the key groups of players of an innovation ecosystem. Next to that, those functional areas have been identified which are relevant to high-performing ecosystems like science parks. The related researches are still in progress, but it is apparent that interrelations of the functional areas and the specific players behind them are key for the success.

In line with related theoretical and empiric researches, the origin of the innovation ecosystem matters, so the establishment stakeholders of the ecosystem and the basic strategy defined at the beginning are integrated parts of the model. As several researches pointed out, the physical environment of an innovation ecosystem also influences the development opportunities, so factors like geographical location and size potential are also factors to consider. The industrial or business environment an innovation ecosystem operates in, together the sectoral focus of the ecosystems are key operational characteristics for the analysis.

In its first part, the paper gives a general overview on complex systems from point of related conclusions on innovation ecosystems. Then, the preliminary of the authors in the subject are show, including the proposed innovation ecosystem model. The model features are described then and the proof of the concept is given according to the researches. An overview on the descriptive features of complex systems based on the referenced papers is given. As the outcome of the methodology of the processing the conclusions lead to the sum-up features derived from the analysed ones. As conclusions of the processing, statements have been made on further development of the already existing model of the authors.

Finally, the next steps of the model development are outlined and advices are concluded for application of the model in the practice and in further researches. This way, the simple model of triple helix and the complexity approach as a view for modelling the real world, are combined to outline a comprehensive model for innovation ecosystems.

QUADRUPLE AND QUINTUPLE HELICES: A SCIENTIFIC PRODUCTION OVERVIEW

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The interactions between different institutional agents form the basis of the triple helix model (Carayannis & Grigoroudis, 2016). These interactions can favor regional development and provide organizations with more knowledge-dense products (Etzkowitz, 2013). The triple helix model proposed by Etzkowitz and Leydesdorff in 1995 suggests that the interaction between academia, manufacturing, and government improves the conditions for innovation in a knowledge-based society (Capetillo et al., 2021). This model is dynamic because it alters the spheres of management, being those bilateral or trilateral, when each actor has its role clearly established for the promotion of innovation (Carayannis & Grigoroudis, 2016). Discussions, studies, and applications of the triple helix model subsidized its evolution with the emerging new models being called quadruple helix and quintuple helix. The quadruple helix model presented by Carayannis and Campbell in 2009 indicates the integration of the civil society, providing collective interactions and the exchange of knowledge throughout four subsystems: teaching, economic, political, and civil society. This model establishes that the development of innovative products, services and solutions can happen with the participation of the user, who, in addition to acting in the process, can propose new types of innovation, thus connecting them with the main stakeholders in the process (manufacturing, academia and government) (Carayannis & Grigoroudis, 2016). The model allows for the emergence of a new perspective of society and democracy and demands there to be a shared development of the knowledge-based economy society, to support, strengthen and advance the production of knowledge itself, in form of research, and its application, as in innovation. (Carayannis & Campbell, 2021). In the quintuple helix model, presented by Carayannis, Barth and Campbell in 2012, environmental problems are interpreted as opportunities to boost the production of knowledge and the creation of innovations, establishing a relationship of mutual gain between ecology, knowledge production, and innovation, establishing a synergy between its agents (economy, society, and democracy) (Carayannis & Campbell, 2021). In this way, research involving the quadruple and quintuple helix models can contribute to innovation and regional development. This research aimed to answer the following question: How widespread are the studies of these models? Thus, the objective of this research is to map the scientific productions on the interactive quadruple helix and quintuple helix models. It is a bibliometric study based on the *Knowledge Development Process Constructivist* (Proknow-C) method, which establishes a structured process to carry out research on a given topic (Ensslin, Ensslin & Pinto, 2013). Proknow-C is composed of four main steps: selection of the bibliographic portfolio; bibliometric analysis of the bibliographic portfolio; systemic analysis of the bibliographic portfolio; and elaboration of the research goals. For this research, the first two steps of the method were used. Initially, a search was performed in seven databases (*Institute of Electrical and Electronic Engineers, Emerald, Scielo, Science Direct, Scopus, Web of Science* and *Wiley*) using the following search terms and boolean operators: ““quadruple helix” OR “quintuple helix””. With this strategy, 729 articles were found. Based on the established filtering criteria, such as duplicity, adherence to the title and representativeness by citation, 622 articles were dismissed, resulting in 107 selected for full further reading to verify their adherence to the research. After reading, 58 articles were eliminated, leaving 49 to compose the bibliographic portfolio of the research. The analysis showed that these articles were published between 2008 and 2021. The growing interest in the topic can be observed due to the number of publications in the years of 2020 with 17 articles, and of 2021 with 21 articles. These 49 articles add up to a total of 8,096 citations, out of which 1,735 citations belong to a single article. The most represented journal was the *Journal of the Knowledge Economy*, with 21 published articles, followed by *Sustainability* and *R&D Management*, both with seven articles. The other journals have a maximum of five published articles on the topic. The author with the highest number of articles published on the topics is Elias G. Carayannis, with 11 articles. The results obtained in the research allow us to answer the initial question regarding the propagation of studies on these models, which intensified in the years 2020 and 2021. It is concluded that the quadruple and quintuple helix innovation models have been gaining prominence in the scientific community, since they are comprehensive innovation models, capable of meeting the demands of society.

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CAN MARKETING BE USEFUL IN IMPROVING RELATIONS BETWEEN ACTORS ON THE INNOVATION SCENE?

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The main aim of this paper is to present and discuss the concept of science marketing. It will allow us to identify possible directions of marketing use by actors on the innovation scene. The paper is based on literature studies and, so, theoretical considerations will predominate here.

The essence of science marketing is management of knowledge flows between academia/scientific organizations on the one side, and three other actors on the innovation scene (the State, industry/business and civil society – according to the Quadruple Helix model) on the other side. The view-point of scientific organizations (universities and public research organizations, PROs) predominates in this paper.

Science marketing is de facto a new knowledge marketing. Contemporary knowledge marketing should be a target, relationship marketing using the Internet as an important technical tool.

There exist two main varieties of science marketing: (a) public science marketing (PSM) and (b) science-to-business marketing (S2B). Different goals (dissemination or commercialization of results of an R&D project) and different audiences impinge on the choice between two dissimilar sets of instruments characteristic of the two kinds of marketing. Moreover, a form of a new science product (a physical good, a service, an idea, a concept, a model, or information) also has a big influence on this choice in practice.

Marketing thinking and use can support the communication actions undertaken by scientific organizations and leading to knowledge dissemination. The addressees are then the State/government and civil society. In this case, we speak about PSM. In the case of communication leading to knowledge commercialization, the addressees are industry/businesses. Then we talk about S2B marketing that may be conducted within the so-called University-Business Cooperation (UBC).

There are at least seven characteristic features of marketing thinking:

- Marketing thinking starts ‘from the end’, that is, from a (potential) customer; in other words, from the market. So, the first question is not ‘What can we offer to whom?’ but ‘To whom can we offer what?’ Therefore, a segmentation of the science environment should precede marketing actions.
- What is important is not only the product or service offered, but also how it is offered; moreover, a digital version of a product is increasingly needed nowadays.
- In marketing, a service is treated in the same way as each product but is non-materialized.
- As a matter of fact, an organization offers not a product/service as such, but its utility value (shortly, value) determined by its usability for a potential user.
- Brand as a marketing tool is equally important as product/service *per se*.
- Organizations often engage potential users/customers in the development process of new products, sometimes from the very beginning. This constitutes a value co-creation with clients, which is one of the features of relationship marketing.
- A sign of the times is the close cooperation between researchers and designers, on the one hand, and marketers, on the other.

Thanks to the above principles, marketing thinking and use can improve science relations not only with the business sector but also with the other actors playing on the innovation scene.

A quite long list of advantages (see the Table) confirms that the concept of science marketing is worthy of notice by those who deal with university-industry-government-society relations. However, an application of marketing theory here must be very cautious. Due to the listed contradictions, a use of marketing as a supportive tool may be relatively narrow, especially in science-society relations.

Table. The pros and cons of marketing.

Pros	Cons
Marketing facilitates a comprehensive and integrated approach to activities in the market	Marketing is a profit-orientation, and so marketing actions often are on the edge of law and non-ethical
Achievements in market segmentation may be highly useful for the identification and choice of target audiences	Persistent marketing, especially advertising and price manipulation, make many people's lives miserable
By assumption, a man and his needs are 'the apple of marketing's eye'	Aggressive marketing many a time brings about the prodigality of material resources
Marketing informs people about the new products that may turned out to be useful for them	The will to gain and retain a client 'at any price' results in excessive costs
Marketing supports interpersonal relationships between people and the organization's cooperation with stakeholders and clients	Values offered by marketing sometimes differ from real values being acknowledged in a given society/ community
Marketing helps fulfil the gap between science and its business environment	
Marketing allows the measurement of effects of undertaken actions	

Source: the author.

Science marketing should be used especially in such countries like Poland where: (i) the vast majority of scientific production is being created in universities/PROs, (ii) the cooperation between science and business is very weak, (iii) there exists a low level of trust both in economy and in society, (iv) public procurement in the field of technological solutions is underdeveloped, and (v) public-private partnerships are developed very weakly.

All this confirms that researchers and science communicators should study and make better use of the tools used by marketing. They should focus more on marketing techniques if they want to be more effective.

TRIPLE HELIX AND INDUSTRY 4.0: A BIBLIOMETRIC ANALYSIS AND SYSTEMATIC LITERATURE REVIEW

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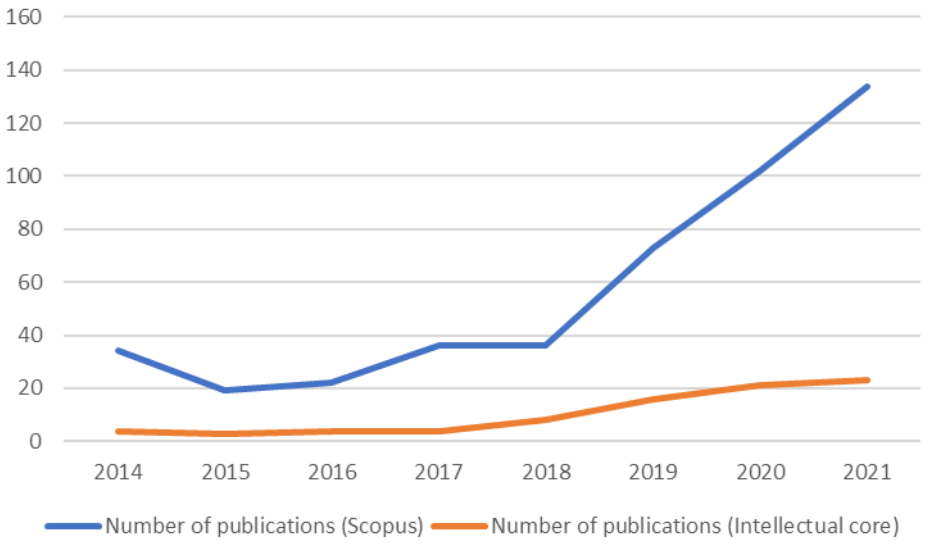
The importance of Triple Helix (TH) has been studied for more than two decades (Etzkowitz & Leydesdorff, 2000), with an increasing emphasis on the academic entrepreneurial paradigm (Etzkowitz *et al.*, 2000). Furthermore, more recently, the diffusion of Industry 4.0 (I4.0) technologies, with their influence on production and processes (Zheng *et al.*, 2019), has attracted researchers' attention. In this scenario, the aim of this paper is to provide a literature review at TH and I4.0 intersection.

We performed a bibliometric analysis for analysing the structure and the dynamics and helping with science mapping (Zupic & Čater, 2015). We used bibliographic coupling (BC) (Kessler, 1963) to emphasise the research communities, and co-citation (CC) analysis (McCain, 1990) for understanding the theoretical roots.

English scientific articles (2014-2021) were collected from the Scopus database as follows: ((TITLE-ABS-KEY ("triple helix") OR TITLE-ABS-KEY ((acad* OR univ*) AND (govern* OR publ*) AND (industr* OR compan* OR firm*)))) AND (digit* OR "Industry 4.0" OR i4.0 OR fourth) AND (LIMIT-TO (SUBJAREA, "BUSI")) .

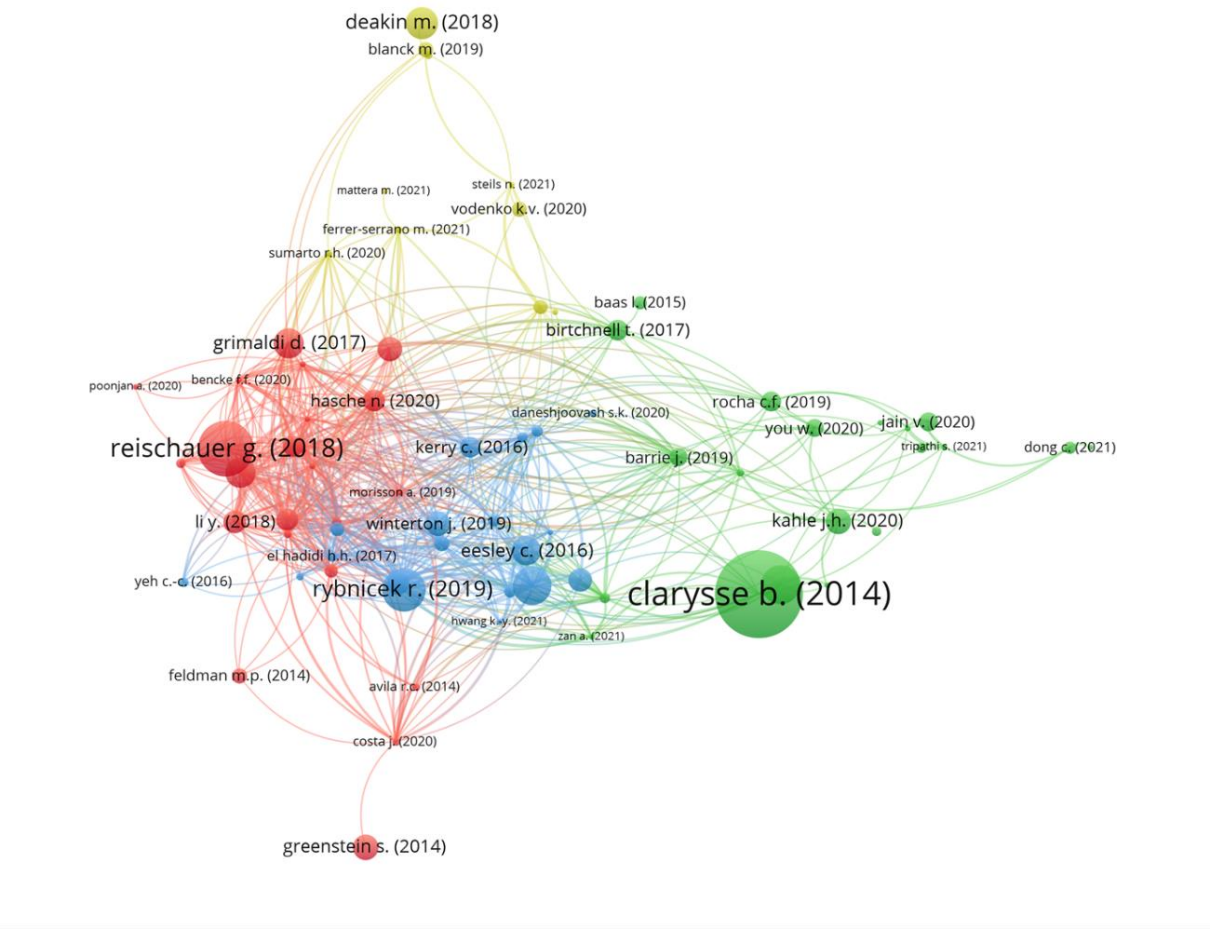
We obtained 746 documents, reduced to 456 using ABS. We analysed titles and abstract, ending with an intellectual core of 83 publications.

Figure 1 Trends: total publications (filtered by ABS) and intellectual core.



For the BC (Figure 2) we used the full-counting method, obtaining 4 clusters (minimum size: 10).

Figure 2 BC.



The first cluster (red, 23 papers; timeframe: 2014-2021) focuses on n-helices, education and efficiency. The second (green; 20; 2014-2021) deals with ecosystems and business models (BM), being instead more heterogenous. Both are coherent with I4.0 and TH. Cluster 3 (blue, 19; 2016-2021) focuses on academic-entrepreneurship and university-industry relations. The fourth (yellow, 10; 2018-2021) deals with smart cities and sustainability. The connection between this cluster and the others are weaker, furthermore relations amongst its papers are less tight than clusters 1 and 3.

We performed a preliminary systematic literature review (SLR) of most cited documents of each cluster (Table 1).

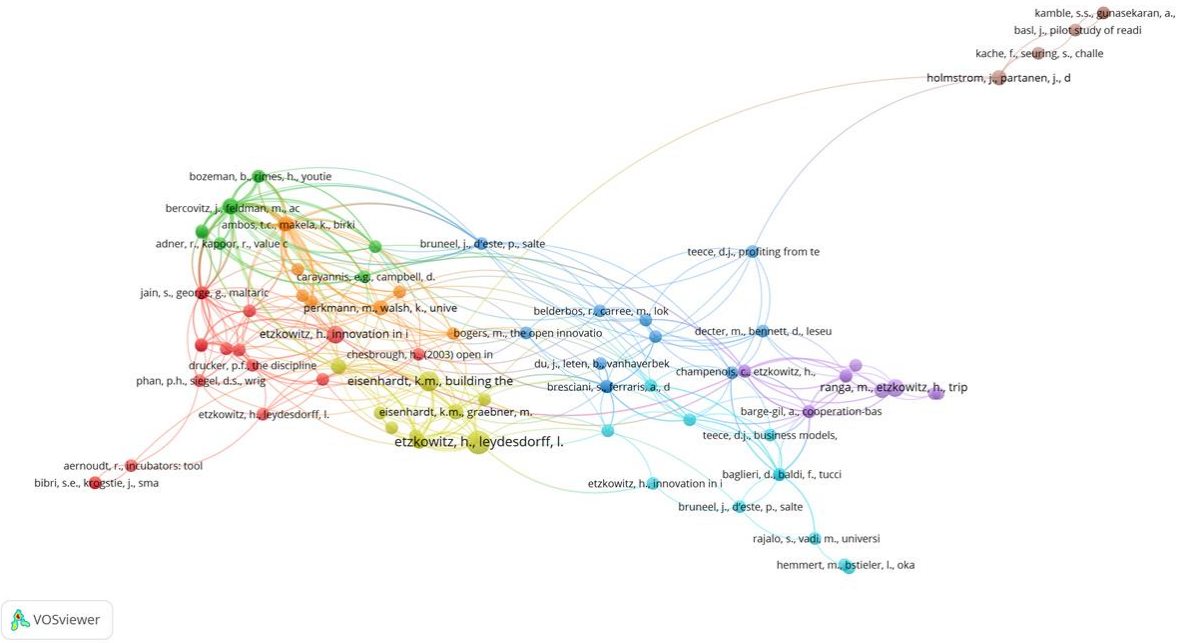
Table 1 SLR.

Papers	**Cluster**	**RQ**	**Theoretical lens**	**Methodology**	**Main findings**
Reischauer (2018)	red	"innovation-discursive view to clarify the identity of I4.0"	Innovation discursive view	Case study	"Consider I4.0 as policy driven innovation discourse in manufacturing industries that aims to institutionalize innovation systems that encompass business, academia, and politics."

Clarysse *et al.* (2014).	Green	"existence of a relation between knowledge and business ecosystems"	Ecosystem analysis	Network analysis	knowledge ecosystem is well structured and concentrated. No presence at the local level of the business ecosystem.
Rybnicek and Königsgruber (2019).	Blue	"What factors influence the success of a collaboration between industry and universities?"	Rigorous methodological approach for understanding the industry–university collaborations.	SLR	New conceptual model composed by generic collaboration, factors, and moderators.
Deakin and Reid (2018).	Yellow	Synthesis of the literature about smart cities (TH perspective)	Interdisciplinary approach to Smart cities and TH	Literature review	Analysis of the critical insights of smart cities.

We also performed the CC analysis (Figure 3): full counting method, cited references as units of analysis, minimum citations 2, with a total of 6227 cited references. Of these, 98 references matching the threshold obtaining 8 clusters.

Figure 3 CC analysis.



Cluster 1 (red; 16; 1998-2018) analyses the micro-determinants of academic entrepreneurship and open innovation. Cluster 2 (green; 12; 2000-2015) deals with academic spin-offs and the discovery of opportunities by academics. Cluster 3 (blue; 12; 1986-2019) underlines the importance of partner selection, collaborations and partners' peculiarities. Cluster 4 (light green; 11; 1989-2019) is more heterogenous, including case studies and n-helices articles. It might be the theoretical root of the red cluster in the BC. Cluster 5 (violet; 11; 1989-2019) deals with the dynamics of TH, considering the factors influencing and changing how the actors of TH relate to each other. Cluster 6 (light blue; 11; 2002-2019) is about BMs and it might be related to the green cluster of BC. Cluster 7 (orange; 10; 1993-2019) deals with promotion, licensing, and marketing and, consequently, the valorisation of innovation. This could represent the theoretical roots of blue cluster in BC. Cluster 8 (brown; 10; 2014-2018) is about supply chain and maturity models. Hence, trying to individuate the theoretical roots, we can enlighten: entrepreneurship and innovation (clusters 1 and 2), development of relations and their typologies (3 and 5), value creations of n-helix relations (6,7 and 8).

From this preliminary analysis, we can advance some first conclusions: the literature about TH and I4.0 is still at its early stage; instead of considering the whole facets of I4.0 that contributes to the breakthrough effect of the paradigm

4.0, the literature including TH focuses on specific aspects (*e.g.* related to the technology itself, or to the policies). Hence it is still missing a comprehensive analysis of the whole I4.0 paradigm and TH.

The next steps would be to include a deeper SLR, together with a refinement of the analysis already performed.

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NEO-TRIPLE HELIX MODEL OF INNOVATION ECOSYSTEMS: INTEGRATING TRIPLE, QUADRUPLE AND QUINTUPLE HELIX MODELS

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This paper proposes the neo-Triple Helix model of innovation ecosystems by integrating the of Triple, Quadruple and Quintuple Helix models, inspired by Lewontin's gene, organism and environment Triple Helix metaphor. The model considers innovation ecosystems evolved through interactions between 1) innovation dynamics (or genes), 2) social structures and 3) the natural environment. The systems include two-layer triple helix interactions (or triads): university, industry and government at the gene level, and innovation genes, social structures and the natural environment at the system level. Innovation dynamics are conceptualised by integrating the neo-institutional and neo-evolutionary perspectives of the Triple Helix model. The dialectical relationships between innovation genes, social structures and the natural environment are primarily explained using aspects of the Quadruple and Quintuple Helix models. The neo-Triple Helix model clarifies debates on different helix innovation models, advances helical approaches through synergy building and can guide empirical research and policy design on innovation ecosystems.

My elaboration of the model meets the three criteria for developing an optimal theoretical approach to innovation ecosystems that Cai and Lattu (2021) has identified by referring to some influential scholarly works.

First, Lundvall noted, 'what qualifies as a good theory of innovation is not carved in stone but has to evolve as a result of changes in society and our attempts to understand these challenges' (Fagerberg et al., 2013, p. 7). The evolution of helical approaches, from the Triple Helix to Quadruple Helix and then to Quintuple Helix, somehow reflects scholarly efforts to capture new changes and emerging challenges in the knowledge-based society. By integrating insights of these helical approaches, the New-Triple-Helix model is developed to provide a conceptual framework for advancing our understandings of the contemporary society for sustainable innovation.

Second, when developing a theoretical/conceptual framework, one must avoid being over-complicated in its analytical foci. This concerns Occam's razor principle, which advocates including complex constructs only if essential (Braithwaite, 2017). The Triple Helix model considers triadic interactions as an Occam's razor principle; the complex interplays between innovation actors are simplified according to Simmel's social geometry of triadic interactions (Cai & Etzkowitz, 2020). The Neo-Triple-Helix model also focuses on the triadic interactions but uses a different analogy (Lewontin's Triple Helix in biology) to identify the three helices: Innovation genes, social structures and the natural environment. Within innovation genes, the Triple Helix DNA is also based on triadic interactions.

Third, the theory of innovation ecosystems deals with the conditions and mechanisms fostering sustainable innovation, which consists of environmental, social and economic dimensions (Elkington, 1998). The Neo-Triple-Helix model explains dialectical relations between the key components in innovation ecosystems, i.e., innovation genes, social structures and the natural environment, which respectively address sustainable innovation in economic, social and environmental dimensions.

My conceptualisation of Neo-Type Helix model of innovation ecosystems helps resolve a dilemma in building synergies between Triple and Quadruple (Quintuple) Helix models: While integrating the two supplementary models could potentially provide a useful analytical tool for understanding the mechanisms of innovation processes in contemporary society, it is challenge to integrate them due to their different theoretical orientations (Cai & Lattu, 2021). The Neo-Triple-Helix model largely keep the merits of both Quadruple/Quintuple Helix and Triple Helix at the same time: being 'flexible enough to incorporate emerging factors on the one hand' and 'adhering to the Occam's razor principle on the other' (Cai & Lattu, 2021, p. 18). Moreover, the New-Triple-Helix model advances existing helical approaches to innovation in three aspects.

First, it answers a question hotly debated in innovation studies: How is the triple helix model different from an innovation system? In the second edition of *The Triple Helix book*, Etzkowitz and Zhou (2017) directly respond to the question by arguing that the Triple Helix thesis goes beyond innovation systems theory, but their explanations of the differences between Triple Helix and innovation systems remain abstract (Cai, 2020). In their recent article, Zhou and Etzkowitz (2021) assert that the Triple Helix, as a universal model, serves as a spiral tool to develop an innovation system and 'can be used to address issues in micro, meso and macro levels' (p.3). In line with their thinking, the Neo-Triple Helix model further distinguishes the Triple Helix model and an innovation (eco)system by conceptualising the former as a Triple Helix DNA (constituting innovation genes) and the latter the innovation ecosystems consisting innovation gens, social structures fostering sustainable innovation and the natural environment.

Second, when conceptualising innovation genes, I have critically reflected and integrated Etzkowitz's neo-institutional perspective of Triple Helix and Leydesdorff's neo-evolutional perspective of Triple Helix. The integration of the two perspectives helps better understand how Triple Helix spheres and Triple Helix functions make up Triple Helix spaces. It also makes it possible to operationalise or measure 'take the role of the other', which can hardly be grasped in empirical research. The measurements include not only Leydesdorff's method of measuring Triple Helix synergies but also other approaches, such as the one measuring how efficiently the Triple synergies are achieved (Jovanović et al., Forthcoming).

Third, the Neo-Triple Helix model further explains Carayannis and Campbell's (2021) proposition 'the Quadruple Helix integrates and contextualises the Triple Helix, while the Quintuple Helix integrates and contextualises the Quadruple Helix (and the Triple Helix)' (p. 3). Specifically, the Neo-Triple-Helix model simplifies the complex Quintuple Helix innovation ecosystems, in which Triple Helix and Quadruple Helix are embedded, as Triple Helix interactions between innovation genes, social organisms and the natural environment. The relations between innovation genes and social structures account for how the Quadruple Helix integrates and contextualise the Triple Helix. The relations between social structures and the natural environment account for how the Quintuple Helix integrates and contextualise the Quadruple Helix. The relations between the natural environment and innovation genes account for how the Quintuple Helix integrates and contextualise the Triple Helix.

Keywords: Triple Helix; Quadruple Helix; Quintuple Helix; Neo-Triple-Helix; Innovation systems; Sustainability; Civil society; Natural environment.

THE TRIPLE HELIX RELATIONSHIPS: A PARADIGM FOR FUTURE STUDIES AND TECHNOLOGY FORESIGHT

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For about two years, social and political institutions around the world have been investing all available resources and working on the implementation of recovery plans and tools (think of Next Generation EU) to face the social, economic and cultural effects of the pandemic and to make the planet greener, more digital and more resilient.

In this frenetic work of rebirth, there is naturally a greater effort and a greater desire to ensure a better future for the next generations; at the same time, however, a bitter reflection also emerges on the fact that the pandemic has caught us completely unprepared, discovering all our fragility.

Therefore, it is necessary to ask ourselves about the mistakes made and the lack of reflection on the consequences of our actions: why have we continued to exploit natural resources wildl? why have we continued to use polluting products? why have we abused technologies? why didn't we invest in smart working policies before? How will companies and institutions organize themselves to face the post-pandemic without having to go back to “the before"?

These questions, and many others, re-propose the need to think about the future, from a long-term perspective that knows how to interpret the signals and help design more resilient policies in the face of systemic shocks: in other words, today more than ever, it is necessary systematically and synergistically study the future. A study that becomes a need (Barbieri Masini, 2012) especially in periods of change, and this is all the more true the more the social chance will be sudden and the more turbulent the systemic complexity (Luhmann, 1990). Studying possible futures is also a choice that every person or society must make in the present: society can and can be described not only through its past history but also through its future projects (Berger, 1964). Looking to the future through studies is, then, a way of thinking because the future is already part of our life in the form of anticipation of the future itself.

On the basis of these statements, the aim is to analyze how the Triple Helix relations (but also those of quadruple and quintuple) can be a candidate to be a paradigm of future studies and technology foresight, in the systemic attempt to observe the future of science, technology, society, economy and their interactions in order to promote social, economic and environmental benefits (Tegart, 2003)

The systemic structure of the model, its internal dynamism, the monitoring action and the feedback mechanisim - without which the same general system is missing, so much so that speaks of a teleonomy of the system - (Paparella, 2014), constitute the fundamental prerequisites for talking about spaces of knowledge and anticipation of the future useful for helping to stabilize systemic solutions, otherwise unstable (Dubois, 2000; Leydesdorff, 2008).

From this perspective, the forecasting process within the Triple Helix would be connected to the broader relational and communicative processes, which are crucial for:
- the dissemination of sustainable innovation,
- but also, for the construction of the same advances on technology,
- for the development of theoretical reference paradigms for anticipation processes,
- and for the same decisions relating to the choice and use of methods (Arnaldii, 2010: 130).

THE INHIBITORS TO THE COMMERCIALIZATION OF UNIVERSITY INVENTIONS

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While a considerable body of literature investigates individual and firm-level characteristics associated with the success of university spinoffs, recent work emphasizes the importance of the context to entrepreneurial innovation (Autio et al. 2014). Previous literature highlighted the presence of inhibitors pertaining to academic entrepreneurship and, more indirectly, to university-industry technology transfer (TT) (Ankrah and AL-Tabbaa, 2015; Ramos-Vielba et al., 2016).

From this, it has emerged that one of the barriers to Technology readiness scale (TRL) enhancement and to the effective commercialization of research based inventions (RBIs) is a lack of funding sources that allow inventions to be developed to a point at which they can be commercialized successfully (Benner and Sandström, 2000; Lockett and Wright, 2005; Munari et al., 2016). Yet, it is not clear which factors are most prevailing among such inhibitors, neither which relation exists between them. In order to explore the emergence of patterns concerning the inhibitors we relied on the adoption of an inductive and interpretative approach (Edmondson and Mcmanus, 2007). Our main informants were the applicants (i.e. professors and researchers) to an internal call for funding at Politecnico di Torino (Italy).

Apart from direct observations, we also collected data from documents and reports made available by the technology transfer office (TTO) to perform data triangulation (Patton, 2002; Yin, 2017). We accessed such data in the form of archival documents (in written and electronic form) and databases. We triangulated these data with interviews with the principal investigators (PIs) of the projects. We decided to choose the PI of each project as the key informant, because of his/her long-term experience in conducting research projects. During this stage, we analysed data from the interviews in order to identify the inhibitors to the development of RBIs. Each round of data analysis was characterized by three phases of coding through what is commonly known as the Gioia methodology (Corley and Gioia, 2004; Gioia et al., 2013). As suggested by Gioia et al. (2013), we managed first-order and second-order themes and aggregated theoretical dimensions into a data structure tree. In light of the theoretical background presented above, we identified three theoretical dimensions of inhibitors (i.e. structural, relational and cultural). Structural inhibitors concern recurrent problems that research teams face to increase the TRL of their RBIs. They also reflect policies, incentives and/ or resource allocation processes that create permanent obstacles to meeting such goals.

Structural inhibitors negatively affect the advancement of the TRL. Relational inhibitors refer to the problems academics have to face to build connections with other stakeholders, whose involvement is key for the development and commercialization of RBIs. These inhibitors, taken together, prevent researchers from reaching the stakeholders that could, in principle, introduce the right complementary resources needed to advance and commercialize RBIs.

Finally, cultural inhibitors refer to the problems that originate from the misleading beliefs that research teams have, or from their fallacy in interpreting and processing some signals from firms. When analysing the several hurdles faced by the research teams in transferring their RBIs to the market, we realized that not all of the three classes of identified inhibitors harmed the commercialization of RBIs in a direct way. Although we found a direct relationship for relational inhibitors, we recognized that both structural and cultural inhibitors had an indirect effect on the commercialization of RBIs (i.e., increasing the magnitude of relational inhibitors) and self-reinforced each other in a vicious loop.

THE TRIPLE HELIX MODEL EVOLUTION: A SOCIAL NETWORK ANALYSIS

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Presented by Etzkowitz and Leydersdoff (1995), the Triple Helix (TH) model has been used by researchers and public managers (Cai & Etzkowitz, 2020) to classify and analyze the interactions between actors in the university-industry-government spheres in innovation and development (Lee, Lee & Shon, 2020). According to Amaral and Messias (2020), the term TH does not refer only to a model but to a complex and dynamic network of studies, including conferences, an international association of academic researchers, scientific publications, webinars, among others. Cai and Etzkowitz (2020) supported this argument, claiming that studies on innovation environments based on the model are present in all continents. Currently, the interest of researchers in the subject is not limited to its application in innovation environments. There is also an effort to understand the epistemological propositions of Etzkowitz and Leydersdoff. In the literature, studies that present the state of the art are identified, such as those by Cai and Etzkowitz (2020), which gathers a systematic literature review, by Galvao et al. (2019) and Halilem (2010), and articles with bibliometric analysis of publications, such as of Amaral and Messias (2020). However, there are few articles that sought to understand the evolution of the theme from suitable methodologies for this, such as social network analysis (SNA) (Amaral and Messias, 2020).

In contrast to the scenario of the theme popularity, Cai and Lattu (2021) claim that there is a gradual transition movement, natural according to them, in replacing the use of TH as a theoretical framework with other models inspired by it. Thus, this study seeks to understand the evolution of the Triple Helix model using SNA as an analytical tool. Also, specifically, we sought to understand, based on the data obtained with the SNA, whether there are indications of a migratory movement of authors between theories, as defended by Cai and Lattu (2021).

The social network analysis technique was applied using CiteSpace software, based on data collected from the Web of Science collection. The sample consists of a total of 1122 articles published between 1995 and 2022 in indexed journals. From the resources available by CiteSpace, statistics related to the network number of nodes, density, modularity, silhouette, betweenness centrality, burstness, and the pennant diagram were collected.

In addition to the network's statistical data, the results indicate two trends within the TH literature. The first is a possible theoretical replacement by authors who study innovation systems in developed economy countries, whose focus has been changed from the TH model to the Quadruple Helix. The second is the continuity of studies based on the TH model by authors who study innovation systems in the least developing economies. Possibly, in the last, the focus is on the neo-institutional approach of TH while in the former, the neo-evolutionary approach is dominant (Cai & Amaral, 2021). Beyond that, it was possible to visualize the global collaboration network and indicate which authors and articles are currently impacting it. And finally, the SNA data provided an analytical expansion, allowing us to identify how articles published in each country cognitively impact authors from different locations.

As a limitation, the study was based only on the Web of Science database, which does not guarantee access to all published works on the subject. Researchers interested in expanding this study should consider including other databases of publications. A suggestion for future works is to deepen the analysis of cognitive proximities between countries, authors, and even specific publications, seeking to map the network in this analytical path.

Based on the results found, Triple Helix Association leaders should consider investing in promoting partnerships between authors whose analysis focus is on innovation systems in developing economies, particularly on the spread of the entrepreneurial university concept; and inquiry what are the demands for adjustments, from the authors whose research perspective focus is innovation environments in developed economies, providing possible adjustments to the TH model, preventing its obsolescence in this scenario. Cai & Lattu (2020) have discussed strengths and gaps in the TH and Amaral & Cai (2021) proposed a research agenda to model enhancement. Still, studies that use social network analysis to understand the evolution of the TH academic movement are scarce, and this article can contribute by filling part of this gap.

Keywords: Triple Helix; Social Network Analysis; Theoretical Evolution.

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THE SUSTAINABLE TRIPLE HELIX: OPERATIONALIZING THE SUSTAINABILITY AGENDA IN THE GERMAN NORTHERN BLACK FOREST NATIONAL PARK

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The key objective addressed is the altered agenda of environmental conservation and the new role of social sciences in place-based policy implementation. We critically discuss the adequacy of governance models provided by the triple helix for the operationalization of the sustainability agenda. The focus is on novel national parks which address the protection of nature and the integration of local stakeholders with diverse interests in times of climate change. For policy implementation programs, sustainable triple-helix (STH) is introduced as organizational model to facilitate the transformational path towards environmental, social and financial sustainability. The specific characteristics of what evidence based and participatory initiatives have as systems of decision-making and operation, are illustrated. The secondary data analysis of the empirical case of the establishment of the National Park Northern Black Forest in 2014, in a structurally and economically strong region, triggered by a coalition of Green Party and Social Democrats in the Bundesland Baden-Wurttemberg is used to support the discussion. The findings of the analysis indicate that the creation of protected areas and novel ecosystems need the social sciences, as well as the guidance of scientifically based expert knowledge. The new sustainably triple helix (STH) provides a governance model and a design for process management.

The sixth report of the Intergovernmental Panel on Climate Change (IPCC) provides evidence-based policy recommendations to support national governments in place-based policies. The main objectives lie in reaching the global targets of 1.5° Celsius and in the implementation of the United Nations Sustainable Development Goals including the Strategy of Implementing the Aichi targets of the Convention on Biological Diversity (IPCC 2021; IPCC 2021b; (Mace, Norris & Fitter, 2012). Dinerstein et al. (2019) propose a science-driven approach for saving biodiversity in pairing the 1.5-degree targets of the Paris Climate Agreement with a Global Deal for Nature (GDN) ´that targets 30% of Earth to be formally protected and an additional 20% designated as climate stabilization areas, by 2030, to stay below 1.5 degrees' (Dinerstein et al., 2019).

The recommendations challenge existing governmental frameworks and science-based eco-centric paradigms in environmental conservation (Sutherland et al., 2018) and propose a people centered-conservation approach of critical social science and capital driven conservation. This paradigm shift is the undercurrent of the debate in the diverse conservation and ecology community (Sandbrook *et al.*, 2019; Holmes, Sandbrook and Fisher, 2016) on how to reach the targets. While traditionally, environmental conservation proposes a protection of nature from human influence, because human impact and economic growth must inevitably end in land degradation and endangered wildlife due to unsustainable practices (Taylor et al., 2020; Hiss, 2014), *New Conservation* reintroduces human health into ecology sciences and emphasizes the value of nature and intact ecosystems for human wellbeing and survival (Sandbrook *et al.*, 2019). Consequently, environmental governance (Clement, 2021) suggests an intertwined future of environmental and socio-economic systems to anticipate climate change – a future which is only sustainable on the premise of equity, stakeholder participation and policy adaptation (Leach et al., 2018).

In this new view, place-based concepts do not only concentrate on regulating services like net prime production and carbon sequestration, but also comprise the valuation of provisioning ecosystem services like spiritual recreation, health, income and food provision, while local stakeholder integration and equal participation are early involved in the solution building. In this new approach, novel stakeholders with conflicting interests appear on the conservation agenda: Indigenous stewards, subsistence farmers or capital driven environmental entrepreneurs, citizens bring in local and market knowledge. They are expected to develop and implement more sustainable place-based policies and novel ecosystems (Peter & Michelle, 2012).

The translation of the new paradigm in environmental conservation into a socio-economic program is a proper domain of the social sciences (Leydesdorff, 2021) as it needs methods for interpretation of what things mean (social sciences) as different from what they are (biology). In our study we employ the sustainable triple helix (STH) framework (Etzkowitz & Zhou, 2006) as a method to analyze the second order selection mechanism, i.e. the socio-economical connotation of science in place-based developments. The STH governance model (Zhou & Etzkowitz, 2021) is characterized by an underlying paradigm of sustainability. The model constitutes a different design principle for the relation and selection of players and differs from the original Triple Helix focused which addressed technological innovation and economic growth in university. industry and government relations. The STH provides a pathway to implement ecological and socio-economic policies and align diverging interests and constitutes a functional approach

for the operationalization and application of knowledge in a framework that defines sustainability in the tradition of the Club of Rome (Schwarz-Herion, 2018). Furthermore, knowledge production goes beyond the innovative capacity of institutionalized science. It includes application of knowledge includes business models of circular economy and social entrepreneurship. Local innovation, open access and interpretation of scientific facts by experts, laymen, indigenous people, and local stakeholders are central elements of both concepts, New Conservation and Sustainable Triple Helix.

Both concepts new conservatism and sustainable triple helix address the challenge of implementation, transformation and changing order (Collins, 1992) and run on the premises of sustainability for system building and change. In our paper this is exemplified in the altered concept of National Parks from secluded places for the protection of pristine nature, which exclude and expropriate local stakeholders (ecocentrism), to an evidence-based ecosystem service concept designed and managed by local stakeholders within a new environmental governance framework (new conservation). It turns out that the new environmental policy of the IPCC unitedly erodes the primacy of science and challenges the institutionalized interrelationship of science, industry and government and places ecology policy on the research agenda of social science, political science and behavioral studies. The sustainable triple helix model stands for a concept that integrates society, and social and environmental sustainability at the same time and provides an approach for good governance.

CREATING A COOPERATION NETWORK AS A DIRECTION OF ENTREPRENEURIAL DISCOVERY PROCESS DEVELOPMENT. IMPLICATIONS FOR EU REGIONS

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Regional strategies of smart specialisation (RIS3) is a scientific concept around which activities in the field of innovation policies of EU regions in the financial perspective 2014-2020 have been concentrated. Its implementation requires an entrepreneurial discovery process (EDP) enabling the use of "entrepreneurial" knowledge (Gianelle et al., 2016) fragmented and dispersed fragmented and dispersed among different specialized entities belonging to the regional innovation system based on the Quadruple Helix model. Originally, the EDP was considered an element of the RIS3 concept, intended to identify areas of smart specialisation in the regions of the European Union. It was also intended to provide policy makers with information necessary for designing a Smart Specialisation Strategy, taking into account the dynamics of socio-economic changes (design phase) (Foray & Goenaga, 2013). With over time, during which the concept was widely implemented, a wider range of possibilities for its application was perceived (Rodríguez-Pose & Wilkie, 2015). There has been an evolution in the perception of the EDP's essence, which manifested itself in a move away from establishing entities solely for the implementation of specific short-term (ad hoc) tasks towards building complex and sustainable cooperation networks embedded in the regional innovation environment. This requires a holistic approach, taking into account the need to combine activities aimed at building management structures with activities leading to the strengthening of the social (and relational) capital of the region.

The aim of the article is to present a theoretical approach to the essence of the phenomenon and to present a model of cooperation network management based on a three-tier structure. It is based on the assumption that all activities undertaken for the benefit of conducting PPO can be located on one of the three levels (macro, meso and micro), and then the appropriate entities can be created based on the role they are to play. The principles of this model were defined during the project: *Improve the RIS3 effectiveness through the management of the entrepreneurial discovery process (Beyond EDP)* carried out from 2016 to 2021. They are included in a report prepared by representatives of the partner regions of the project *(How to deal with the main Entrepreneurial Discovery Process challenges. Synthesis report of the three taskforces on EDP Management as part as Beyond EDP).*

In addition, the article presents the results of a comparative analysis (benchmarking) of the various approaches to networking in the partner regions of the project, which provided data to allow it to be carried out. These include: Centre Val-de Loire (France) - project leader, Bourgogne Franche-Comté (France), Centru (Romania), Castilla y Leon (Spain), Östergötland (Sweden) and Lodzkie Region (Poland). The identified differences result from the specificity of socio-economic conditions (including the state of development of innovation environment). In particular, they concern: methods of engaging regional stakeholders, their role in the network, the specificity of network entities, the scope of activities undertaken and the challenges to be met to ensure continuous and effective implementation of the EDP.

The author is a representative of one of the project partner regions (Lodzkie Region).

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ON THE NAME CHANGING OF AREAS OF INNOVATION

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The name plays an important role in defining and differentiating a company within a category, as well as in building an organization's positioning (Aaker, 1996, Muzellec, 2003, Kotler, 2015). The classification of business name models by Muzellec (2006) and Schmeltz and Kjedlsen (2016) show that the names may have a more strategic or more institutional tendency, that is, they may aim for more differentiation or similarity, respectively, depending on the chosen name typology. This type of typology was applied in previous studies to conventional companies. However, from the 1950s onwards, more complex and collaborative structures emerged, the Science Parks and the Innovation Area (hereinafter the area of innovation - AOI) (IASP, 2017, UKSPA, n.d) composed of different entities (government, university and industry), each one with particular purposes, but which together sought synergies for greater robustness in terms of economic and innovative development of a region. Interestingly, our recent empirical studies have shown that the motivation for choosing names also claims similarity or differentiation in a category. However, it was also observed that in the short time span of this field's existence, there were already signs of name changes, depending on the channel to be used. In addition, it was noted that there is little research on how often AoI names change and why those organizations dedicated to innovation in certain regions change their names. Given that these organizations are often supported by extensive government policy and funding initiatives, and are considered vital to driving regional economic development, it is important to understand how their name affects their performance. In this sense, we propose the following research question: How do the names of areas of innovation evolve and why? Thus, the objective of this article is to uncover the mindset of leaders of AOI around the world, about the construction and evolution of their names.

This study will employ a quantitative approach, utilizing the database of the Innovation Association of Science Parks and Area of Innovation (IASP) which comprises the global population of AOI. First, we will seek to determine how many science parks have changed their name over the course of time. Following up on these results, each AOI which changed their name will be individually contacted through the auspices of the IASP to reveal the rationale and the process behind the change.

The research findings will make significant contributions to scholars and practitioners. On the one hand, this article sheds light on AOI research to understand the reasons for name change and whether there is a lack of concern in the correct maintenance of AOI names to help the positioning of the parks. Secondly, it also helps managers understand if the evolution occurs towards types of names with a more strategic or more institutional tendency.

This paper identified new insights into how AOI leaders create and change their names and sheds light on the theory, as it is the first time that the proposed model is applied to this type of complex organization, composed by actors of the Triple Helix, which is still relatively new. Secondly, it also helps managers understand the importance of thinking about the role of their organization's name in its long-term positioning.

While the research is still ongoing, in this paper we will contribute by helping the leaders of AOI to understand the impact of their name and branding on the perceptions of their stakeholders. We also will contribute by suggesting guidelines for leaders in order for them to change their organizations' name more strategically.

Given that these organizations often are supported by extensive government policy and funding initiatives and are perceived as vital to driving regional economic development, our next step is to analyze how the naming of an Area of Innovation affects its performance.

Keywords: Area of Innovation, Science Park, naming, branding, institutional theory, triple helix

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ACROSS DISCIPLINES, TO MAKE AN IMPACT.THE TECHNOLOGICAL IMPACT OF BOUNDARY-SPANNING RESEARCH PROJECTS

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Boundary spanning research is increasing recognition among scholars and policymakers due to its potential in generating novel and breakthrough scientific contributions. For over three decades, management studies have been investigating the consequences of spanning boundaries in different fields, such as strategy and finance (Bergh, 1995; Murray, 1998; Yang et al., 2014), innovation (Fleming, 2001; Hargadon 2002; Schilling and Green, 2011), entrepreneurship (Gartner, 1985; Kilduff et al., 2000). These studies have described boundary spanning as a strategy characterized by two main opposing dynamics. On the one hand, it allows to see connections across different domains: bridging disconnected knowledge spaces results in better and more creative ideas (Lo and Kennedy, 2015). On the other hand, it implies penalties: investing in multiple areas disperses competences and increases costs of knowledge integration and coordination (Bromham et al., 2016; Kotha et al., 2013, Leahey et al., 2016; Yegros-Yegros et al., 2015).

As far as boundary spanning in academia, previous studies investigated its effect for the scientific audience, disregarding how boundary spanning approaches are related to technology transfer activities. We, thus, intend to answer the following research question: *are boundary spanning research projects more likely sources of technological impact?* Combining a consideration of both the benefits and costs of spanning the boundaries of knowledge domains in conducting research, we argue that scientific discoveries stemming from *intermediate* levels of interdisciplinarity should have an advantage in generating technological impact, as compared to those generated from extreme levels of interdisciplinarity (either very low or very high). Moreover, we analyze the moderating role of the organizational context where boundary-spanning research is developed by focusing on the effect of the applied nature of the host institution of the project. In particular, we expect that scientific teams operating in application oriented institutions might have an advantage in turning the results of their interdisciplinary work into technological impact, since they operate in a context that is more accustomed to this type of research and they can therefore benefit from reduced coordination costs and difficulties of perception by the target audiences.

To investigate these issues, we examine the relationship between boundary spanning research projects, that integrate knowledge from diverse disciplinary fields, and their ability to generate technological impact. We focus on the context of the projects funded by the European Research Council (ERC), the most important funding agency for Frontier Research in Europe. We first identify the scientific publications generated by a set of 3,697 projects funded by the ERC, and construct project-based measures of boundary spanning by looking at the variety of disciplinary backgrounds of their scientific outlets. We then identify the set of subsequent patents citing those publications as relevant state-of-the art in order to capture the knowledge exchange process between science and technology (Azoulay et al., 2015; Callaert et al., 2014; Veugelers and Wang, 2019; Marx and Fuegi, 2019).

The results of our regression analyses document the existence of an inverted U-shaped relationship between the measures of boundary spanning and technological impact, consistently with our hypothesis. Although we did not find strong statistical support for the moderation role of contextual factors, in our regression analyses, we documented that in cases of low level of variety and more evenness portfolio, the research projects developed by applied research institutes are more likely to impact technology development than those developed inside generalist institutions.

We consider that the results presented on this study are relevant to improve the understanding about the impact of research projects on the development of new technologies.

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MICRO AND SMALL BUSINESS INNOVATION INDICATORS IN BRAZIL: A META-SYNTHESIS MODEL BUILDING

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Despite a large number of micro and small companies (MSEs) existing in the Brazilian market, the average quality of entrepreneurs in Brazil is low, highlighting the low qualification and low use of new technologies/processes, which can be confirmed by 98th position that Brazil occupies in the ranking of Global Entrepreneurship Index (GEI 20180. The lack of orientation towards innovation and even towards the management itself is noted. These are factors that directly and significantly interfere in the survival of MSEs. These companies represent around 98.2% of existing legal entities in Brazil, and 51.63% of the generation of jobs, in addition to contributing to 27% of the country's GDP.

This work aimed to propose a management model to assess the stage of innovation in micro and small businesses. This proposition occurred by identifying relevant indicators for the companies and the validation. Together with them, of those with the highest priority for innovation management.

This is an applied research of a qualitative nature that was structured in four stages: 1) present a theoretical literature review of the main themes involved, such as MSEs and innovation; 2) identify existing models and indicators for measuring the degree of business innovation; 3) build a general framework for comparing existing models and indicators, select indicators and propose a new meta-model for application; 4) validate and refine the meta-model from the application in MSEs. In the first stage, several documents collected in databases such as Web of Science were analyzed, enhancing the discussion of the importance of innovation and, in parallel, of the MSEs. To identify the models and tools for assessing innovation in companies, documents were collected from the identified models, namely: IM Maturity from North Carolina State University, the Barometer of Innovation, the Sawhney, Wolcott & Arroniz model, the model Valor Innovation Brazil Award, the SEBRAE's Local Innovation Agent Program (ALI) model, the Two Wheels Model, the PUC-Rio's Innovation Management Support Program (NAGI) model, among others. Then, a comparative table was built identifying the existing indicators in the models and allowing the construction of a meta-model based on the selection of common indicators. The fourth stage was split into two parts. The first was the practical application of the meta-model with selected MSEs. The field research was carried out throughout 2000 with 48 companies in the Southeast region of Brazil, in the sectors of commerce, industry and services, which participated in a survey conducted by the Post-Graduate Program in Administration at the Universidade Federal Fluminense. The second part was to collect the opinion of entrepreneurs about the indicators and the meta-model, allowing adjustments to be made and consolidating a tool with 44 indicators.

The research is theoretical, with a proposal for practical application of the generated indicators. From an academic point of view, an attempt was made to build a model for the management and assessment of innovation in micro and small businesses, bringing up the discussion on innovation in companies of this size. According to the businessmen's opinions, there is a low emphasis on intellectual property issues (considered of little relevance) and university-business interaction (considered relevant, but little practiced). Issues of access to capital and credit, taxes, employee training, were identified as relevant.

It was observed that MSEs consider innovation as a relevant topic in their organizational trajectories. In this sense, the central theme of this study fills the gap in the absence of a measurement instrument to measure innovation in MSEs, which have different characteristics and specificities from larger organizations. Such specificities impact its innovative performance and management, indicating the need for constant self-assessment to improve these results.

This research study's indicators and meta-model represent a unique character, from its conception to its first application and validation with active and active MSEs in the market. The study makes it possible to analyze the degree of innovation in companies concerning their profile and segments. The study results cannot be generalized to all Brazilian MSEs, but they bring clues for future research.

Keywords: Innovation; Micro and Small Businesses; Innovation Indicators; Innovation assessment.

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SOUTH AFRICA'S RESEARCH UNIVERSITIES - SOCIAL CONTRACT, THIRD MISSION AND COLLABORATION

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This exploratory set of case studies adds to the under-developed literature on the political economy of Africa's science systems as understood through the contract between science and society. The objects of study for this work are South Africa's five research universities, each with its own social contract and network of collaborators and collaborating institutions.

A general overview of the social contract for science is provided before attention shifts to the historic, political, industrial and social origins of what are colloquially known as the 'big five.' These institutions have played a specific role in social and political development. The big five have responded to social and economic demands in quite different ways, especially insofar as previous military/security imperatives were concerned, and most recently the high burden of disease that stresses the social fabric. This has been characterized as navigation twin imperatives - science for the state, and 'own' science as embodied in Polanyi's notion of the Republic of Science. The drift toward basic research, as demonstrated in the data of the annual Frascati Manual compliant R&D Surveys is noted and questioned.

Publication data for each of the five universities is analyzed to determine research focus, intensity, quality, and collaboration partners.

It will be argued that each university nestles in its own local system of innovation, while connecting to sectoral systems of innovation, and the wider invisible college of science. The sectoral system of innovation that addresses infectious disease displays the characteristics of a quadruple helix. Other sectoral system of innovations are of a triple helix type, with varying intensities among the triplet of actors. The Covid-19 Pandemic has stressed all institutions and has called on the country's research community to introspect and perhaps re-orient.

The case studies point to the existence of pockets of excellence that that operate at the research frontier. For these pockets more powerfully to impact requires openness: the willingness to import the best equipment and skills, retention and concentration of resources, and determination.
Attention is thus given to the interaction among innovation, industrial and immigration policy that bear on these possibilities, and in the case of the health sciences, the WHO 'One-Health' agenda, with prevention, treatment and care treatment informed by the quadruple helix actors.
Among other interventions this requires expansion and retention of talent. In PPP $ terms university researchers are well paid and this should attract peers from abroad. Yet barriers to inward migration prevent growth. The five research universities are the core of local and Sub-Saharan doctoral training, graduating thousands of international doctoral students, yet retaining in the order of 5%. The others go home, which is positive for the graduates, their families and countries of origin. South Africa's universities contribute to brain 'circulation,' not brain drain. The benefit to the science is largely unquantified.

On the innovation front, there have been important developments in the pharmaceutical industry despite weak links with the universities. Local and international investment allows for 'formulate and fill' of foreign licensed vaccines. For the universities to gain the depth and breadth of resources to engage in meaningful collaboration to bring a vaccine to market is a journey on a long and winding road, the more so as techno-nationalism, a reborn import substitution and localization agenda, and restrictions on international staff and students may obstruct. To enable deeper collaboration would require the declaration of a national mission to generate vaccines, a different emphasis in the social contract, and a well-resourced set of partnerships with the universities as a vital component.

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29 JUNE 2022

THEME 2: ENTREPRENEURSHIP EDUCATION IN THE CONTEXT OF TH APPROACHES

INSTITUTIONAL INNOVATION IN UNIVERSITY-BASED EXPERIMENTAL SPACES: THE CASE OF EDUCATIONAL LAB IN FINLAND

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It's been soundly argued that a university cannot (and doesn't have such a privilege to) be disentangled from a region or locality it's operating within and reliant upon. Thus, solving global or national issues in research and education should be synchronized with the university "third mission" – to provide an adequate level of response to local needs in terms of employment, business support and applicability of research. Even though academic revolutions were not that numerous in quantity, they imposed substantial structural and developmental transformations, both in terms of knowledge production, its preservation and subsequent dissemination. The necessity of resembling local communities' economic, legal, and social priorities has been unequivocally articulated and emphasized. These trends gave rise to the concept of Entrepreneurial University that has opened a runway for experimentation with novel dimensions of organizational transformation towards accomplishment of the university's top-up mission. This organizational transformation process could be conceptualized in terms of institutional innovation, which takes place within the university organization and nurtures its developmental periphery. A tangible example of such an institutional innovation process is the design of *experimental spaces* (Cartel et al., 2019) that are targeted at strengthening links between university education and external business priorities.

This paper focuses on processual and developmental dynamics of one specific joint initiative of Triple Helix institutional spheres in a Finnish city – educational lab. This novel collaborative initiative was constructed to stimulate local economic development after cluster spikes of the dominating regional employer had been brutally erased from the city's business landscape. Educational lab, established as an experimental space within university structure, had a twofold mission: provision of re-skilling and re-education opportunities for a precious pool of freshly unemployed ICT-professionals, and supplying them with entrepreneurial and employment bonds with local game industry representatives.

Therefore, research question of this paper is stated as follows:
How does the design of university-based experimental spaces induce institutional innovation?
We argue that although the concept of Entrepreneurial University had been comprehensively theorized and widely accepted by scholars, its practical realization is still confronted with substantial challenges. Establishment of the educational lab as an experimental space was aimed to enrich University with tighter business links and innovative pedagogical methods. However, the space's functioning was accompanied with considerable administrative, communication, financial and legal challenges, which ultimately resembled University's management disinclination towards institutional innovation and acclaimed entrepreneurial stance.

Infusing "Triple Helix Spaces" functional framework with the concept of *experimental space,* this paper aims to evaluate 1) internal processes related to the educational lab's inception and evolution; 2) the space's institutional innovation potential. This is done via applying a three-step model of institutional work which comprises *boundary work*, *distancing work*, and *anchoring work.*

In the context of the educational lab, boundary work refers to the space's deliberate efforts to establish and maintain stable, resourceful, legitimate connections with University's management and administration. Due to the novelty of pedagogical offering and unconventional educational design, certain distancing work was assumed as well. This was reflected in both physical framing of the space's premises, as well as cognitive disentanglement of participants from traditional modes of learning.

Whereas boundary and distancing work concepts are instrumental to unbox processual architecture of the educational lab's inception and evolution, anchoring work is targeted to examine direct or indirect impacts experimental space has had on institutional innovation, both in terms of pedagogical practices and business community embeddedness.

Analysis of this paper is based on qualitative data and employs a case-study design carried upon the educational lab as the main research site. Launched in 2012, the lab was considered as one of the instruments for enhancement of employability and business-generating prospects of unemployed ICT-professionals. Initiation of the educational lab as an experimental pedagogical program was a result of tripartite negotiations involving local government, private business and university representatives (*consensus space*). Since game industry had already topped the roster of

promising developmental areas, novel educational endeavor *(innovation space)* was eagerly embraced by the Cultural Department of the local University of Applied Sciences.

Noteworthy, inclination towards educational initiatives was deeply rooted in a long-standing tradition of education and research, which was cultivated in the studied Finnish city long before the global corporation had taken over the reins of economic control in the region. This tradition has formed a stable *knowledge space*, complimented by a strong trust towards university system. Turning towards the university for re-education and update of skills was therefore a viable and the most straightforward option for most unemployed after the corporation's collapse.

Intended data collection process implies conducting semi-structured interviews with actors involved in the inception and evolution of the educational lab: both form the University (representatives of management and administration), and from curators of the space's daily functioning (lab's founders and employees). Interview data will be supported by reports, reviews, presentations, and other relevant documents available for examination. Qualitative content analysis is subsequently applied to the data collected.

Institutional innovation in a university system, which is internally tilted towards stability and tradition, and externally pressured towards the third mission accomplishment, may provoke disbalancing consequences for its reputation, authority, and public trust. Therefore, construction of university-based experimental spaces may serve as an exploratory, reflective tool for testing incoming endeavors, suppressing immediate economic threats, and satisfying acute community demands. Moreover, establishment of such spaces provides an opportunity for a cautious, gradual institutional renewal, thus, protecting university from any hasty and financially irrevocable institutionalization decisions. Unpacking internal processes, which underpinned educational lab's inception and evolution, this study strives to shed the light on institutional effects this experimental space has had on the organization it was embedded within. More specifically, the paper aims to uncover changes the space induced both in terms of pedagogical methods, and in overall advancement of the University's entrepreneurial status.

Keywords: experimental space; institutional innovation; boundary work; distancing work; anchoring work; Triple Helix; Triple Helix Spaces.

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IMPROVING STARTUP-TEAMS SUPPORTS IN VCL SCENARIO: THE ROLE OF E-MENTORING

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Today, digitalization has covered many aspects of life. It is growing and has also embraced the modern higher education system. Because, to better utilize the universities, requires a change in missions and the way it is pursued. This change does not necessarily mean replacement, but with the aim of improvement and development. When it is seen that the future of education is moving towards digitalization, a change in mission, and a way of providing services is necessary. Therefore, the infrastructure and technological process for the correct transfer of knowledge to students is considered an integral and inevitable part of higher education.

On the other side, considering the professional needs of students in society, the existence of some inefficiency in the professional skills and competencies of graduates in recent decades and the declining motivation of young students is a challenge. One of the challenging fields is the projects and tasks based on group work. The group work field is an important element for engaging students in collaborative learning. Collaboration among globally dispersed students can be an important element of the emerging online or blended learning environment pedagogy. It allows isolated students to interact with their peers and extend their individual learning. So, it could be said that virtual group work has 2 important elements that could be considered at the global level, including students' engagement and e-learning environment.

Researchers have made various suggestions to address that considering the field of virtual group work in the teaching-learning process is significant and needs to improve the practical education of students because it causes them to improve in collaborative learning abilities. One of the educations that can provide smart education and university teaching-learning process and meet the students' professional needs along with theoretical knowledge and also through which experiences in the form of knowledge creation and transfer, is the e-mentoring.

E-Mentoring is one of the strategies that can create a continuous and useful relationship in an interactive framework to transfer the knowledge and skill of experienced professionals to students during group work. Because e-mentoring provides a process of continuous psychological and social support and shapes education in form of friendly relationships. E-Mentoring also helps students master the subject which they work on, and solve the found problem. That is why it improves the attitudes, values, and skills required and thus individual growth. In fact, the e-mentoring process to develop the student's abilities in the virtual collaborative learning environment. Also, universities and higher education institutions need to utilize the e-mentoring potential in this type of learning environment. Additionally, it can create more effective and efficient communication at the international levels. Because by creating a suitable placement, e-mentoring causes the students to receive additional support including skills related to the scenario of group work.

The Dresden University of Technology as a practical context has been considered the virtual collaboration for students in form of a Collaborative Learning Course (CVC). This course has been implemented for more than 1 decade. After making defining the framework of virtual collaboration, CVC 2021 project is concerning to examine e-mentoring as didactical support for students alongside e-tutoring support for students' group work. This study can highlight the outcomes of CVC and also the contribution of Virtual collaborative environments.

Therefore, paying attention to the two aspects to digitalization of education and its impact on the economic development regionally and internationally, the progress of services delivery in universities and higher education institutions, shows the need to use modern technological and educational tools. On the other hand, they should be used to meet the needs of the economy and society.

TOWARD A SYNERGETIC EDUCATIONAL MODEL VIA UNIVERSITY-INDUSTRY COLLABORATION

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During recent decades, there has been a growing interest in improving the higher education quality and its impact on economic development. The basis of this will for change is the question of the relevance of a so-called old-fashioned educational model. Believing that students need an educational experience similar to what institutions offered three-quarters of a century ago is problematic and does not serve the economic cause. The world is transforming and becoming more technological, affecting business processes giving birth to necessary skills that higher education is not considering yet. Graduates, as well as firms, have been expressing their frustration about the educational system's inefficiency. Especially in developing countries where we often hear alarming statements such as "we don't find what they taught us at university in work" or "the graduates lack skills and we need to train them like they never studied before."

Additionally, the economy has become rapidly changing, globalized, knowledge-based, and digitalized, offering two sets of usefulness and liabilities. Not following up with the proper education could turn the gift into a curse; thus, the economy would incur every disadvantage instead of benefiting the usefulness, leaving every involved party at high risk. Consequently, higher education quality is a serious matter, and systematic actions must be taken involving every stakeholder. Several countries established successful plans, and their educational models are updated strategically by forecasting the future. However, unfortunately, we have witnessed in numerous contexts the failure of educational systems in keeping up with the rapid change, giving birth to several issues: the lack of employability, the foundational skills gap, the shift and growth of students' needs, student enrollment decline, financial difficulties, state funding decrease, and much more. Universities are a driving force behind economic development by generating necessary skills and knowledge, crucial for innovation, especially in industrial sectors. This reality should concern both the university and the industry, giving them enough reasons to join forces and address the educational system's issues and challenges. The reason why a need for an efficient structure for cooperation manifests. University-industry collaboration provides the framework for facilitating work procedures, coordinating the processes, supporting all stakeholders' interests to achieve effective outcomes, and creating synergy. As a win-win association between a higher education institution and a firm, university-industry collaboration is essential to creating exploitable knowledge and highly skilled human capital that the industry needs. Industrials, in this case, communicate their specific needs to universities so they can update their programs or even participate in the elaboration of research agendas and curriculums. Several studies in the university-industry collaboration literature address this form of partnership for educational purposes. Nevertheless, there is a lack of a conceptual model that delivers a methodology on how such an alliance can help improve the higher education system. This paper reflects on the university-industry collaboration and its benefits as a model that would enhance the higher education quality, considering the context, collaboration forms, drivers, barriers. This paper also attempts to design a synergetic educational model that could be a blueprint for policymaking, higher education governance, and industry leadership.

Keywords: university-industry collaboration; triple helix; higher education model; higher education quality.

INVESTIGATING THE DETERMINANTS OF THE ENVIRONMENTALLY-SUSTAINABLE ENTREPRENEURIAL ORIENTATION OF UNIVERSITY STUDENTS IN ITALY

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This research study is geared to deepen the factors impacting on the environment-friendly entrepreneurial orientation of university students in Italy. The main aim of this work is providing academics and policy-makers with an insightful understanding of university context- and ecosystem-related factors as well as of family, social and behavioral ones. This way, the findings may help academics and policy-makers in the design and implementation of entrepreneurial universities in Italy, in order to address better and fill policy gaps through the introduction of ad hoc measures within the national academic system.

This research study claims a threefold originality. First, it analyzes data of a unique dataset that covers a representative sample of university students in Italy. These real-world data from a country-level scenario are not affected by any local or region-related bias. Hence, the results stemming from this study are original and prove to be reliable and valid. Second, the adoption of a structural equation model ensures a more methodologically reliable study, if compared to those in extant literature. The model is composed of factors and variables that are thoroughly identified by building on an in-depth literature review. Third, to the best of authors' knowledge, the environmental-friendly entrepreneurial orientation is hitherto under-investigated, whilst the recent and current focus on sustainability and environment-friendly efforts in entrepreneurial activities are steadily growing globally, thus, proving the value and timeliness of the study itself.

Data come from the survey carried out under the Global University Entrepreneurial Spirit Students' Survey (GUESSS) in 2016. It is an international project involving more than 50 countries and more than 1,000 universities globally. The questionnaire is administered online and a multi-level coordination structure exists in order to ensure methodological homogeneity and data reliability during the data collection process. The survey conducted in Italy provides a unique dataset including 4,446 valid responses from students enrolled in 39 Italian universities. Therefore, the sample utilized in this study covers 3.6% of the total population interviewed globally.

An overarching set of factors and variables is collected including (but not limited to): country- and cultural-level variables; legal aspects and norms; study and academic career; societal environment; readiness to start a new business; objectives and motivation for the new business; ownership level and commitment; co-founders solidarity with student-entrepreneurs; idea source; appeal of and interest in parental business; subjective norms; tolerance to (entrepreneurial) risk; soft skills etc.

Data are analyzed through a Structural Equation Model (SEM), after performing an Exploratory Factor Analysis (EFA) and a Confirmatory Factor Analysis (CFA).

The main findings of this research study prove that the environmental-orientation of entrepreneurial efforts of university students in Italy is predominantly and positively affected by individual characteristics and behavioral aspects. A minor, but still significant role, is played by the availability of resources to undertake environmentally-sustainable entrepreneurial initiatives. Finally, the social context as well as family's and friends' influence impact negatively on environmental-orientation of entrepreneurial efforts of university students in Italy.

The items/constructs considered in the structural equation model of this study are much higher in number than in other contributions in extant literature. However, some factors or variables may remain uncovered as well as possible moderating/mediating effects may remain unexplored. An additional limitation applies to this study: despite findings stem from valid and reliable data – i.e. 4,446 valid responses at the country level –, they are not generalizable to other (non-Italian) national contexts. Hence, this work opens new research avenues on the sustainability-oriented entrepreneurial spirit of university students, widening the current knowledge domain in extant literature. The main implications of this work are of interest for both academics and policy makers.

People operating in the academia - especially in Italy - may exploit the findings of this study in order to design and implement better quality entrepreneurial programs for their students that are oriented towards environmental sustainability purposes.

Policy makers may identify and also prioritize relevant areas of intervention and the corresponding reforms and/or investments. This way, the academic system could achieve higher performances related to the environment-friendly entrepreneurial initiatives of university students at the country-level.

Keywords: sustainable entrepreneurship; entrepreneurial university; entrepreneurial orientation; environment-friendly entrepreneurship; structural equation modeling.

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THEME 3: CONNECTING AND UPGRADING INDUSTRIAL DISTRICTS

VALORISATION OF SUSTAINABLE RESEARCH AND INNOVATION INFRASTRUCTURES IN REGIONAL INDUSTRIAL ECOSYSTEMS

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World of today is facing several major challenges such as climate change and aging of societies, which must be urgently addressed. For many of those challenges, research and science are expected to be the driving forces for positive change. As a response, European Commission has established remarkable policy level strategies and recommendations such as Green and Digital Transformation and European Research Area. Nevertheless, despite the ambitious goals set by the high-level polices, the gap between research and innovation is often profound and difficult to be bridged at practical level.

To accelerate the uptake of research and innovation results by society, the EU valorisation policy has been introduced. It aims to involve all the players in the process to transform these results into sustainable products, processes and services that bring added value and sustainable impact on the society at all dimensions, namely economically, environmentally, and socially.

One practical element to contribute to the improved valorisation level concerns the existing and new research and innovation infrastructures (RIIs), especially hosted by educational institutions. They often require extensive and long-term investments in both new technologies and high levels of expertise. However, the utilisation degree is frequently relatively low due to missing or inappropriate service models.

To increase the efficiency and consequently also their valorisation to the society at large, close collaboration and co-creation with all quadruple helix stakeholders, i.e., universities, industry and SMEs, public authorities, and citizens should be guaranteed. Embedded features of our service and collaboration model of RIIs as a case initiative presented here include, e.g., digitalization, improved agility and dialogue, accessibility and sustainability, and co-creative continuous capacity building of talents.

Aims and target groups

Our vision in Tampere University of Applied Sciences related to leveraging the added value of research and innovation infrastructures is to:

- Improve the efficiency and accessibility of research and innovation infrastructures for the benefit of all stakeholders
- Strengthen the competitiveness of regional innovation ecosystems, especially SMEs
- Increase our impact in building sustainable and resilient societies while simultaneously leveraging quality of life of citizens

The target audience of our best practice are all stakeholders of the regional innovation ecosystem, i.e., educational and research institutions, companies and SMEs, public authorities and other public sector organisations, and citizens.

Key Features of our Approach

As a practically oriented higher education institution, Tampere University of Applied Sciences builds bridges between research and innovation. We want to make a significant impact to the competitiveness and wellbeing of our partner stakeholders. Tools for this include capacity building actions, updating and upskilling of future competences, and participating in creating new innovations and businesses.

The Knowledge Transfer Charter (KTC) developed in TAMK provides a unique toolbox to support these aims. The process builds on offering the stakeholders our research and innovation infrastructures as demonstration, piloting and testing environments for hand-on experimentation of new innovative technologies and services. The physical infrastructures jointly with our business expertise significantly speeds up the innovation and commercialization cycle. The same process can also be implemented in real-life environments, Living Labs, e.g., for smart city solutions.

Achievements & Learnings of the Valorisation

One example of the valorisation of our holistic approach has been in the context of the InnoHEIs project funded by Interreg Europe (2019-2022), where TAMK and Council of Tampere Region have jointly participated. The close collaboration within a joint project and target setting has significantly improved the dialogue and common understanding of between the university and public authority. In addition to the involvement of these two axes of the Triple Helix, also other relevant stakeholders such as industry support organisations, companies and SMEs, and representatives of the education innovation ecosystem have been actively included in the strategic planning and guidance. In this way, co-creative processes focusing on strengthening the missing links in the usage of research and innovation infrastructures have been established. Examples of the valorisation of the achievements so far for various Triple Helix stakeholders, expanded to even Quadruple Helix beneficiaries, include:

- *Education and research institutions*: Development of joint service models among different organisations, inter-connected research and innovation infrastructures, virtualization of RIIs to support their sustainable, inclusive, and digital utilisation
- *Companies and SMEs*: increase in joint R&I efforts (project funding & commercialisation), more continuous dialogue of future competence needs for both degree students and life-long learners
- *Public authorities*: Inclusion of the important role of RIIs in the new Regional Development Programme and Smart, Sustainable Specialisation Strategy (S4) of Tampere Region guiding both regional policies and the related policy implementation instruments such as the ERDF
- *Citizens*: Opening of the RIIs and the related processes such as KTC towards smart city development and citizen engagement (Living Labs)

The current green and digital transition as well as global competitiveness targets set European industry in a challenging position. Simultaneously, the pandemic has limited our possibilities for traditional face-to-face collaboration, and many new ways of working are here to stay. New product and process innovations must be communicated and co-developed at an ever-accelerating pace and within physically spread multidisciplinary teams. Time from idea to innovation must be squeezed to minimum, and tools and processes need to foster co-creative work that makes visible also the initiatives not foreseen at the early stages of the development.

Research and innovation infrastructures conceptualised as joint assets for bridging the gap between research and practical industry value chains have great potential to serve as platforms for co-creating and sharing knowledge. Hence, their new and sustainable service model can encourage all Triple Helix stakeholders jointly to co-innovate and develop new technologies and services by taking advantage of hands-on demonstration environments and infrastructures as part of the knowledge transfer process.

INNOVATION AND COMPETITIVE ADVANTAGE IN ITALIAN CLUSTERS: THE PAPER SECTOR IN TUSCANY

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The paper industry in Italy has a strong concentration in the Lucca area, an industrial district composed of hundreds of companies involved in producing paper, paper tissue and cardboard, in converting of paper into final products, in producing machinery and equipment, in the supply of specialized services for the paper industry. Within the district, there is a complete supply-chain, with a strong integration among firms: this is the most important determinant of the competitive advantage and the external economies of the district.

The leading companies of the cluster are family-owned companies that face worldwide competition thank to innovations in process, new strategy of product differentiation, and investments for the international growth. Our research paper focuses on the innovation process of the Lucca district and on the “Triple Helix links” of the leading companies. Our research paper is an empirical study that applies a micro-macro approach, as it collects economic data about all the local firms involved in the paper production, in the paper processing, in the machinery industry, in the pulp logistics. Istat data about international trade complete the data sources and allow us to link the innovation process with the international growth of the cluster. In addition, we made a dozen of interviews to local experts on the paper industry and local firms.

The export data show that the Lucca cluster has a strong competitive advantage at international level, and our research paper tries to understand the role of innovation within the competitive advantage. The research paper describes the innovation process of the leading companies mainly in terms of process innovation, as the product innovation within the paper industry is quite weak. In the last decade, many investments have been directed to new plants and machinery that improve the sustainable development of the companies.

The Triple Helix approach is well defined in the Lucca cluster, as there are all the agents of an ecosystem of innovation: the supply of innovation (universities of Pisa, Florence and IMT School of Lucca), the professional training schools (Istituto Tecnico Marchi-Forti di Pescia, Istituto Superiore di Istruzione di Barga, the Master carta & cartone, Celsius, Fondazione Lucchese per la Formazione), the local high-tech labs (albo art.14 DM 593/2000, FAR D.D. 79/2010/Ric); the supply of technology transfer services (Lucense Science Park, Polo di innovazione Innopaper, Polo Navacchio-Pisa, Innovhub-Milano); the demand of innovation coming from local firms (13 paper companies with patents at the European Patent Office; 36 paper firms with the ISO9000 or ISO14001 certifications; 25 paper firms with grants from public R&D programs); the local public institutions supporting R&D programs linking private companies and Public Research Organizations (Chamber of Commerce, Entrepreneurial organizations - such as Confindustria, Assocarta and Aticelca, Tuscan Region Government, Province of Lucca Government).

An important role is played by the industrial machinery sector in transferring innovation towards paper production and paper processing companies, as the machinery industry has strong relations with universities, mainly with polytechnics, at national and international level. Thanks to the local machinery sector, the Lucca paper industry can exploit all the process innovations to reduce production costs and to gain price competitiveness. More recently, the local machinery sector has been focused on new plants and machinery that can improve the sustainable development of the company in terms of savings of raw materials, energy power, working hours, as well as in terms of upgrading work security, environmental care, marketing & commercial strategies.

It is worth to underline that local companies exploit all the external economies at cluster level, mainly based on skilled workers, full supply chain and commercial infrastructures, more than on innovation or university-company links. As already mentioned, investments on innovation process are mainly focused on the sustainable development of the paper industry. In addition, it is worth to notice some new investments in product innovation that have been led by ESG strategy to produce new families of paper products that follow the “green product” approach: to serve the top segment of the demand, very interested in environment care, the paper industry is going to implement all the new technologies that allow companies to produce high quality paper products by recycled paper, raw materials, and chemical components. A new marketing strategy for a very traditional product, such as paper tissue, is born.

KNOWLEDGE MANAGEMENT IN INNOVATIVE COMPANIES IN THE INDUSTRIAL POLE OF MANAUS: A CASE STUDY

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With the geopolitical objective of promoting the integration of the Amazon to the national scenario and populate the low demographic density of the State of Amazonas, the Manaus Free Trade Zone (ZFM) was created by Law No. 3,173/57, expanded by Decree No. 288/67. The Manaus Free Trade Zone is an industrial zone in Manaus (Industrial Pole of Manaus-PIM), created to boost the economic development of the Western Amazon. Administered by the Superintendence of the Manaus Free Trade Zone (SUFRAMA), the Industrial Pole currently houses about 400 industries especially concentrated in the television, computer and motorcycle sectors. Based on Suframa's annual report, PIM's annual nominal revenue in 2020 was R$ 78.77 billion, with the participation of the subsectors of activities distributed as well: Electronics (27.47%), Computer Goods (18.54%), Chemical (15.32%), Duas Rodas (14.86%), Others (12.00%), Thermoplastic (6.12%) and Metallurgical (5.71%).

The evolution of socioeconomic indicators indicates that the incentive program for PIM has had positive and relevant impacts throughout recent history. From the general point of view, results show that there has been a strong growth in the state's participation in the total GDP of the national industry since the creation of the ZFM (FGV,2019). More specifically, this movement allowed the constitution of a sophisticated industrial park in the region with high productive sophistication with several important impacts. For example, it promoted per capita income growth, as wages in local industry remain stable and above the national average in recent years. In addition, it provided the expansion of schooling in the region, since the average schooling among workers in the manaus industry is about 3 years higher than the average of several important states in the country.

Focusing on that context, this study seeks to investigate how knowledge management practices, based on patterns of Socialization, Outsourcing, Combination and Internalization (Nonaka and Takeuchi, 1997) occur, in their similarities and differences, in more and less innovative PIM companies in their products and/or processes. The study is based on a case study involving 2 intentionally chosen PIM companies, using predominantly qualitative analysis techniques. Initially a set of 6 managers, 3 of each company, were interviewed through a semi-structured script, trying to qualify the emphasis given by companies to knowledge management and to innovativeness. The *software* IRAMUTEQ (Interface*de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires)* was used in this phase, to which the transcribed texts of the interviews were submitted. Then, a self-administered questionnaire was applied to a sample of employees, in a total of 20 managers of the average management per company, who evaluated how the knowledge management processes occurred, and to what degree of systematization. The results of the answers to these questionnaires were analyzed by the Statistical Package for Social *Sciences-SPSS* 16.0 and R version 2.11.0.

The analysis and interpretations of the collected data allowed to show, for example, that the company that privileges, in its practices of knowledge management, the culture of creativity, in a more systematic way, both in the perception of senior management and in the managers of the middle management, has a higher performance pattern in innovativeness in processes, because they emphasize the dissemination of this strategic thinking to its entire internal community, with clear repercussions on their business and competitiveness.

The study seeks, therefore, to contribute to the advancement of the theme based on a very specific district, but in a region known worldwide for the challenges and interests present, trying to get a better understanding of the phenomenon. When exploring whether knowledge management is linked to innovative results for this set of companies, it is seeking evidence and validation, even with limitations and inaccuracies, whether a strategy oriented to the valorization of knowledge is linked to the innovation, the market and, in the last instance, to business competitiveness as a whole.

A TRIPLE HELIX ACCELERATION PROGRAM FOR SMES OF "MADE IN ITALY": A CASE STUDY BASED ON PRATO TEXTILE INDUSTRIAL DISTRICT

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The triple helix innovation model in which innovation is boosted through the dynamic interaction among industry, government and university has been widely adopted in the Global North to foster technology transfer process with the aim of enhancing regional development (Etzkowitz & Klofsten, 2005). The application of triple helix theories and practices found its roots in the high-tech clusters which flourished around outstanding universities such as MIT and Cambridge: here the knowledge spillovers from academia to local firms and the ties between university spin offs and their mother organizations provided a fertile environment for high innovation rate and fast-growing regional development (Uyarra, 2010; Cai & Etzkowitz, 2020). Policy makers world-wide have attempted to replicate these results by developing specific policies to support technology transfer and university-industry collaborations. In this regard, scholars warned against a one fits-all approach, since university-industry collaborations are not always easy to be set up due to specific place-based features (Kempton, 2019) and to possible misalignment between the objectives of individual academics and universities central strategies (Bellandi et al., 2021). Indeed, universities are increasingly competing among each other in the global higher education market seeking to achieve research excellence and attract international students and these tendencies may impede an effective collaboration with local firms (Bonaccorsi, 2017). For example, in a peripheral region where SMEs do not operate at the technological frontier, the local university might be not interested in cooperation with them and prefer putting its efforts in more research-driven projects (Benneworth & Nieth, 2018). Also, SMEs might lack the necessary absorptive capacity to interact with research-intensive universities creating barriers towards university-industry collaborations (Apa et al., 2020). Nonetheless, recent contributions highlight that universities and related technologies transfer structures are crucial to support the upgrading of knowledge and the competitiveness of SMEs also pertaining to more traditional industrial sectors (such as food, textile, and machinery) (Apa et al., 2020; Abbate et a., 2020). In this regard, it has been noted that countries and regions characterized by these industries have received far less attention from the scientific literature on technology transfer relationships if compared to studies on high technology clusters of the United States and their universities. With the present work we aim at contributing to the few studies which have addressed the role of university technology transfer practices in countries such as Italy characterized by the presence of SMEs in industrial districts.

Italy is indeed an interesting country to focus on as it "represents a case where interactions between the three actors in the triple helix model have been minimal" (Apa et al., 2020 p. 2). Moreover, the economic system of this country has been historically characterized by the presence of industrial districts and the literature largely recognized this association (Pyke et al., 1991).

In particular, we aim at unpacking how a triple helix acceleration program might work within an industrial district characterized by a traditional industrial sector such as the textile one. To do this we will consider, with the help of a set of focussed interviews, the case of Prato Industrial Smart Accelerator (CTE PRISMA) based in the Prato textile industrial district. This projects aims at creating a new technology transfer infrastructure "to investigate and exploit the innovative potential of emerging technologies - Internet of Things, Artificial Intelligence, Blockchain and 5G - applied to the textile-fashion sector (T&M) and Made in Italy" (from https://cteprisma.startupitalia.eu). CTE PRISMA involves the whole set of triple helix spheres that are represented here by the University of Florence and PIN Prato (a Services Consortium affiliated to the University of Florence), Prato local municipality and a set of start-ups, with Nana Bianca, a company specialised in business acceleration programs, playing as and intermediate organization for high tech and digital start-ups based in Florence.

We will try, first, to evaluate what solutions is CTE PRISMA developing and implementing to create and accelerate new companies in the Prato district. Secondly, we will look at the implications in terms of triple helix models, and how this could point out a path for renewing the local textile sector, making it more competitive, sustainable, and efficient. Finally, policy and planning implications for the specific case of Prato and the Prato industrial district are discussed as the study helps to shed light on possible transition paths towards the Industry 4.0 + scenario (Bellandi & De Propris, 2021).

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29 JUNE 2022

THEME 4: PARTNERSHIPS OF EMERGING ACTORS AND HYBRID ORGANIZATIONS FOR KNOWLEDGE CO-CREATION, INNOVATION, AND SUSTAINABILITY

THE ROLE OF NATIONAL ACADEMIES IN EXPLOITING THE TRIPLE HELIX PARADIGM TO CATALYSE RESPONSE, RECOVERY AND RESILIENCE TO COVID-19

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Numerous organisations, governments, public and private, have been working towards establishing systems and solutions to mitigate against the COVID-19 pandemic. This paper addresses the key role that national academies, especially in the UK, US, and China, have played in promoting Triple Helix interactions between governments, academia and the commercial sector in developing three aspects of reaction to the pandemic - a rapid Response, a comprehensive Recovery, and a wide-ranging Resilience, to quickly and effectively react to future crises.

National Academies are learned organisations, which provide independent, objective advice to inform policy with evidence, encourage innovation, support research and address challenging issues for the benefit of society. Members or Fellows of national academies are the crème de la crème of the country's scientists and engineers; and it is through this influential body of individuals that the national academies promote and oversee matters of national and international interest.

As the Pandemic crisis unfolded, the UK Royal Academy of Engineering launched a "positive response" programme" in August 2020 (Royal Academy of Engineering, 2022), to provide brokerage, policy advice and expertise and funding support to deliver rapid developmental programmes. Through its network of Academy Fellows in partnership with entrepreneurs, engineers and clinicians, the Academy provided support for innovators, and created a route for government to access the breadth of expertise and capabilities across the engineering profession.

The Academy launch attracted a massive response with some 566 offers, and after a formal review short listed those that needed fast tracking, resources, or where the Academy could make the right connections to facilitate rapid progress. The projects ranged from helping innovations in the adoption of practices in field hospitals, Project CARE that helped entrepreneurs to devise and supply personal protective equipment for effective use in healthcare facilities; helped academic colleagues from Imperial College, working for the DNA Nudge project, to extend DNA diagnostic chip to detect COVID-19 without the need for laboratory analysis, and many more, including the design and manufacture of ventilators, testing kit, field hospitals and logistic supply chains that rely on effective engineering.

The paper will provide analysis of the initiatives taken by the three National Academies to mitigate against COVID-19, and illustrate how the learned bodies supported the mobilisation of effort to confront the pandemic.
The paper will pick up Use Cases from the three bodies to offer a description of the Triple Helix interactions to deliver rapid, timely, and effective solutions to support the Response to COVID 19.

To meet the shortage of breathing aids, University College London partnered with Mercedes AMG High Performance Powertrains with funding support from the UK National Health Service, to devise respiratory equipment, a special breathing aid known as a Continuous Positive Airway Pressure (CPAP) device to help treat clinically ill COVID-19 patients. The team manufactured 10,000 breathing aids for use in UK hospitals and shared the designs with organisations from 105 other countries at no cost (Royal Academy of Engineering, 2022b).

In China, the China Petroleum and Chemical Corporation (Sinopec) massively upscaled its facilities to produce meltdown fabrics for medical supplies. In 2020, Sinopec formed a joint centre in Tianjin with the Tianjin Research Institute for Advanced Equipment to develop lubricant formulations (Fangqing, 2020) and, in parallel, has established the Geophysical Resources Academy with Imperial College London to drive cutting edge research and training in the geophysical sciences.

The second aspect of this study is to analyse the way in which engineers and engineering innovations empowered the Recovery from the pandemic, working with the national academies. Triple Helix interactions accelerated the development of vaccines, and engineers accelerated the dissemination of vaccines by exploiting both established and novel techniques.

A case in point is the development of the AstraZeneca vaccine achieved through the partnership between Oxford University and AstraZeneca, which was announced on 30 April 2020, funded by the UK Government's Vaccine Task Force, aimed at "the further development, large-scale manufacture and potential distribution of the COVID-19 vaccine

candidate currently being trialled by the University". The vaccine was developed by a dedicated team at Oxford, tested and trialled, with positive results from the trial being received in November 2020. In parallel, AstraZeneca had upscaled production facilities to deliver the vaccines doses in their millions in a very short period of time later (Oxford, 2020; UK Research and Innovation, 2021).

In a similar vein, the Moderna Vaccine was developed in 2020/2021, under the leadership of Dr Noubar B Afeyan, the Chairman of Moderna, a faculty member of MIT who co-invented the underlying technology for using engineered messenger RNA as a human therapeutic modality. The development was funded up to a billion dollars by BARRDA (the Biomedical Advanced Research and Development Authority, part of the US Department of Health and Human Services (Moderna, 2022).

To effect Recovery, Tian Hongji, the President of the Central South University of China has worked on ventilation and virus control for mass passenger transportation in China, under the aegis of the Chinese Academy of Engineering. In a similar vein, Professor Burak Ozdogunar of Carnegie Mellon University has developed and tested a new microneedle array platform capable of delivering vaccines directly into the skin, with the particular goal of improving COVID-19 vaccination in the developing world. Professor Cath Noakes of Leeds University, UK, has analysed the influence of indoor airflows and effectiveness of engineering approaches to controlling airborne disease transmission in order to provide effective solutions to managing risks of airborne COVID transmission (National Academy of Engineering, 2021).

The third aspect of the value chain is the development of a healthy and Resilient future as nations recover from COVID-19 and prepare for any future pandemicss (National Academy of Engineering, 2021; Lander & Sullivan, 2021).

The paper will thus offer a critique of the role of the national academies in harnessing triple helix iterations to address and confront the Response, Recovery, and Resilience in the face of the COVID-19 pandemic, and to identify challenges and shortcomings in the approaches taken.

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MULTIDIMENSIONAL PROXIMITY AND COOPERATIVE INNOVATION: EVIDENCE FROM CHINA'S HIGH-TECH INDUSTRY

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The rapid development of science and technology has put forward higher requirements for the innovation capability of organizations. The resources within a single organization have been unable to meet the existing challenges. More and more enterprises and scientific research institutions have obtained more innovation elements through mutual cooperation. Cooperative innovation has been become an irreversible trend. How to better promote the development of China's high-tech industries and adapt to the complex and ever-changing domestic and foreign environment is a must for China's high-quality economic development and sustainable development. This study selects the patent data of China's high-tech industry from 2002 to 2021 as the research object and conducts a systematic analysis of the development of China's high-tech industry. Based on resource dependence theory and triple helix theory, the effects of institutional proximity, geographic proximity, technological proximity on cooperative innovation and the moderating role of technological diversification are investigated. The research shows that: (1) Institutional proximity has a positive impact on the performance of cooperative innovation among different innovation subjects, geographic proximity has a significant role in promoting cooperative innovation among organizations, and there is an inverted U-shaped relationship between technological proximity and cooperative innovation performance among organizations. . Proximity is still an important factor that affects the organization's cooperative innovation. According to the results of this study, the same institutional arrangement provides the "glue" for organizational cooperation and improves the possibility of organizational cooperative innovation; the development of communication and transportation technology does not. Completely eliminate the influence of spatial and geographical distance on cooperative innovation, and organizations are more willing to carry out cooperative innovation with organizations with closer geographical distance; technological proximity has a non-linear impact on cooperative innovation, and inter-organizational cooperation must have a certain common knowledge base, but also maintain. (2) After introducing the moderating variable of technological diversification, as the level of organizational technological diversification increases, the positive effect of institutional proximity on cooperative innovation increases, and the inverted U-shaped relationship between technological proximity and cooperative innovation also increases; while technological diversification increases. The moderating effect between geographic proximity and cooperative innovation is not significant. Technological diversification is the diversification and enrichment of organizational technical elements, and organizations with a higher level of diversification are more likely to cooperate with other innovative entities. (3) Based on the triple helix theory, comparing the different effects of proximity on three types of cooperative innovations: enterprise-university, enterprise-enterprise, and government-enterprise, it is found that geographic proximity has a significant role in promoting enterprise-enterprise and government-enterprise. , and there is no significant difference in the impact on the two forms of cooperative innovation; there is an inverted U-shaped relationship between technological proximity and enterprise-enterprise cooperative innovation, while it has a significant negative impact on enterprise-university and government-enterprise cooperative innovation, and The negative impact on government-enterprise cooperative innovation is stronger than that of enterprise-university. In distinguishing different forms of cooperative innovation, we found that the influence of multi-dimensional proximity on cooperative innovation is also affected by contextual factors, and the cooperative innovation of colleges and enterprises has been freed from the constraints of geographical distance. Technological proximity has become an unfavorable factor hindering university-enterprise, government-enterprise cooperation and innovation.

KNOWLEDGE ECONOMY FOR SOCIAL DEVELOPMENT INITIATIVE

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The purpose of the KEB Initiative is to ensure that clients in developing countries (DC) gain full access to the benefits of the Knowledge Economy (KE). KE is defined as the added, non-monetary value that society accrues from increased access to information, data and knowledge, as a by-product of the new global communication and data processing technologies. This added value, however, is realized only if a concerted effort is made to capture, analyze, disseminate and evaluate such knowledge, and feed it back to the development investment operator and the communities themselves. KE aims to make knowledge a valuable instrument for economic development. This Initiative would contribute to the achievement of the foremost development objectives: fostering sustainable economic growth and reducing poverty, while promoting excellence, innovation and equity. Through this Initiative, the DC would improve design and execution of existing projects, as well as identify a whole new breed of dedicated KE projects.

Various observers describe today's global economy as one in transition to a "knowledge economy", an interconnected, *globalized* economy where knowledge resources such as *know-how*, expertise and intellectual property are more critical than other economic resources such as land, natural resources, or even manpower. These observers point at countries with abundant natural resources that have been plagued by chronic economic, social and political crises, while others, not nearly as well endowed in conventional resources, are able to experience sustained economic growth by focusing instead on their human capital

The transition towards a KE in developing countries will require a cross-sector investment effort. Italy could play a most significant role in bringing these results about, by making a concerted effort to widen the reach of the KE across all social sectors. To do so, part of the investment portfolio would need to be revised to ensure a significant portion of their operations are KE- compliant, as well as to include new operations directed specifically towards realizing the benefits of the KE.

No international organization has yet developed indicators, methods and instruments to capture the promise of the KE and make it into objective, measurable, benefits.

In order to maximize the potential benefits derived from the KE to its clients, a KE Initiative could be started, through which capital and human resources would be **focused exclusively** on analyzing the opportunity and developing the instruments to extend the benefits of the KE to all DC beneficiary countries.

The Initiative would be temporary –expected duration is three years. During those three years, the KE Initiative would be expected to (i) develop KE-specific indicators, outputs and outcomes; (ii) review a sample of existing sector-specific projects and suggest means to make them KE- compliant; (iii) create new pipeline of operations devoted explicitly to KE objectives; (iv) train DC staff in KE compliance techniques and instruments. The following table shows proposed outputs and outcomes for the three-year period.

The **Knowledge Economy** is characterized by the recognition of knowledge as a source of competitiveness, where value lies in new ideas, software, services and social relationships, using technology as an instrument, not as an end in itself. The following benefits are expected from the application of KE instruments:

- Provision of accurate, complete and timely information to decision-makers, ensuring that they have the information they need when they need it;
- Alignment of resources with market demands and opportunities;
- Greater diversification and creativity, stimulating entrepreneurship and widening income opportunities;
- Greater demand for innovation industry infrastructure;
- Reduction of waste –duplication, overlapping, repetition;
- Greater individual and collective capacity of organizations and countries to make development respond to their

Output/Outcome	Year 1	Year 2	Year 3
Indicators of project KE performance developed	√		
Best-practices in KE identified in other international organizations	√		
Losses & missed opportunities to gain KE benefits identified (project sample)	√		
Sector-specific projects incorporate KE instruments in their design	2	3	3
Sector-specific projects in execution with some KE instruments added		3	3
New KE specific operations identified		1	3
Training seminars for KE network in headquarters	1	1	
KE-certified staff trained and capable of multiplying effect			10
Lessons-learned and case study publications		1	1
EIB figures among leaders in KE compliance			√

CASE: PRO_MOVE LAJEADO, AN INNOVATION CITY MOVEMENT FOSTERED BY THE TRIPLE HELIX

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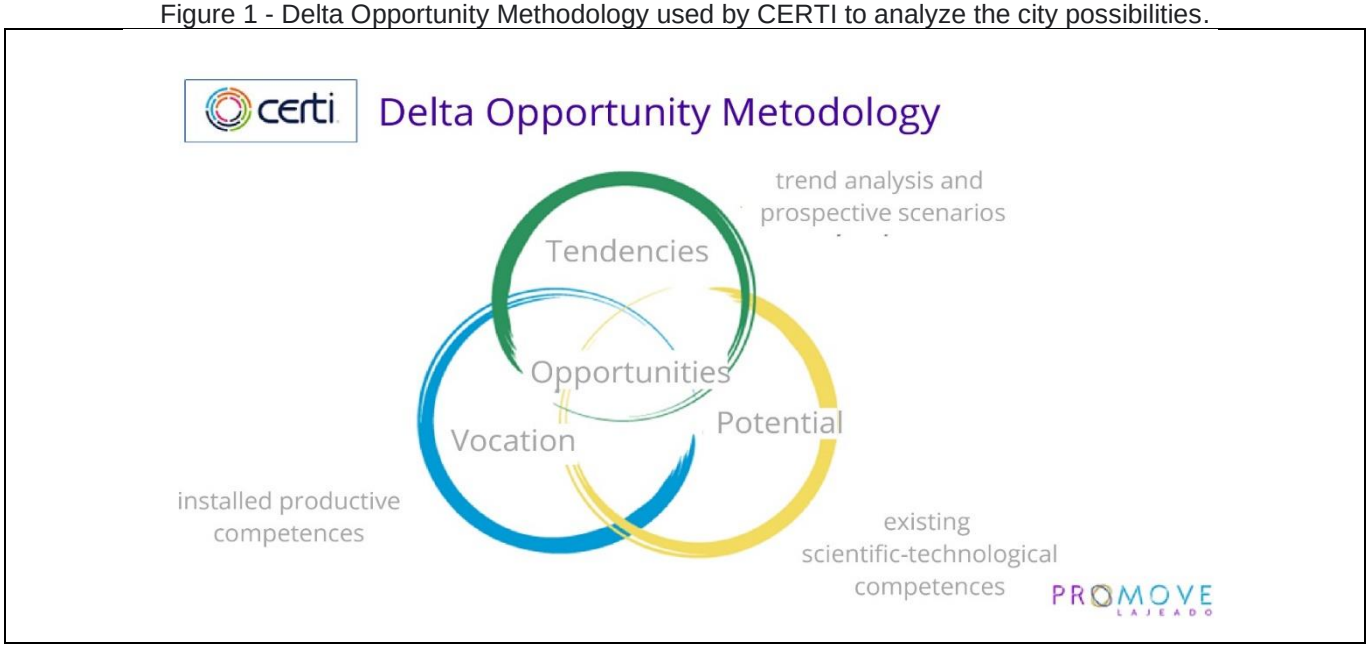
Lajeado is a city with 86.000 habitants in Rio Grande do Sul state, south of Brazil. The city is 131 years old, has a mix of ascendant cultures but strong german and italian influences. Situated in the Taquari River Valley, it´s located in a prosper region with good quality of life indexes, as 6th most developed city in Brazil (FIRJAN, 2016) and 30th on municipalities competitiveness ranking (*Raking de Competitividade dos Municípios*, 2021). The region has a strong food industry, a regional community university – UNIVATES and a local hospital awarded as the best brazilian hospital in cities under 100.000hab.

This scenario shows the city already has a flourishing environment of business and ambience for good relations among public, private and educational sectors. In the intention to promote a better articulation with the triple helix, and being the innovation a successful result of the exploration of new ideas, the governance of the relationships of actors in the ecosystem network is a crucial factor for the success of innovation processes. To this end, it is suggested that in the interrelational process there is a role for third parties that can have a positive impact on the development of the relationship network between organizations.

Pro_Move Lajeado was launched in March 2019, with representatives of the government, academia, society and private companies, to came together to transform Lajeado into an innovative and connected city through a new economic matrix: that of knowledge and innovation. The movement created by the group, called Pro_Move Lajeado, began the work of mobilizing the society of Lajeado in pursuit of this objective. To help in the process of diagnosis, organization, planning and integrated development of the new innovation ecosystem, the city hall together with the university hired an Innovation Research Institute – CERTI (*Fundação Centros de Referência em Tecnologias Inovadoras)*. After numerous studies, workshops, identification and analysis of trends, vocations, potentials, opportunities, actors, talents, environments, capital, clusters and governance, the Movement's Action Plan was defined. In this Plan, the propellers (Government, Companies, Society and Academies) and actors involved assumed the responsibility of executing specific actions relevant to the objectives and goals of the movement.

The Figure 1 show the Delta Opportunity Methodology used by CERTI to analyze the city possibilities.

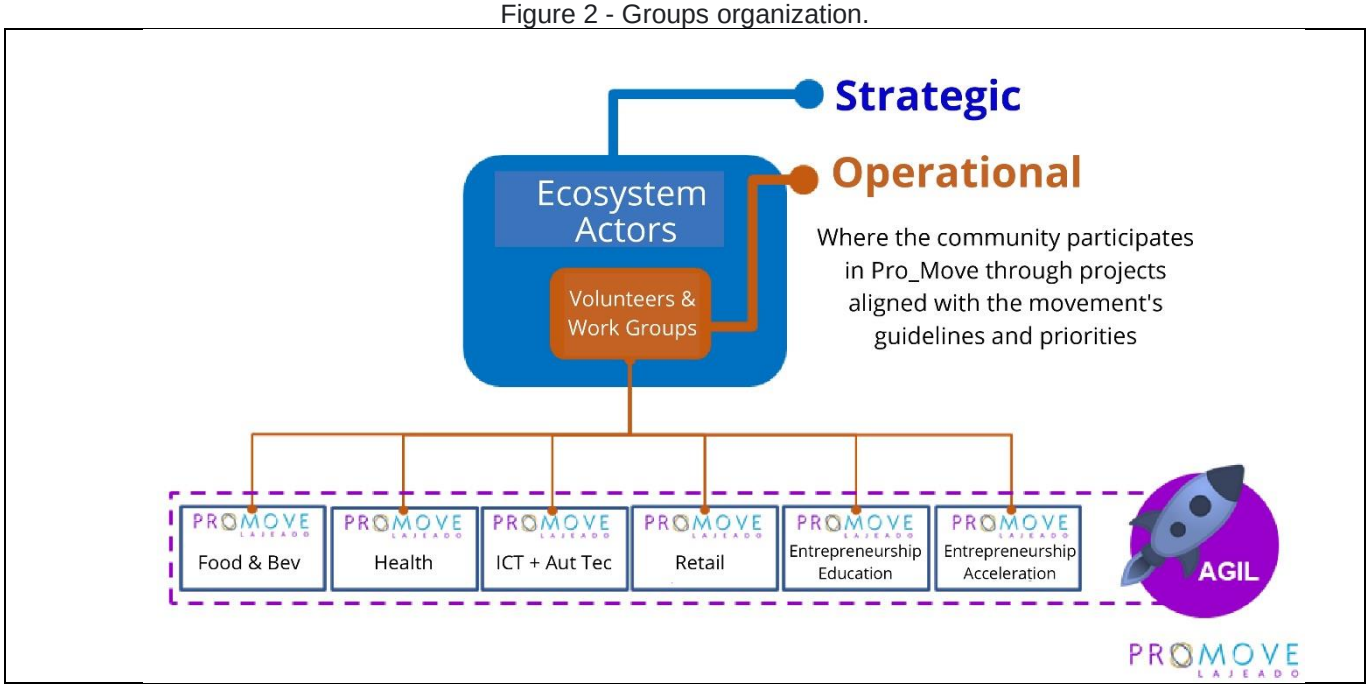
Figure 1 - Delta Opportunity Methodology used by CERTI to analyze the city possibilities.



After the diagnosis and plan, Pro_Move started working groups of development axes: Food, Health, Information Technology and Communication. The groups are formed by representatives of the triple helix, have monthly meetings, and develop projects together focusing on the development of the city as a whole. Another 3 axes are

organized later, that of Retail, and projects related to education, which are transversal to the other groups. Figure 2 demonstrates the groups organization.

Figure 2 - Groups organization.



The AGIL mentioned in the Figure 2 is a structuring project from Pro_Move. since the participants of the work groups, and the representatives of the triple helix themselves, are volunteers to the movement, it was necessary to create an organization to assist in the articulation of actions, methodology of processes, and continuity of projects that was independent of changes in management. in the triple helix actors. With this intention, to allow a balanced governance in the intentions and expectations of cooperation of the ecosystem, AGIL - Local Innovation Agency was created.

Figure 3.

From 2019 to the present date, Pro_Moe Lajeado already brings together more than 15 initiatives that have had a positive impact on society and helped to establish an innovation table, which together with operational tactical work by AGIL accompany new 17 projects that consolidate regional development through innovation. in Lajeado. The

result of this is the classification as a finalist ecosystem in the National Innovation Award of the National Conference of Industries.

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MAPPING INNOVATION INTERMEDIARIES' TYPES AND FUNCTIONS: A COMPUTATIONAL REVIEW OF THE LITERATURE

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Innovation intermediaries are organisations that typically facilitate triple helix interactions within innovation systems. Over time, these organisations have become more numerous and diverse. Faced with this growing heterogeneity, there is a need for better understanding of what these organisations are and what type of innovation intermediation they perform. To do so, we use a combination of text mining and bibliometric techniques, and we identify seven different streams of literature, six of which refer to distinct types of intermediaries, performing specific functions and often involving specific types of organisations. Looking at the evolution of the different streams over time, we found that the early contributions focus on university incubators, science and technology parks, and the role they play within different types of innovation systems. More recently, the focus has shifted on open innovation intermediaries, be they physical organisations or virtual platforms, and on transition intermediaries. Despite the differences between the various types of intermediaries and the literatures that analyse them, the bibliographic coupling shows that all strands of literature have a common theoretical basis, which includes the triple helix and the open innovation approaches.

The growing need to bring together firms, universities, research institutes and other organisations in the context of complex innovation processes has intensified the debate around organisations that support firm-level and collaborative innovation – often called knowledge, technology or innovation intermediaries (Dalziel, 2010; Bakici et al., 2013; Kivimaa et al., 2019; Rossi et al., 2020). Studies on innovation intermediaries have long existed (Van Lente et al., 2003; Hoppe & Ozdenoren, 2005; Howells, 2006; Winch & Courtney, 2007; Stewart & Hyysalo, 2008). However, as the literature on intermediaries has expanded, our overall understanding of what innovation intermediaries do and of their characteristics has become hazier. This is so for at least two interrelated reasons. First, the literature has approached intermediaries from a variety of perspectives, using various terms (e.g., brokers, matchmakers, boundary spanners) and focusing on different types of organizations, ranging from knowledge-intensive business services providers (KIBS), technology transfer agencies, science parks, incubators to virtual platforms such as crowdsourcing platforms. This heterogeneity makes it difficult to discern patterns, for example in terms of the key intermediary types and their most important functions.

Second, as intermediaries are increasingly 'in demand', they have in fact become more numerous and more diverse, sometimes specialising in specific activities or sectors, and new types of intermediaries have emerged in response to emerging needs. These include the rise of new digital technologies, which are systemic and complex in nature, and which require the involvement of actors who are able to co-ordinate and manage these multi-party systems (Hossain, 2012; Rossi et al., 2020). Moreover, the need to invest in sustainability leads to the emergence of intermediaries that support sustainable transitions (Kivimaa et al., 2019). The expansion of the variety of intermediaries makes it more difficult to identify their common traits and differences.

Faced with this growing heterogeneity, the limitations of subsuming this complex phenomenon under one or a few terms like 'intermediaries', 'brokers' and the like, have become clear, and there are growing calls for better understanding of what are the organisations that engage in innovation intermediation activities, how they differ, and how they relate to each other (Dalziel, 2010; Rossi et al., 2020).

The present study aims to fill this knowledge gap by comprehensively mining the literature on innovation intermediaries that has been produced in the last four decades, in order to identify: (i) the key 'types' of intermediaries, (ii) the key functions and activities of each type, and (iii) the extent to which different 'types' overlap or belong to different domains. To do so, we use a combination of text mining and bibliometric techniques. Starting with a systematic literature search, we analyse the resulting corpus to identify its most characteristic features and how these features change over time. We then perform a cluster analysis of articles' title and abstracts, which, combined with content analysis of the texts (i.e., titles and abstracts and - when necessary –the entire paper), allows us to identify different 'types' of intermediaries and describe their main characteristics. To understand whether and to what extent the various types of intermediaries are related, we deploy a bibliographic coupling analysis. Looking at the evolution of the different streams over time, we found that the early contributions focus on university incubators, science and technology parks, and the role they play within different types of innovation systems. More recently, the focus has shifted on open innovation intermediaries, be they physical organisations or virtual platforms, and on transition intermediaries. Despite the differences between the various types of intermediaries and the literatures that analyse

them, the bibliographic coupling shows that all strands of literature have a common theoretical basis, which includes the triple helix and the open innovation approaches.

Keywords: Innovation intermediaries; computational literature review; open innovation intermediaries; innovation system intermediaries; transition intermediaries; cluster intermediaries; KIBS; incubators.

OPEN INNOVATION TEST BEDS AS INNOVATIVE TRANSNATIONAL COOPERATIVE ASSOCIATIONS TO FOSTER INNOVATIONS AND TECHNOLOGY TRANSFERS: THE NEWSKIN OITB CASE

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Through the Work Programme 2018 – 2020 of the Horizon 2020 Programme, the European Commission took the decision to launch the creation of more than 20 new specific entities called “Open Innovation Test Beds” (OITBs). OITBs gather across Europe reference innovation ecosystem organisations. These organisations own unique capabilities in order accelerate the industrial uptake of Key Enabling Technologies (KET). These unique capabilities include access to physical facilities, know-how and Route to Market services required for the development, testing, upscaling and commercialisation of KET enabled products. The OITBs create the framework for these organisations to synergistically coordinate efforts and actions. OITBs are accessible through a Single-Entry Point that simplifies and facilitates the access to the whole services portfolio in a single process. The S.E.P plays a key role to reduce the inherent complexity to access independently to a set of facilities and know-hows distributed across Europe. The main goals of the OITBs is to provide technology services to users and overcome the “Valley of Death” and commercialise KET enabled products that create a new state of art able to meet sustainable development goals and create the basis of the knowledge-based society. The type of members of OITBs as well as users should be as open as possible, thus it must gather different stakeholders belonging to the triple helix such as universities, research centres, SMEs, start-ups, large enterprises, associations, clusters and public authorities. Therefore, OITBs will provide a framework to cooperate and upgrade technologies in specific research sectors relevant for society and industries. On the long run, the European Commission expects that the OITBs will be self sufficient and structure innovation ecosystems interested in KET,

The NewSkin project is one of these OITBs focusing on Advanced Surface Nano-Technologies. Coordinated by the European Convention for Constructional Steelwork and composed of 34 partners from 12 European countries. ALPHA-RLH, a French competitiveness cluster specialised in the photonics and electronics industries, The European Convention for Constructional Steel, with DREAM Cluster Water & Environment, the European Cluster of Ceramics, CONFINDUSTRIA EMILIA Area Centro, AquaTT and m27 are the seven key partners of the NewSkin OITB representing the interests of the European Industry. Our role is to coordinate and animate the innovation ecosystem of the NewSkin project to ensure the long-term sustainability of the NewSkin OITB. The NewSkin OITB will provide the European Innovation Ecosystem with the necessary technologies, resources and services to uptake a set of game changing, efficient and cost- effective innovative processes to manufacture nano-enabled industrial and consumer products as well as the necessary testing capabilities to demonstrate nano-enhanced goods features. Thus, the NewSkin OITB will create and validate to TRL7 and higher (system prototype demonstration in operational environment) new technologies to meet the challenges of key European industries such as steel, ceramics, transport, water treatment and the general industry. From 2020 to 2022, the NewSkin Consortium has worked in the creation of the OITB structure, the Innovation Ecosystem engagement, the upgrade of the testing and pilot plant facilities and the generation of value proposition for the targeted industries. Once the OITB structure has been created and the value proposition validated by the implementation of show cases, the OITB has started the services provision according to the defined value proposition. From 2022 to 2024 NewSkin services will be available under payment scheme and on free basis in 4 competitive open calls that will be evaluated on a six months basis. After the conclusion of the fourth call, the OITB will act as a self-sustainable entity, embodied by an *Association Internationale Sans But Lucratif*, that generates revenues with open access services and fair pricing conditions. Any entity can participate in the open calls and expect to obtain free services from the NewSkin consortium. To facilitate the organisation of the innovation ecosystem and the provision of services, the NewSkin OITB has launched an online platform aiming at gathering 3000 stakeholders interested in the field of nanotechnologies. In addition, the NewSkin consortium will provide route to market services during the final commercialisation stage including corporate funding, supply chain management and access to market support.

Through the NewSkin case, the European Commission demonstrates that OITBs can stimulate collaboration by gathering resources and existing skills at the European level while supporting all types of organisations independently from their geographical location, and thus contributing to the creation of a more open and connected European innovation ecosystem. Open Innovation Test Beds are also creating networks amongst themselves, to offer additional services, to allow experiments and knowledge to be disseminated, and to provide organisations of the triple helix with a single-entry point to their capabilities and services in technology development. They are expected to form European networks of competences along the entire value chain, and match the needs of industry by providing users with easy access to facilities, at different locations as needed. These networks should reach out to users across

different regions of Europe. This is especially important to European regions that are building up or improving their capacities.

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IMPLEMENTING THE SCIENCE AND TECHNOLOGY AGENDA THROUGH STATE PROGRAMS FOR THE DEVELOPMENT OF TECHNOLOGIES AND INNOVATIONS WITH THE PARTICIPATION OF TRIPLE HELIX ACTORS

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The National Technology Initiative (NTI) is a long-term comprehensive program creating conditions for ensuring the leadership of Russian companies in new high-tech markets that will determine the structure of the global economy in the next 15-20 years.

National Technology Initiative:
- united entrepreneurs with ambitions to build global companies;
- established Competence Centers based in universities and institutes of the Russian Academy of Sciences for the development of cross-cutting technologies (big data; neurotechnology, artificial intelligence, distributed ledger technologies, quantum technologies, new production technologies, industrial Internet, robotics and sensorics components, wireless communication technologies, virtual and augmented reality technologies);
- involved several hundred thousand schoolchildren in robotics, digital technologies, drones, biotech;
- created together with entrepreneurs and authorities working groups aimed to change legislation, for example, in the field of using air and land vehicles.

Holding interviews with experts, we were trying to assess:
- what stakeholders of this initiative received from participation in it, was it successful;
- and how unique this phenomenon or common practice is.

Our team was involved in two series of interviews:
- with key stakeholders of the National Technology Initiative,
- and with international experts on programs and strategies in the field of scientific and technological development in different countries.
The content of the interview with international experts includes a discussion of well-known research and technological development programs in different countries, implemented in the period 2010-2020.
The hypothesis for the interview:
- research and technological development programmes are a way of concentrating government, public and corporate, SMEs resources on the country's participation in global competition;
- the success of the programme is determined by its ability to create new knowledge, attract domestic and foreign investment in established or new sectors, its contribution on creating new champion companies, jobs and budget revenues;
- the key factors for the programme success – the programme’s conceptual framework (its broad positioning in society) and the type of relations between its participants (for example, based on communities), which allows to unite independent players on common goals that are normally unreachable for individual players.
Goals and objectives of the interview: to compare the ways of implementing science and technology agenda in different countries.

National Technology Initiative is a multi-focus program facing several scientific and technological areas and markets. At the same time, according to experts, the most successful are the programmes, which are focused on specific scientific and technological fields.

1. Subsidizing culture vs Entrepreneurial culture

Key risk of science and technology programmes initiated by government is that they develop a subsidizing culture, as opposed to an initial focus on involving entrepreneurs. An associated risk is the growth of bureaucratization of access to public funding within the program.
At the same time, many experts note the success of the experience in implementing acceleration programs that involve universities and companies in generating a stream of startups and technological solutions. The next step is not only to accelerate individual companies / startups, but also accelerate ecosystems.

2. Interdisciplinary approach vs Programmes focused on a limited number of destinations

Most of the current programmes cover either a wide range of scientific and technological areas, or include the development of cross-cutting technologies, which in their turn also attract different areas. In such conditions, it is difficult for the program holders to navigate which activities are important and necessary, and which can be discarded. Therefore, experts note that it is better to pay special attention on a narrower list of technological areas.

3. Long-term and future oriented innovation and technology policy vs impact-oriented innovation and technology policy

In the traditional approach to technology policy, technology development programmes are usually long-term and future oriented, and the planning process is based on the desired vision of the future. But experts note that for successful implementation of a scientific and technological programme, it is necessary to simultaneously launch the process from the other side: focus on the impact, which is assessed based on the existing competencies, and involve participants who develop or own technologies and are ready to work with the market now.

4. Clusters: Managerial organization vs Investments in companies

From the point of view of managing institutional forms of cooperation of participants in technological / innovative development, a successful experience is the formation of clusters, when different players unite around the scientific and technological sphere or the market. At the same time, it is noted that financing of cluster projects is more effective if it goes directly to the companies implementing this project, and not to the managing organization.

The value of the study is in highlighting the key factors for the success of scientific and technological development programs. At this stage of the study, a number of such factors have already been identified:

Technology and innovation programmes, like National Technology Initiative, set up the discussion between different organizations and institutions and enhanced the formation of communities around technological challenges holders of ideas.

The success of a technological development program is determined not only by the protocol of interaction between representatives of the triple helix institutional spheres, but also between representatives of different sectors of the economy and between representatives of various fields of science.

Entrepreneurs joined the programmes like the NTI because they got the opportunity to jointly shape the vision of the future in new business areas. And of course, they have the set of required competences. And then move on to projects and the creation of new companies.

Technological barriers. Overcoming the technological barrier allows to generate value and form new markets. In this regard, National Technology Initiative focuses not on large companies, but on SME’s, for which overcoming technological barriers lies in the core of their business.

5. One of the characteristics of technology and innovation programmes should be the systemic feedback from small and medium-sized technology companies, start-ups, on the basis of which the country's technological policy is further built. You have developed tax policy, participated in changing laws at the state and municipal levels.

UNCERTAINTY MANAGEMENT IN INNOVATION ECOSYSTEMS

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Innovation ecosystem literature is undergoing vigorous growth (Shipilov & Gawer, 2020; Hou & Shi, 2020; Su et al., 2018; Suominen et al., 2019). IE literature is vast and portrays recent new structures of economic relations (Jacobides et al., 2018). Authors propose various conceptualizations for this construct - business ecosystem, knowledge ecosystem, innovation ecosystem, entrepreneurial ecosystem, digital ecosystem). Ecosystems are communities of a not fully hierarchically controlled and independent, heterogeneous set of actors with varying degrees of multilateral and non-generic complementarities who collectively generate a coherent, ecosystem-level output and related value offering targeted at a defined user audience (Thomas & Autio, 2020; Adner, 2017). A focal actor typically orchestrates these expanded value chain systems that possess key technology (such as a platform) or other resources (Adner, 2017; Jacobides et al., 2018).

The innovation ecosystem literature is much more than a metaphor (e.g., Moore, 1993; Iansiti & Levien, 2004) or context for open innovation (e.g., Chesbrough, 2003), a new way to perform strategic analysis (e.g., Teece, 2007), and a concept for explaining the importance of value creation (e.g., Adner, 2012). Literature has matured in recent years and considers ecosystems an actionable new structure of economic relationships (Jacobides et al., 2018) that requires specific management (Adner, 2017). IE is a fertile field for the emergence of uncertainties of different natures (Thomas & Ritala, 2021) and different levels (Gomes et al., 2019) because they grow in a non-linear way, with the development trajectories being emergent rather than strictly controlled (Ritala & Almpanopoulou, 2017). The ecosystem breaks the pillars based on individuality towards a good systemic, integrated, and distributive vision (Dattee et al., 2018). Extant contemporary IE scientific literature streams have focused on answering why, when, and how actors align, what ecosystems are and how they operate (Jacobides et al., 2018; Suominen et al., 2019).

The literature has already shown the source of several different types of uncertainty at the project and organizational level, but studies of uncertainty management at the ecosystem level are relatively scarce (de Vasconcelos Gomes et al., 2018; 2021; Dattee et al., 2018; Adner & Kapoor, 2010). We know much less about how emerging ecosystems deal with uncertainty - the loss of predictability such that the future is unpredictably different from the past, and information about the future is incomplete, unknown, or unavailable (Furr & Eggers, 2021; Knight, 1921).

Based on this research gap, this research intends to present an analytical framework of uncertainties that affect innovation ecosystems' emergence. To do that, we intend to conduct a qualitative multiple case studies methodological approach in three innovation ecosystems health-technologies-related. Each ecosystem consisted of an interconnected group of heterogeneous actors (firms, technologies, and institutions) with varying degrees of multilateral and non-generic complementarities that shared cognitive, financial, and technological interdependencies to generate a coherent value offering to the market. The three value propositions are related to delivering innovative technology solutions for global health. We interview multiple actors from the ecosystems to understand the uncertainties that occurred in the emergence process, from creating the technology to building the members' collective value proposition.

This study contributes to the emergence of the innovation ecosystem as a structured research field (Adner et al., 2020, 2017). Uncertainties are context-based. Therefore, new forms of uncertainty not previously identified in the literature may emerge from this study. Also, we need to understand drivers for unlocking ecosystem emergence (Thomas et al., 2022; de Vasconcelos Gomes et al., 2022) to help the organization overcome a series of challenges and uncertainties presented during this emergence process. When an ecosystem is emerging, like other new organizational forms, it often strives to gain resources and institutional support, leading to high failure rates in the early phases (Thomas & Ritala, 2021). Actors may lack access to information and evidence regarding the viability of the emerging ecosystem and its long-term sustainability (Thomas & Ritala, 2021) actors' positions in the ecosystem (Dattée et al., 2018). Actors depended on cooperation from strangers to deliver a still incipient value proposition to the market (Dattee et al., 2018). Emergent IE face doubts regarding the technological, economic, and cognitive independencies that might exist (Thomas & Ritala, 2021). The mutual dependency of value creation suffers from a "chicken-and-egg" problem of launch and adoption because there are insufficient participants to enable an appealing ecosystem value proposition.

This study contributes to public policymakers by depicting elements that inhibit innovation ecosystem emergence. Based on these findings, practitioners may strategize paths for better dealing with situations of different natures in these contexts.

Keywords: innovation ecosystems; uncertainty management; emergence; study case.

IMPLEMENTATION OF TRIPLE HELIX RELATIONS FOR SUSTAINABLE CITIES: FUTURE BY LUND

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Innovation is emphasized important for companies to stay competitive. A company's ability to introduce new products and services is a key success factor for maintaining commercial goals and thus its competitive advantage. It is also obvious that innovation and new technological solutions are needed not only for commercial competitiveness and industrial leadership, but they are also needed more than ever to address global, emerging and societal challenges. Humanity finds creative solutions to address significant challenges, both in innovation and sustainable development (Zhou and Etzkowitz 2021). Engineers, scientists, product developers and even policy makers should interact to develop innovation and address social and economic needs and find solutions not only for technological problems but also for social, economic and environmental challenges. This vision is without doubt desirable and very noble. However, the actual implementation of sustainable development goals (SDGs), that is pursuing climate-smart, ecologically sustainable and human-centered development, valuation of ecosystem services, community-led governance, as well as acceptance of the principles of circular economy is no walk-in-the-park.

With more than half of the world's population now living in urban areas, and cities accounting for 80 per cent of greenhouse gas emissions (Hodson and Marvin 2009), cities are often seen as crucial sites for responding to the dual issues of climate change and peak oil, while also becoming more sustainable in nature (Betsill and Bulkeley 2007; Moser and Dilling 2007; Giradet 2008). A number of towns and cities in the United Kingdom (and across the globe) have taken initiatives to move the agenda further. An emerging theme is to encourage public-private partnership and design innovation policies with the purpose to find innovative solutions to social, economic and environmental challenges. These partnerships rely on contractual relations and development upon a clear-cut idea where the public contractor (e.g., state departments, city council, municipality etc.) requires a solution to problems (Zhou and Etzkowitz 2021). Key players in those networks, however, have their own complex internal dynamics and there would be some inertia and skeptics among these actors. Initiating as well as managing and coordinating such partnership is also complex and risky in its nature. These efforts require investment of resources (time and money) and commitment before any positive effects become visible.

Our study is based on Sweden. Sweden is one of the innovative countries, in particular according to the recent European Innovation Scoreboard (EIS) included parameters of digitalization and environmental sustainability, bringing the ranking closer to EU policy priorities. Sweden and in particular Lund are excellent locations to study innovation networks between university-industry and government that are working on topics related to developing solutions for a sustainable future. Sweden has been a leading country in the European Union (EU) in innovation and has been proactive in promoting sustainability. The city of Lund certainly takes one of the central positions on the map of Sweden when it comes to knowledge and innovations. Lund is a small, university city with a population of ca. 110,000 inhabitants. While megacities clearly have a higher impact on resource-related problems and climate change, small and medium-sized cities should not be neglected so far as their potential role as test-beds for ambitious new governance is concerned. Unlike mega-cities or bigger innovation hubs Lund has been the seedbed for high-technology and innovation despite its size and thereby Lund is a rich case for our proffered thesis for this study. We decided to choose projects from Lund since researcher's in-depth local knowledge of Lund and thereby to offer robust explanations based on this rich knowledge of setting and circumstances (Fenno 2014). Projects at the intersection of innovation and sustainability in Lund are selected to that illustrate the integration of science, firms, and community-led governance. Due to the embedded and complex nature of the variables in this study, the case study method is justified for its ability to capture situational and phenomenological complexity (Yin 1984). We chose a sample of projects (cases) that are representative and which have variations on the dimensions of theoretical interest. Our approach is not intended to increase the generalisability of the findings we rather intend to explore several project contexts in which the dynamics of triple helix model can be more deeply explored. Further, the selection of projects from Lund is motivated by a paradigmatic information-oriented methodology based on the anticipated content of the cases, the ability to generate research utility from a small sample, and the value in identifying a "metaphor … for the domain that [a] case concerns" (Flyvbjerg 2006, p. 230).

We studied the practices of 20 projects in Lund conducted within the framework of "Future by Lund" (https://www.futurebylund.se). All the project teams we studied perform fundamental applied research and innovation work that address the global challenges of combating climate change and its impacts—the UN's Sustainable Development Goals. Projects selected from Future by Lund are presented and analyzed with the help our theoretical framework. We present challenges, and results of these projects and thereby also make triple helix relations

transparent through these innovation projects and guide the reader observe the policy and managerial lessons from the Lund model. The scope of these related policies varies from project to project, but one cannot help but notice that there are seeds from the Triple Helix model present in all of them. We discuss these projects and policies in a sectoral order and based on the challenge they address. We conclude this study with summary remarks and suggestions for future policy related research. Our attempted tone throughout this study is descriptive, that is we have attempted to report in a non-assessing manner the pattern of Triple Helix relations. However, we do note in some correlative patterns. We do so to help to motivate our proffered research agenda. In line with our findings, we refer to this phenomenon by the phrase *diffusion of the innovation spirit.*

STRUGGLE OR FAST VICTORY? A COMPETENCE-BASED APPROACH TO SPIN-OFF FIRMS ACTIVE IN ENERGY INVENTIONS, WITH A FOCUS ON LOCAL UNIVERSITY ECOSYSTEMS

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The study investigates start-ups that are 'fuelled' with up-to-date technology developed at university: university spin-of firms. These firms are defined as established independently, with the aim to develop university inventions and bring them to market. University spin-off firms often receive basic local support in the first years through incubator and accelerator services, but many tend to remain vulnerable due to lack of market knowledge and management skills, short in financial capital and legitimacy, making reaching the market a risky affair. A part of spin-off firms, in contrast, is genuinely risk-taking and may quickly shift to local or specialized markets. Also, compared to large incumbents, such firms may be able to quickly capitalize on innovation and sustainable practices, and by smart networking they may benefit from knowledge flows in local ecosystems more than other spin-offs. However, many constraints are mentioned in literature, specifically on barriers to scaling-up in energy systems.

Energy systems can be conceptualized as socio-technical systems with emphasis on complexity and evolutionary dynamics, including 'layers' of different change dynamics and resistance to change. The so-called regime is seen as acting as the solid structure that preserves stability in the systems, derived from rules that direct and coordinate social and economic behaviour in reproducing system activities. These include lock-in mechanisms, like sunk costs, vested interests, user preferences, experienced business models, that prevent radical change that is transitional. So-called niches are at another system level on which real-life learning about inventions is possible under 'sheltered' circumstances, e.g. beyond influence of the market (prices) and regulation. Experimentation in niches enables learning on effectiveness of inventions, customer demand, regulation (standards), and legitimacy towards large firms, governments, etc. If successful, such experimentation may contribute to institutional changes and reduce regime resistance, thereby opening roads to market introduction of transitional inventions.

In the above context, our focus is on strategic choices of university spin-off firms, and their orientation on innovativeness, pro-activeness and competitive 'aggressiveness'. The choices include the energy technology itself, in terms of radicalness of technology (product) and newness of the market, eventually facing (fierce) 'resistance', e.g. hydrogen as carrier and energy source. Another important choice by firms is to adopt diversification (e.g. with services, or related traditional products) as a short-term risk-avoiding strategy, for example, aimed at raising cash to prevent the 'valley of death' and, additional learning about the targeted market segment. However, strong diversification may cause delay in market introduction of the invention.

In the context of small firms' risk-taking and learning, we use the *competence-based view.* This view posits that owning competence to better identify opportunities in technology and markets, including identifying needs for new resources, may increase competitiveness and enhance a shorter time to market. Size of the founding team and high education level are often mentioned in this respect, as these increase the probability of achieving diverse and rich information. Further, young firms may increase competences by extending the founding team with experienced marketing/business persons, by collaboration with large firms, eventually in a niche, and by attracting first substantial investment. The basic assumption we make is the earlier such steps are taken, the shorter the time to market will be, though there are signs of more complicated development.

Importantly, young firms in risky technology/markets may benefit from supportive local ecosystems, as influenced by national innovation systems, like nationwide subsidies for specific energy R&D and business culture in favour of entrepreneurial (risk-taking) spirit. In addition, metropolitan agglomeration advantages, summarized as knowledge spill-overs and local skilled labour pool, may be at work and speed up market introduction. Such local knowledge assets are assumed to improve opportunity recognition, knowledge networking and dealing with institutional challenges (e.g. legal, regulatory). However, there is some controversy in literature here concerning the relation with city size. According to agglomeration thinking, metropolitan areas and their ecosystems are supposed to provide higher level and more diversified knowledge spill-overs that enhance basic innovation and larger creativity. Against expectation, such trajectory may cause stronger efforts and longer roads to market introduction. Smaller cities, by contrast, may be specialized in certain energy technology, e.g. dependent on close proximity to natural assets, like windy ridges, sunny deserts, and large reservoirs of silicon (solar photovoltaics). The smaller cities and universities involved may be highly specialized in a particular energy technology, eventually driven by large local firms. Such situation may cause practical inventions and shorter roads to market. Another possibility is that smaller cities, drawing

on traditional manufacturing and competences, provide advantage of 'relatedness' to practice of new energy technologies.

To explore above influences on market introduction of energy inventions, we composed a database of 106 spin-off firms in Northwest Europe, including a longitudinal view, and employ Cox regression analysis. Given the outcomes of this groundwork, we next select four spin-off firms to deeper explore (contradictory) relationships with the local university ecosystem, including emerging new actors and hybrid organizations.

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STARTUPS DYNAMIC CAPABILITY: A PATH TO FOSTER COLLABORATION WITH LARGE COMPANIES IN OPEN INNOVATION PROJECTS

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Increasingly, firms immersed in contexts of different technological intensities will suffer from the volatility, uncertainty, complexity, and ambiguity of the environment in which they operate (Fergnani, 2020). High technological startups or spin-offs working with deep technologies – i.e., photonics, electronics artificial intelligence, blockchain, robotics, nanotechnology, quantic computation – can emerge nascent markets. Nascent markets are born in the frontier of more than one cluster or specialized area due to their incomplete or fleeting structures (Fombrun & Rindova, 2001). They can shape entire new industries (Kapoor & Klueter, 2021) or even create an entire innovation ecosystem (Shi et al., 2020). In high-uncertainty markets, information is incomplete, unpredictable, or even unknowable (Kapoor & Klueter, 2021). In this sense, it's not worthy for a single firm to enter this game alone. It's not financially worth addressing all these uncertainties because generic technologies can lead to very different market applications. In addition to high technological market entrance costs, it is also very difficult for firms to master the entire development process and address the technology's complexity alone (Gomes et al., 2021; Kapoor & Klueter, 2021). In this context, firms open innovate.

Companies have long formed partnerships with one another to create value. Partnering with external firms is a good way to solve current challenges. Collaboration can help firms enter new markets and target new customer segments (Berger, 2017; Pioneers.io, 2019a, p. 2), fostering technology development (Urban & von Hippel, 1988; Lane e Lubatkin, 1998, Pisano, 1990). "Corporate-startup collaboration", "Corporate-startup collaboration partnerships" or "corporate-startup engagement" is a phenomenon researched through two perspectives. The interorganizational relationships perspective focuses on collaboration as "a cooperative, inter-organizational relationship that is negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanisms of control" (Hardy, Phillips, & Lawrence, 2003:323). This literature address specific forms of Interorganizational collaboration in supply chain cooperation literature (Gereffi et al., 2005; Mitrega et al., 2017), temporary projects (Sydow and Braun, 2018), complex networks orchestrated by large firms (Dhanaraj and Parke, 2006). The initial conditions of Interorganizational collaboration (the formation, initiation, or "startup" phase) have been addressed in this literature (Schepker, Oh, Martynov, & Poppo, 2014). However, few studies focus on the nature of corporate-startup collaboration (Larkin, M. & O'Halloran, 2018). So corporate-startup collaborations cannot be viewed only through the lens of inter-organizational relationships, and additional perspective is required (Connolly, Turner & Potocki, 2018; Freeman & Engel, 2007; Leitner, 2014).

The second stream, corporate open innovation strategy (Chesbrough's open innovation perspective), seems to explore this relationship deeply. This perspective focuses on collaboration to reach innovation models and develop new technologies (Chesbrough, 2003) through the recombination of knowledge from diverse technology fields (Chesbrough & Bogers, 2014). Collaboration with external companies can provide a variety of knowledge sources, enabling the organizations to reach strategic success (Aylen, 2010; Fabrizio, 2009) and superior financial performance (Faems et al., 2010). Corporate-startup collaboration is a subtopic analyzed in this literature. Innovation scholars stressed the why, when, how large and small firms collaborate, highlighting the opportunities and challenges these alliances may face (Buckley, Prashantham, 2016; Prashantham, Birkinshaw; 2020). In open innovation projects, it's expected that large firms assume the roles of knowledge exploiters while small ones will contribute to the open innovation projects as knowledge explorers (Rothaermel & Alexandre, 2009; March, 1991).

Startup -corporate relationships have led to innovation, new products and new services within the larger corporate alongside engendering better sales and supply chain opportunities to the smaller business (Enkel, & Sagmeister, 2020). But the asymmetry in power leads some researchers to describe startup -corporate relationships as challenging as "swimming with sharks" (Diestre & Rajagopalan, 2012; Katila et al., 2008), "dancing with gorillas" (Prashantham & Birkinshaw,2008) and "surviving bearhugs" (Vandaie & Zaheer, 2014). There are high failure rates of corporate-startup collaboration. Sometimes these failure rates are related to problems in selecting startups for collaboration and uncertainties regarding the creation and appropriation of value in the collaborative process (Gomes et al., 2021).

There are plenty of reasons why startup-corporate fail to obtain success. And the literature showed how large firms could try to optimize their process of searching, attracting and selecting partners and obtain great results in partnership with startups (i.e., see Kumar & Prashantham, 2019). The two parties have important differences in

alliance capabilities and intentions (Prashantham, Birkinshaw; 2020). However, the literature pays little attention to the startup side of open innovation projects (Katila et al., 2008; Simon, Harms, Schiele, 2019). There is a missing piece in the literature regarding the startup capabilities for corporate-startup collaboration in alliances for open innovation. What common capabilities can be found among startups that have successfully formed open innovation projects with corporations?

The purpose of this article is to depict the foundations of startups' capabilities responsible for enabling them to collaborate with large corporations in the early stage of open innovation alliances. We presented and tested three propositions concerning startup-specific capabilities that contribute to the successful alliance formation for open innovation projects. We will perform a qualitative cross-sectional study case with 15 semi-structured and in-deep interviews with Ceos of Deeptech European startups. These startups were successful alliance formation or semi-finalists in alliance formation.

The findings contribute to the literature on external technology sourcing and asymmetric partnerships in open innovation. There is no single pathway to resolving the tensions encountered in large-small cooperation (Prashantham, Birkinshaw, 2020). However, we can understand ways to reduce these tensions by clarifying the startups' capabilities for better success in alliances with large corporations. The ability to collaborate with startups is more important now than ever before, given the pace of technological change and the rapid emergence of new business models driven by digital technology. Few academic research has been conducted on the corporate-startup collaboration in alliances for open innovation in nascent markets looking through the lens of the startups. This study contributes to the literature by comparing successful and unsuccessful startups (Spender et al., 2017) and highlighting a multilevel framework compiling startup capabilities important to alliance formation with large corporations (Bannerjee, 2016).

Keywords: Corporation-startup partnering; alliance; open innovation; collaboration.

DIGITAL ENABLERS OF SUSTAINABLE RURAL DEVELOPMENT: A CASE STUDY OF A SOCIAL ENTERPRISE'S SUCCESS

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A crucial concern for global sustainable development is how to reach the rural world. More than 3 billion people live in the rural areas of developing countries, rely on farming and small family businesses for their livelihood, and are disproportionately poor, with 80% of people in extreme poverty living in rural areas (IFAD 2022). Bringing innovative solutions to the rural population is one of the key steps to advance productivity and knowledge-sharing, improve the quality of life of entire communities and eradicate poverty through sustainable solutions. However, projects for sustainable development in rural areas are complex to implement, because of the remoteness and thus difficulty in reaching the main economic actors – workers, entrepreneurs, intermediaries, service providers – and in connecting them with local markets and organizations, as well as policymakers. Most solutions are ad hoc and hardly scalable.

Digital technologies can help bridge the "remoteness" gap in rural economies, facilitating outreach towards isolated households, unable to access and process knowledge about innovative practices, and that lack market access (He 2019). However, the practical implementation of models of "digital empowerment" in the developing world present numerous challenges. First, remoteness also corresponds to limited availability of infrastructures, electricity and internet access, which are required by classic digital tools, and second – but not less important – people living in rural areas often lack the skills to operate such tools. While policymakers are extremely interested in supporting new digital enablers of sustainable development in rural areas, the pathways to effectively leverage these tools are not yet well established.

The goal of this research is to provide an in-depth analysis of a success case from an innovative award winning social enterprise (referred to as "K" for anonymity) operating in rural areas of Africa and South Asia. The company has achieved multi-dimensional impacts by developing digital technologies apt to share knowledge, link market actors across the value chain, and train agricultural entrepreneurs in economically, socially and environmentally sustainable practices for rural areas. This case study offers numerous relevant insights and examples of best practices to overcome the issues of remoteness (physical distance, lack of internet, irregular power availability) and challenges with available human capital (lack of digital skills and awareness of the most innovative practices).

We choose to examine a single case study with a holistic design as our research methodology, to investigate an emerging phenomenon – social entrepreneurship leveraging digital innovation for development - within its real-life context, namely rural areas of developing countries, given that the specific features of this phenomenon are yet to be conceptualized (Yin 2009). Our research question is: what are the most effective business solutions that can solve the problems of remoteness and lack of human capital in rural areas? The evidence from a specific exploratory case study is a compelling choice of methods to answer our research question, analyzing a phenomenon in its real-life context while maintaining its' richness and full articulation (Eisenhardt and Graebner 2007).

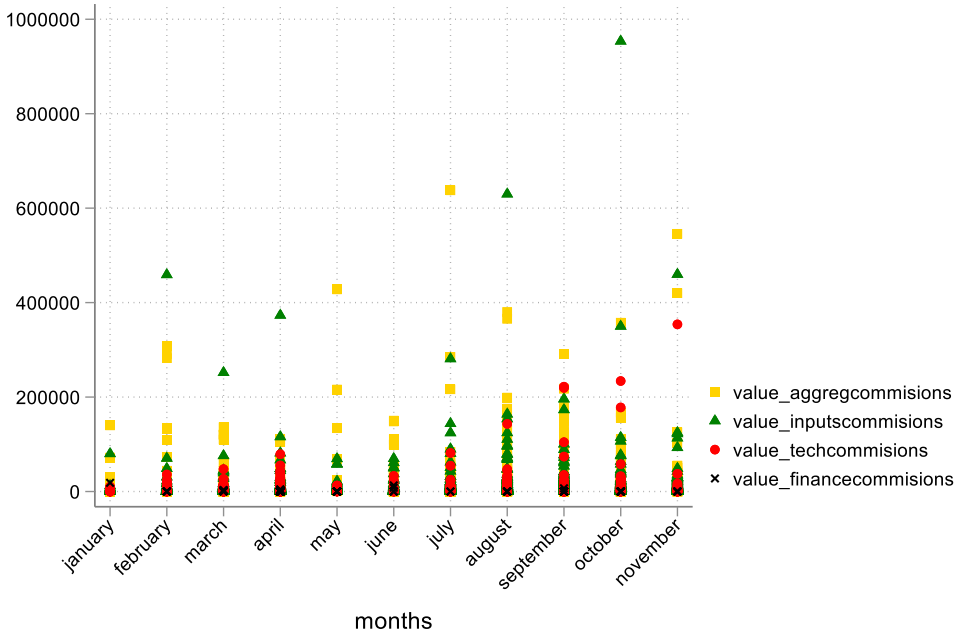
The data for our analysis comes from semi-structured interviews with the founder of the company and his colleagues in 2021, from documentations about the company, in particular the reports produced for different donor organizations that financially support the company, and importantly from data collected by the company through its digital platform regarding the local users of their services. One key advantage of digital tools in this context is in fact the data intelligence available on key outputs relevant for the company's social impacts (for instance number of people reached, frequency of transactions or value of sales), even at the individual user level.

We find that the key value added of K's model is the use of *modular* digital tools to enable training, market creation and exchanges in remote areas. In particular, the company has developed a portable device that includes a library in the cloud, a projector and Wi-Fi router sufficiently compact to fit in a backpack (and that is also functional offline). This portable digital kit provides access to three services through its platform:

1) Accessible **information** (short videos) about agricultural sustainable and best practices to farmers in remote areas;
2) A **virtual marketplace** that agri-entrepreneurs can use to offer to the farmers access to agricultural inputs or products;
3) A **remote learning platform**, that K uses for advanced business training for its agri-entrepreneurs.

The analysis of the data on the training of agricultural entrepreneurs offers encouraging results: already throughout the period of training, participants achieve a substantial amount of income from their extension services (Figure 4).

Figure 4 - Annual commissions earned by agri-entrepreneurs throughout their trainings with K, through their digital marketplace. Commissions are earned from general transactions ("aggregcommissions"), inputs' sales, technology sales (especially agricultural machineries) and financial intermediation. Source: Author's elaboration of K's data.



This digital model of outreach offers significant opportunities for upscaling the services offered by the company. For example, their library currently include more than 10,000 bite-sized HD video content in 10 languages covering 40 crops, livestock, social and business skills. These are complemented with in person on-demand rural advisory by the agri-entrepreneurs. As a further complement, the company is developing conversational AI bots that can provide in-the-moment crop advisory and knowledge nuggets to farmers in local languages or dialects.

Furthermore, the detailed monitoring of the agri-entrepreneurs' activities on each portable device provides insights into the effectiveness of these services, and has allowed the company to iteratively improve its offering, integrating sophisticated mentoring services to facilitate the acquisition of skills and new knowledge. The scalability of the model, combined with the flexibility of its digital platforms, has allowed K to use similar devices also in other three areas: health; water, sanitation and hygiene; and skill building for youth and women. To further leverage its scalability, recently the company has partnered with the World Food Programme for its innovation accelerator programme to expand its operations. Overall, the digitally-enabled approach to rural development mastered by K offers a new model of effective and modular approaches to training, creating connections and systematically improving local practices.

EMERGE AMAZÔNIA: UNIVERSITY-INDUSTRY RELATIONSHIP TO LEVERAGE SCIENCE-BASED STARTUPS FROM AMAZON BIODIVERSITY

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Brazil has the greatest biodiversity on the planet and much of it is concentrated in the Amazon. The potential for generating social and economic development from this wealth is still unexplored and the challenges of climate change and deforestation threaten this ecosystem and the balance of the world.

In order to contribute to this challenge, Emerge Brasil, an innovation consultancy firm, created the project Emerge Amazônia. The objective of this project was to leverage scientific-based technologies that use Amazonian inputs to the market and invest around $50 in three technologies. The investment was made by Emerge itself in startups from mutual convertible into shares. The thesis was based on three main premises: 1) development of science-based innovation; 2) use of inputs from Amazonian biodiversity; 3) involvement of large industries.

Four major Brazilian industries in the areas of health, cosmetics, and food were involved to direct the focus of technological prospecting, where there was the potential of biodiversity and the convergence of the innovation strategy of these companies. In addition to getting to know the mapped technologies, large companies mentored new businesses and have investment priority.

The involvement of large industries from the initial time of the project to determine the prospecting focuses, as well as the direction of the technology, is part of Emerge's thesis that the development of science-based startups together with large corporations is catalyzed to the extent that these companies. Big corporations have the capital for investment, the well-defined market focuses, the structure, personnel, and know-how in scaling technologies.149 technologies were mapped, of which 46 had patents deposited and 109 were from universities or research centers. The distribution of technologies mapped by area followed the volume of publications produced by Brazilian science, with health being the sector with the largest number. Of the 149 technologies mapped, 65 were for health, 56 for food, and 28 for cosmetics.

Most technologies had as a central element the use of new Amazonian inputs or the repositioning of inputs already used for other purposes to the detriment of new processes. The maturity of technologies is mostly concentrated in the initial phase of development and, therefore, at the beginning of the valley of the death of innovation, especially in TRL 3 and 4. Nine technologies were selected to deepen the market direction and investment potential, of which 3 were chosen to receive the investment, being two new phytotherapeutics and one of food.

Emerge Amazônia puts into practice the structured dialogue between university and industry, through an organization specialized in technology transfer, combining corporate strategy with the potential of science to generate innovative products from biodiversity.

The project concluded that there is relevant science being produced on the biodiversity of the Amazon and that there are researchers and industries interested in bringing them to market. There is also market potential in these solutions that encourage the preservation of the forest and promote socio-economic development based on science, technology, and innovation. However, the results are still small given the size, potential, and ambition of Amazon.

WHO DOES LEAD INNOVATION IN AUTOMOTIVE LIVING LABS? COMPARING EXPERIENCES IN THE EUROPEAN LANDSCAPE

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Living Labs (LLs) are user-centred open innovation ecosystems that exploiting a systematic user co-creation approach, integrate research and innovation processes in real-life settings (ENOLL, 2021). Born in US to test social innovation, the diffusion of LLs has constantly increased across Europe in the latest years, extending in many other fields, such as healthcare, automotive and agriculture (Hossain et al., 2019). The co-creation characteristic and its open nature, which brings a broad variety of stakeholders (private firms, public administrations, university till the final users) to work together in the innovation process, have led part of the literature to embed LL concept within the framework of Quadruple Helix (QH) model (Hossain et al., 2019). QH, an extension of the Triple Helix (TH) by Etzkowitz (2003), integrates the Civil Society as the fourth institutional sphere participating in the interactive innovative process together with University, Industry and Government (Carayannis et al., 2009).

Within this integrative framework, LLs can be conceptualized and classified by focusing on the institutional nature of actors having a central role in its formation as hybrid organization and in managing the multi-actor networks involved in innovation processes. Among others, Leminen et al. (2012) propose an actor-based classifications of four different types of LLs: utilizer-driven, enabler-driven, provider-driven and user-driven. The utilizer-driven LL is based on the leading role of the company (Industry sphere) testing its technology and organizing LL activities around its strategic objectives. LLs are enabler-driven when they originate from public-sector projects (Government sphere) pursuing societal improvements. Provider-driven LLs are organized around the leading role of knowledge-providing organizations (University sphere), augmenting knowledge creation, and finding solutions to specific problems. Finally, user-driven LLs are informally organized by end-user communities (Civil Society sphere) to solve everyday issues.

We applied the Leminen et al.'s (2012) taxonomy on LLs aimed at testing one of the most disruptive technology in the actual transition towards new forms of mobility (Fagnant & Kockelman, 2015): Autonomous and Connected Vehicles technologies (ACVs). We analysed some of the most significant European LL experiences to investigate their formation and performance. LLs are indeed a powerful tool to investigate both the benefits expected by the introduction of ACVs (e.g.: road safety, environmental sustainability) and the barriers of different nature (i.e.: legal, technological and psychological) that hinder their diffusion (Fagnant & Kockelman, 2015). Given the articulated set of institutional actors involved in ACVs innovation process and on-road testing, and the complex multidisciplinary issues to face, we believe that investigating within a QH framework which actors are leading the formation of and managing LLs may help understanding LLs' evolution path and performance as hybrid organizations.

Following a comparative and multiple case studies approach (Yin, 1994), six European LLs for on-road testing of ACVs are purposefully selected. Data are collected from multiple sources to increase robustness. Data from secondary sources are validated through semi-structured interviews with Key Informant (in-progress) focusing on actors' participations and roles in LLs' development.

By comparing to Leminen et al. (2013) taxonomy, four cases are enabler-driven types of LLs, having the government or public institutions as leading actor; one is provider-driven (university has leading role) and one is utilizer-driven (industry as key actor), while none of the case is user-driven. Despite all the LLs are located in real or semi-real urban environments, allowing interactions of the technology with the end users, the local communities (civil society) does not take an active role. This could be related to the complex nature of ACVs. Results suggest then that when the technology use requires complex regulatory and governance frameworks, as well as complex competencies and knowledge to be implemented, and a wide range of economic and societal impacts are involved, the government sphere is then more likely to actively form and guide LLs, to the benefit of society. In addition, when the support of public actors is guaranteed, also the university or industry spheres may drive LLs' formation in complex technology application fields. In both latter cases, the focus of the LL's activity shifts to meet more directly the interests of the leading institutional actor, respectively with a greater focus on research-related outcomes and on economic implications and business opportunities.

The paper contributes to the current academic debate on LLS and QH model. It also supports managers and practitioners in performing innovation activities and projects focused on complex technologies, highlighting the network and the actors' configuration that should be evaluated in the construction of a LL for ACVs on-road testing. As with any study, there are limitations. Firstly, the case studies approach does not allow for fully generalization of

results. Secondly, actors' involvement and roles within LL may change over time, and longitudinal analysis is needed. Thirdly, this is a work-in-progress dealing with complex technology, requiring further in-depth analysis. In line with what suggested by the QH literature, the user contribution is sooner or later needed, future research should pay more attention to how users' interaction can be brought inside LLs in ACVs field. Finally, while the Leminen et al.'s (2012) model shows a good capacity to classify existing cases of LLs dealing with complex technology settings, for future research the need of adopting models embedding dynamic perspective and process analysis does urgently emerge.

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RESEARCH, INNOVATE AND EMERGE (RIEM): LESSONS FROM A PROGRAMME FOR STRENGTHENING THE CAPACITY FOR BUSINESS-UNIVERSITY COLLABORATIVE RESEARCH AND INNOVATION IN THE UK

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Engagement with businesses and small and medium enterprises (SMEs) provides an opportunity to better understand the research and innovation (R&I) needs and priorities of these organisations. Different reviews led by the UK government recommend the need to increase the externally led research and innovation process in the sector and collaboration with businesses (The Dowling Review, 2015; Earnest & Young, 2017). With the Covid-19 induced challenges for businesses and HEIs, many organisations developed creative ways for mutual engagement. In this context, a new programme called, Research, Emerge and Innovate (RIEm) was developed by Brunel University London to strengthen the capacity of SMEs for collaborative R&I with HEIs. This paper analyses RIEm's methodological approach, reviews the experience of the delegates representing businesses and explores strategies to better engage with SMEs and HEIs.

During the engagement with over 50 SMEs, accessing HEI resources and expertise came across as a challenge for a large number of organisations. Based on the experience of a similar programme on resource mobilisation strategy development and implementation, the author developed the plan for RIEm. After the internal review in Brunel University London, this was included in Brunel's corporate plan for SME engagement[5].

Support for RIEm within the Research Support and Development (RSDO) Department and the involvement of Business Development (BD) Managers in identifying businesses was very crucial. Each BD Manager engaged with certain organisations to promote RIEm as part of their sectoral specialisation. As Brunel University is already a leading member of the West London Business (WLB), a network of organisations in West London, its leadership helped to promote RIEm to its members. This resulted in a greater number of local businesses to joining the initiative.

The first phase of RIEm demonstrated higher level of interests of SMEs to engage with university. 24 organisations attended the first phase focusing on the research and innovation needs and capacity assessment. The training sessions planned for this phase explored how R&I strengthening needs of businesses could integrated with the expertise Brunel University could offer to help these organisations. Brunel staff presented some of its R&I expertise it may be able to offer to these organisations.

A vast majority of the participants rated very high of the first phase. It helped them to strengthen their understanding on research and innovation process and engaging with the University systems. This also helped the university to better understand the emerging R&I priorities and skills required in these organisations and the context in which they operate. We plan to monitor how each phase of RIEm generates strengthened engagement and also help these organisations to strengthen their R&I capacity.

[5] Brunel University's SME engagement strategy and plan includes RIEm and it secured funding from the UK Government to implement RIEm in 2021-22 with the potential commitment for next couple of years.

PROCESSING SOCIETAL EXPECTATIONS: DECISION-MAKING ON ENTREPRENEURSHIP EDUCATION IN THE ENTERPRISING RESEARCH UNIVERSITY

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The idea about the triple helix of university-industry-government relations was introduced by Etzkowitz as a laboratory for knowledge-based economic development and a pathway for a more enterprising university, which flexibly responds to the needs present in its political and economic environment. Higher education research, on the other hand, has pointed out that university managers have developed a strong sense of uniqueness of their organization, which indicates that the management operates as a filter mediating between the external environmental expectations and internal organizational action. This tension between the external influence and internal determination sets the stage for the current paper: Our goal is to investigate the ways in which university management observes the organization's external environment and translates the environmental stimuli into tangible managerial solutions within the university.

To address this topic, we draw from Luhmann's systems theory to investigate managerial decision-making within an internally differentiated administration structure of an enterprising research university. We conceptualize the university administration and management not as a unified organizational function, but in terms of differentiated offices that have evolved to maintain connection between the university and its complex societal environment. Further, we hold that these differentiated offices operate according to dissimilar structural expectations, which affects the ways in which they process external stimuli into organizational decisions. Thus, we approach the university administration and management in terms of problems that are observed and managerially reduced to arrive at temporally binding organizational decisions. We pay attention to entrepreneurial, i.e., experimental organizing, which only recently has been adopted in the public sector to deal with organizations' internal and external multiplicity. Our analysis therefore shows how conventional public administration with characteristics of bureaucracy is supplemented and partly substituted by novel managerial techniques ensuing from the private sector. By so doing, we will demonstrate the ways in which universities managerially transform themselves via selectively processing external stimuli into potentializing organizational structures that help them to meet the novel entrepreneurial expectations set by the society.

Our research is based upon analysis of the decision-making process in the University of Helsinki, which introduced entrepreneurship education into its structure in the 2010s. Further, we focus on an emergent organizational unit, the Helsinki Think Company (HTC), which is a student entrepreneurship hub established in 2013. We regard this object of study sufficiently controversial to allow us to observe how the traditional public administration and new managerial procedures become mobilized within the university as it seeks to expand its operations to include a program to foster student entrepreneurship. Thus, the organizational initiative we analyse not only relates to the changes concerning education and schooling as well as science and research, but also influences the novel area of the university's third mission services administration. Thus, we formulate our research question as follows: How is the socially complex initiative of student entrepreneurship processed by internally differentiated administration and management structure of a university?

During the analysis we will use systems-theoretical framework to analyse semantics of the reference problems and their articulation in the duration of the observed decision-making process. We take these semantics to correlate with the complexity of structural expectations present in the university's environment, and the ways in which these are administratively observed and managerially coordinated to reduce the decisional complexity about the entrepreneurship hub. Further, because the studied initiative appeared as socially unusual in relation to the identity of a "Bildung" university (Bildungsuniversität), the temporal dimension proves central in the processing of decisional meanings. Thus, under the epistemic guidance of systems theory, we observe varying temporalization of the HTC initiative according to the structural viewpoints of the different administrative branches of the case university. In practice, the data is coded by 1) identifying the managerial descriptions of the complex environmental expectations and problems, 2) recognising how these are reduced by the administration and management offices of the university and 3) discovering what decisions ensue from such complexity reduction. Figure shown below summarizes our empirical results on a general level with specific references to the details of the analysed decision-making process.

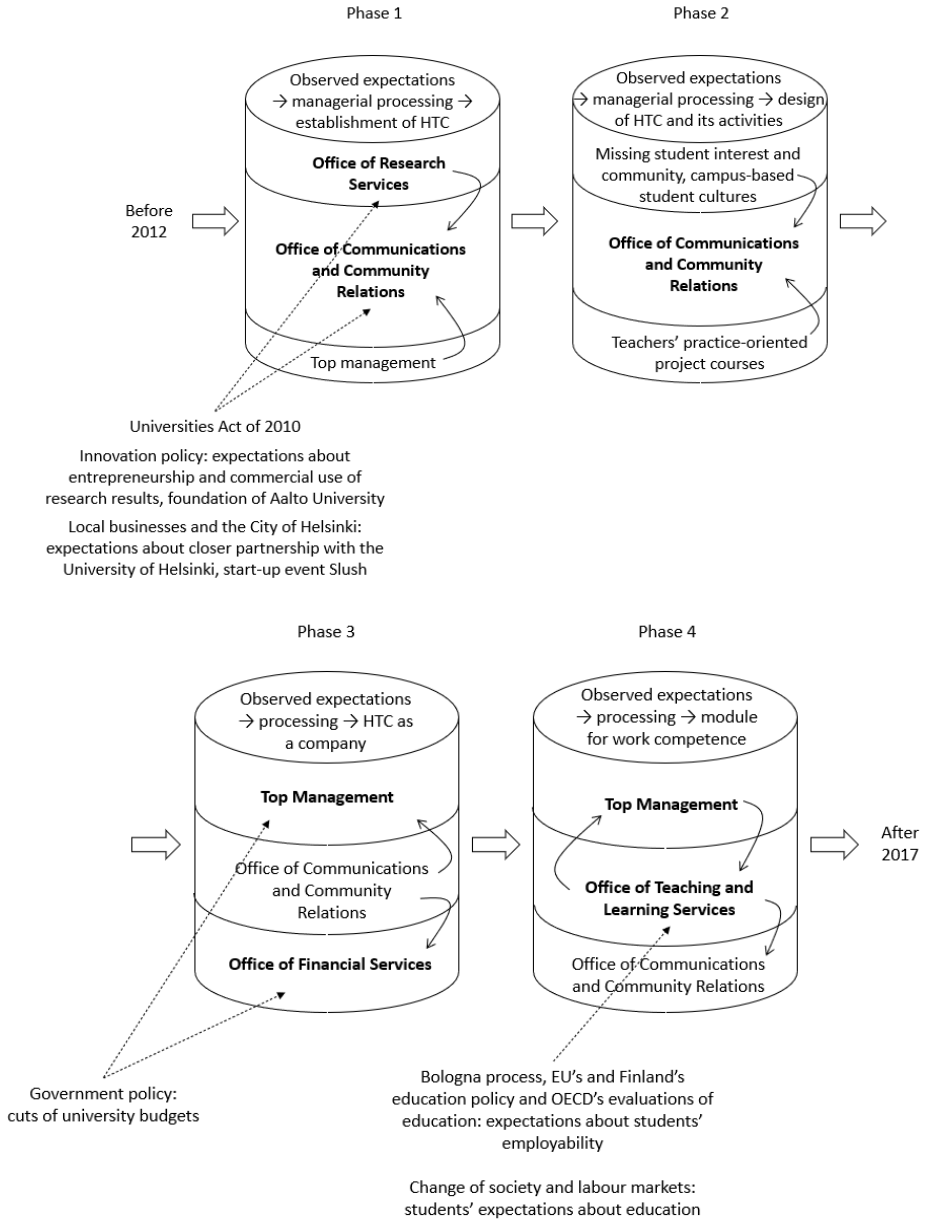

Figure. Four phases of the decision-making process about Helsinki Think Company.

The figure above depicts four phases of the decision-making process about HTC after the new university legislation had come in force in 2010. This legislation offered an impulse for the Finnish universities to reorganize their administration already aligned with ideas drawing from new public management (NPM) and innovation policy programs of the 1990s. However, the more fundamental restructuring of the administration along the lines of NPM paralleled the processing of the studied initiative. During it, we detect temporal transfer of responsibility in decision making between various subdivisions of the university administration and management, such as teaching and learning, research, finances as well as communications and community relations administrations. Via such specification of the university's administrative and managerial structure with dissimilar principal system references in higher education, scientific research, economy, and politics, we address the internally differentiated nature of the administrative and managerial decision-making not only in terms of teaching but also with respect to the services designed to advance scientific research and the university's economic third mission performances.

In summary, this paper improves understanding of the organizational consequences of intensified societal engagement of the university by using a systems-theoretical approach to understand decision-making in an enterprising organization. It shows how politico-economic conditions of the society are observed and interpreted by different administrative offices of the university, and gradually translated into decisions about the entrepreneurship hub providing extra-curricular education for students. Instead of supporting the research that emphasizes direct penetration of political ideas into the university, the present analysis shows how external inspiration becomes interpretatively observed and managerially processed by the university's administrative offices, thereby creating divergent awareness contexts and dissimilar temporalizations of the initiative. Consequently, the initiative of the

entrepreneurship hub investigated here may be considered “a potentializing organization”, which allows somewhat open-ended experimentation in relation to the university’s multiple missions and stakeholders thus facilitating organizational stability in the changing society.

EXPLORING HOW PLATFORMS FOR HELIXES CAN COME TO BE – INVESTIGATING CROSS-SECTOR COLLABORATION IN THE CONSTRUCTION AND REAL ESTATE INDUSTRY

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Urban development demands large construction projects, e.g., housing, schools, preschools, and infrastructure - for good and for bad. A negative effect of construction projects is their impact on the climate, as they affect the climate negatively with high carbon dioxide emissions. This is a challenge metropolitan areas, all over the world, are facing. Such challenges are not solved by single actors, but through cross-sector collaborations. Collaboration between actors and sectors can help solve resource dependency issues, create synergies, and gather competence necessary to solve wicked and complex issues (Huxham, 1996; Sullivan & Skelcher, 2002; Osborne, 2006; Hilwert & Swindell, 2013).

When cross-sector collaborations are more mature, they can be understood as triple, quadruple, or quintuple helix systems. In this paper we put focus on the initial process, when actors from different sectors come together to jointly work with a complex challenge, like climate neutral solutions for the building and construction sector.

If actors across sectors should work together to meet complex challenges, there is a need for a platform bringing them together. With this paper we aim to explore and understand the creation of such a platform, its opportunities, and challenges to work across sectors for a more sustainable construction and real estate industry. We will analyze the creation of the platform from an entrepreneurship perspective, by seeing the platform as the creation of a new organization (Gartner, 1985) with an identity of its own (Brunsson and Sahlin-Andersson, 2000), and identify how resources were mobilized, and how a shared vision was agreed upon. This analysis is followed by a discussion on challenges and opportunities, drawing form research from the field of triple helix (Cai and Etzkowitz,2020), hybrid organizations (Grossi et al., 2017) and cross-sector collaboration (Klijn et al., 2010).

Local roadmap for a climate-neutral construction and real estate industry in Malmö 2030 (LFM30) is an initiative to implement the sustainable development goals in the local context of Malmö. The platform LFM30 aims to foster co-creation of knowledge, innovation and sustainability in the construction and real estate industry in the city of Malmö and consists of about 170 different organisations. The road map was initiated in dialogue between the municipality of Malmö and private, and public companies in the industries. It is today organized by the industry. The work includes all actors who work with new construction or renovation, real estate management, remodeling, or demolition. The initiative is actor-driven and supported by The Swedish Construction Federation, Fossil-free Sweden, the municipality of Malmö and, The information center for sustainable building in Sweden[6].

To manage to meet the goals of LFM30 new innovations and solutions will be developed, those innovations will span across different actors and areas, which implies that system innovations are developed. We consider system innovations as “a network model of innovation,” involving multiple instances of collaboration between multiple actors with the aim of creating innovations. (Staffansson-Pauli, et al., 2020).

LFM30 works with six different subprojects: business models and incentives, circular economy, sustainable building materials, climate calculation, sustainable management of the buildings, sustainable construction sites and transports. The purpose of the road map is to create climate-neutral solutions. One way to work is to apply a life cycle perspective where construction methods and material used are assessed.

Cross-sector collaborations are necessary to manage the effects of climate change. From the study we however learn that when it comes to meeting complex challenges there is a high level of uncertainty, which implies that the shared understanding of the roles of each actor is important. Prior research however show how cross-sector collaborations are challenging. Especially problematic it seems to be to in the liminal space between sectors to find a shared understanding of not only the role of different actors but also the purpose of the collaboration. With this paper we are challenged to learn how a platform for cross-sector collaboration come to be and how new organizations

[6] Information Centre for Sustainable Building was established in 2018 to promote energy-efficient renovations and constructions. The center advocates a life-cycle perspective, and the use of sustainable materials to have low climate impact. The center makes information on renovation and energy efficiency accessible, and furthermore, they assure the quality of information to actors involved in construction and renovation processes.

spanning over sectors are constructed and how they create their own identity and purpose. In doing so this study contribute to extant literature on cross-sector collaboration by shedding light on why some attempts to collaborate fail, while others came to be.

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KNOWLEDGE CO-CREATION FOR SOCIAL INNOVATION THROUGH TRIPLE HELIX PARTNERSHIPS AND BEYOND: A CONCEPTUAL MODEL BASED ON SUSTAINABLE URBAN HOUSING PROJECTS IN SWEDEN

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Demographic change has created significant societal challenges in Sweden, such as aging population and immigrant integration. The global pandemic exacerbates the situation. Sweden is among the countries with highest level of life expectancy in the world (UN, 2015; WHO, 2016) and loneliness of senior people has long been a social problem (Toube 2013). Due to the pandemic restrictions, senior loneliness has greatly increased according to a report of the Swedish Public Health Agency, 2021. Social segregation is another societal challenge in Sweden particularly after the 2015 refugee crisis. Statistics shows that immigrants are disproportionately exposed to the risk of severe Covid complications and death. The refugees are among the most severely impacted due to higher proportion of overweight, obesity, smoker, and poorer access to health care (Magrio et al. 2020, Zdravkovic et al. 2020).

The enormous scale and scope of these societal challenges make it impossible to offer effective solutions solely by government nor by conventional ways of social services. So far, academic and political discourses have primarily emphasized state-led and market-driven solutions, or technological fixes. Lately, however, the attention has been turned towards social innovation which entails new concepts, approaches, and solutions for sustainability. The mechanisms of social innovation are the exchange of ideas, shifting of roles, blending market and public principles, and co-creation of knowledge among public and private sectors as well as NGOs and individual citizens (Phills et al. 2008, Westley et al, 2017) which relies on the triple helix (TH) partnership and beyond.

Housing is one of the most important social determinants of health, social justice, and social equity. Housing company's role in sustainable urban development is non-substitutable. However, most of the literature related to real estate and innovation is about technological innovation targeting environmental issues such as energy consumption and building performance (Pauli et al. 2020). Social innovation in housing, particularly those through TH partnership, remain ignored in research.

This paper studies the process of knowledge co-creation through TH partnership and beyond in two social innovation projects in a municipality in Sweden. We try to answer the questions as follows:

- What are the mechanisms of knowledge co-creation for social innovation?
- What are the different actors' roles in the process of knowledge co-creation?
- How does local context influence the knowledge co-creation process for social innovation?

This study adopts a process-oriented in-depth multiple case study method. We studied Sällbo project and DrottningH project in the municipality of Helsingborg in Sweden. Sällbo is an innovative housing project based on the new housing concept of conviviality and co-living. In this experimental project, senior people live with young refugees and young native Swedes, generations and cultures meet, and social life is at the center. DrottningH project is an urban re-development project in an infamously vulnerable area aiming at a social, ecological and economic sustainable community. Immigrants and refugees are engaged into the development process. Both projects present strong characteristics of knowledge co-creation through TH partnership and beyond.

Drawing on the case studies, we develop a conceptual model where the knowledge co-creation mechanisms, actors' roles and the influence of local context are illustrated and discussed. It is found that the knowledge co-creation in the projects is accompanied by the cognitive change of the TH partners from senior-people-and-refugees-as-passive-social-service-receivers to senior-people-and-refugees-as-active-social-value-co-creators. It is also found that economic benefit is still an unignorable incentive in social innovation projects in for sustainable urban development.

The paper tries to fill up two research gaps. First gap is within TH studies. Notwithstanding an increasing body of TH study in knowledge co-creation, innovation, and sustainability transition, the majority still focuses on technological innovation and environmental sustainability. There is a lack of attention on social innovation and social sustainability. Second gap is within real estate studies. There is also a severe dominance of engineering and technological perspective and a lack of research on social innovation in real estate sector, particularly from the TH perspective.

The paper is based on unique primary data and personal experience/participation of the two authors in the two case projects over years. It develops a conceptual model to enrich our understanding of social innovation in real estate

sector from a TH perspective. It also provides policy and practical implications for social innovation addressing societal challenges.

Keywords: social innovation; triple helix partnership; knowledge co-creation; urban housing; real estate company.

PARTNERSHIPS FOR INNOVATION, NEW PRODUCT CO-CREATION AND LOCAL DEVELOPMENT: SUCCESSFUL EXPERIENCES OF TRIPLE HELIX IN SOUTHERN BRAZIL

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This text reports successful practical experiences involving institutions that adopted The triple Helix of University-industry-government interactions, in southern Brazil. Universidade de Caxias do Sul (UCS) is a university based in the city of Caxias do Sul, in the State of Rio Grande do Sul. UCS was founded in 1967 and throughout its 55 years of existence is committed to excellence in education, that highlights it in national and international rankings of higher education evaluation. The institutional guidelines that guide UCS' strategies are: academic excellence, focus on research and innovation, national and international insertion, economic, social and environmental sustainability, management and compliance, digital transformation and valuing people. UCS offers 99 undergraduate courses, 196 specialization/MBA courses, 18 Masters courses and 10 Doctoral courses. UCS is a multi-campus university, which is installed in seven cities in addition to the main campus in Caxias do Sul.

UCS is the main academic supporter of “Mobilization for Caxias do Sul” (MOBICAXIAS), a non-profit institution, based on the concept of the Triple Helix, currently Quadri Helix, formed by representative leaders of the Public Power (Executive and Legislative), Private Initiative (Business Entities), Academia (Universities and Colleges) and Organized Civil Society, such as: unions, associations and other institutions and organizations of a community, cultural and social nature, in addition to individuals united and committed to the future of the city.

MOBICAXIAS has its headquarters within the main campus of UCS. Among its main lines of action is the promotion of tourism, improvement of local infrastructure and investment attraction. New actions are planned for 2022 in the areas of urban mobility, smart cities, health and education. In the municipal elections held in 2021, MOBICAXIAS presented suggestions for the strategic development of the city (CAXIAS 2040) to all candidates for municipal mayor. All proposals presented by MOBICAXIAS are guided by the "Sustainable Development Goals". In the area of infrastructure, MOBICAXIAS supports and interacts with private investors, government agents and the Academy, with the aim of creating better competitive conditions for local companies, with investments in new and modern logistical equipment, such as duplication of highways, a new airport, new porto on the northern coast of the state of Rio Grande do Sul and reactivation of freight and passenger railways. As for attracting investments, MOBICAXIAS, with the support of sponsoring companies, offered the city's new Socio-Economic Profile 2021, prepared by UCS, to the City Hall of Caxias do Sul. MOBICAXIAS also supports and promotes UCS GRAPHENE, a business unit from the University of Caxias do Sul, which is the largest producer of graphene production on an industrial scale in Latin America, installed by an University. The plant has been in operation since March 2020 and is the result of nearly two decades of advanced research into nanomaterials and the provision of innovative technological services.

UCS GRAPHENE has the capacity to produce 5,000 kg/year and is able to supply the Brazilian and international markets with high quality graphene. In addition, it develops innovative projects and technology transfer in several areas of knowledge, new products or improving existing ones from the incorporation of graphene, nanomaterials or other materials. The development of new products takes place through partnerships with companies, through value co-creation, connection to the innovation ecosystem, the sum of expertise and the integration of the players involved. The insertion of products with graphene in the market demonstrates the importance of the connection between UCS and the private sector, having as direct gains the economic development and the valorization of the research developed by the University. UCS GRAPHENE received recognition from government sectors, especially the Ministry of Science, Technology and Innovation (MCTI), which has supported and publicized this initiative in its sphere of action. UCS GRAPHENE became a partner unit of Empresa Brasileira de Pesquisa e Inovação Industrial (EMBRAPII), a social organization of the MCTI, accredited to work in the automotive area with a focus on: advanced materials, composites and high performance nanocomposites, developing improvements in production processes of automotive components and studies for the application of graphene and other materials on an industrial scale.

From the examples presented, the concepts proposed in the Triple Helix have been configured as a successful model of practical actions for regional development, development of innovation and interaction between social actors.

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THEME 5: TRANSLATIONAL RESEARCH IN HEALTH SCIENCE IN THE POST PANDEMIC WORLD

THE HEALTHCARE ACTOR AS AN INNOVATOR IN MEDICAL DEVICE DEVELOPMENT

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Medical device innovation involves different sectors, including government, healthcare, academia, science councils, and industry - each having their role in the innovation chain. Collaboration between these sectors results in knowledge transfer and access to capital across sectors and is essential in medical device innovation to ensure that developed technologies address patient needs and reach the market. In a series of recent studies of the medical device landscape in South Africa (Chimhundu, de Jager, & Douglas, 2015; de Jager, Chimhundu, Saidi, & Douglas, 2017; Salie, de Jager, Dreher, & Douglas, 2019; Salie, de Jager, & Douglas, 2021) the healthcare actor was identified as a key actor contributing to knowledge development for medical device innovation. In these studies, the healthcare actor presents from academic hospitals in the public sector and in their private capacity in the private sector. These actors are clinicians, often university-affiliated clinicians, who are authors of scientific publications and inventors listed on patents. These studies confirm assertions by Lander (2013) and Hicks & Katz (1996) who highlight the important role of the healthcare sector in biomedical innovation.

In the South African medical devices' innovation ecosystem, the healthcare actor is not acknowledged as an innovator; their role in innovation is limited to that of identifying the clinical need, access to patients, and being end-users of devices. Furthermore, healthcare actors are not met with institutional support in the form of policy and strategy to encourage innovation. The focus of this research-in-progress study is to identify institutional mechanisms (i.e. laws, norms and standards, etc.) that promotes healthcare actors as innovators and co-creators of medical devices in the South African medical devices' innovation ecosystem.

The previous studies identified actors who contribute to the scientific and technological knowledge base for medical device innovation in South Africa. In the current study, a review of actor institutions investigates the institutional landscape in which these actors operate. Only formal codified institutions, in the form of national policy and strategy, government agency institutions, and organisational strategy of actors, were reviewed. At a national level, medical device innovation is addressed in the Bio-Economy strategy (Department of Science and Technology, 2013), with a quadruple helix model (Carayannis & Campbell, 2009) as the proposed framework. The strategy, however, leaves the civil society helix broad, and does not explicitly include healthcare as one of the helices in the innovation model. Furthermore, clinicians are limited in innovation by certain health professional standards. A health professional may not be involved in any commercial activity (manufacture, promotion, sale, etc.) related to medicines or medical devices (Health Professions Council of South Africa, 2016). There are also limitations in which private hospitals may not employ healthcare professionals, because of the profit-driven motive of such organisations. Clinicians have worked around these, by acting as consultants to industry providing a genuine service and are reasonably compensated for their services.
The current study highlights the gaps in the institutions for medical device innovation in South Africa and explores institutional mechanisms to encourage the participation of the healthcare actor in medical device innovation. The specific research questions can be stated as:

1. How can healthcare actors be recognized as innovators in the South African medical devices' ecosystem?
2. How could this be addressed within government and actor institutions?

Conceptual framework

We investigate the alignment of three theoretical frameworks for innovation, i.e. the National System of Innovation (NSI), Technological Innovation Systems (TIS) and the Quadruple Helix Model for Innovation. Through the NSI and TIS frameworks, we explore the links between actors, networks and institutions at a national level (NSI) and a technology level (TIS). The positioning of the healthcare actor in the Bio-Economy Strategy using Quadruple Helix Model for Innovation is explored. Implications for all three frameworks are drawn.

Findings

Our analysis will focus on the gaps identified in the review of the actor institutions, and look externally to similar innovation systems (e.g. biotechnology and pharmaceuticals) and contexts (e.g. other developing countries), where our primary outcome is to bridge this knowledge gap in the South African setting. In future studies, we may look at actor interviews with the healthcare sector, identifying promoters and barriers for innovation at the institutional level.

Contribution

The role of the healthcare actor in medical device development has been demonstrated, but not yet formally acknowledged at the institutional level in South Africa. Innovation system framework applications have not been well documented in developing countries, nor for medical devices. A study of this nature would advance the application of existing innovation frameworks and situate the role of actors, networks and institutions in the medical device innovation ecosystem in South Africa.

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ENTREPRENEURIAL EDUCATION IN A MEDICAL CONTEXT - THE EFFECT OF ENTREPRENEURIAL ORIENTATION ON THE PERFORMANCE OF DIGITAL HEALTH STARTUPS

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In the year 2020, due to the COVID-19 pandemic, funding of health innovation startups has reached a new high. Compared to 2019, funding has increased by a staggering 55%, with a total of 770 deals raising $21.6 billion in 2020[7]. This growing interest in health care entrepreneurship along with regulatory changes in the German health care system presents an interesting opportunity for research on the medical entrepreneurship landscape. In a first pilot study, we analyze the founding teams of German startups in the digital health industry to examine the effect of medical knowledge within the team, as well as the presence of an entrepreneurial education program at the medical founder's alma mater on the company's investment performance.

We hypothesize that the presence of founders with medical degrees in a digital health startup is positively associated with the company's investment performance. Additionally, we hypothesize that the existence of an entrepreneurial education program at the medical founder's alma mater as an indicator for the institution's entrepreneurial orientation is positively associated with the startup's investment performance.

The data for this research stems from a variety of data sources. Data on the companies is generated by utilizing Crunchbase. For this preliminary study, the sample is restricted to companies headquartered in Germany, active in the health care industry with their founding date between 1990 and 2020. Due to some missing and contradicting information, a few companies are eliminated from the sample, leaving a total of 172 that may be used for further analysis. For this group of companies, we extract further information such as the companies' total funding amounts as a performance indicator. Additionally, we carry out systematic research to identify the educational background of the founders. With this approach, we collect data on the number of degrees, fields of studies, and universities at which the founders obtained their degrees. Based on this data, we are able to research whether or not an entrepreneurial education program for medical students exists. Although the mere presence of such programs does not imply that the medical expert attended them, we use this metric as an indicator of entrepreneurial orientation of the scholar's alma mater.

We carry out a regression analysis to analyze the effect of the presence of medical knowledge on a startup's investment performance. Similarly, we carry out a regression analysis to measure the effect of the alma mater's entrepreneurial orientation for medical scholars on the financial performance of their companies.

With our article, we extend the literature on medical entrepreneurship in the field of new and innovative health technologies and digital health. Although a large body of research already exists on medical entrepreneurship, most articles in this field include self-employed physicians who start their own practice. Our research, however, is more focused on innovative startups in the digital health and medical technology context. By focusing on the medical knowledge in the founding teams, we aim to further the literature on human capital theory and provide practical insights for medical experts into the entrepreneurial landscape. Additionally, we provide insights into the value of entrepreneurial orientation and education programs for medical scholars.

[1]StartUp Health Insights (2021)

APPROACHING EHEALTH CONCEPT: ADVANTAGES, DISADVANTAGES, AND FUTURE DEVELOPMENT

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A few years ago, textbooks were the only source of medical information. Nowadays, anyone can find medical information by accessing the Internet from almost anywhere in the world. Information and communication technologies have changed the way we access, analyze and use health information. EHealth, mHealth, telehealth mobile health or telemedicine are synonymous of a new concept that has been in use for almost two decades. Nevertheless, even today, there is little consensus on eHealth definitions and although numerous authors propose some guiding principles for the future of eHealt, its main advantages or disadvantages and the future development of eHealth research in the post pandemic world.

This research aims to define the concept of eHealth, recognize its main advantages and potential harms or challenges and acknowledge the aspects of eHealth that need to be explored in future research and its evolution pre and post COVID. The main purpose of this research is to analyze the state-of-the-art research on eHealth from the perspective of a well-being society.

A literature review was conducted by searching all peer-reviewed articles published prior to May 2022 in Web of Science database. The search was conducted using keywords such as «eHealth», «eHealth definition», «eHealth advantages», «eHealth problems» or «eHealth future». Of the numerous documents retrieved, we analyzed only peer-reviewed articles throughout their titles, abstracts and full text versions were needed. We were able to select one hundred articles that included contents related to our objectives.

Of the one hundred articles studied, twenty studies contained eHealth definitions. The more mentioned aspects, within the definitions, were the information and communication technologies, health care delivery, the Internet and the importance of being user centered. A twenty-nine percent mentioned some advantages of ehealth. The state of art showed that the main advantage was that eHealth improved the accessibility to health information, followed by the chance of tailoring the health interventions. Other themes that emerged were user empowerment or the opportunity to reduce costs. On the other hand, seventy-three articles mentioned eHealth disadvantages. The most cited was the poor quality of the information available, followed by the user's difficulty to evaluate in a proper way that quality, the existence of technical or not easily understandable information, or the risk of potential harms. Finally, we studied the forty percent of articles that mentioned recommendations for future eHealth research. The most cited proposals were to improve user's health and eHealth literacy, and health care providers implication in eHealth development and delivery.

Despite not finding consensus around the eHealth definition, we have found some features that can help to define eHealth as the delivery of user centred health care services through information and communication technologies, mainly Internet. The main advantages of using eHealth services are the improvement of accessibility to health, the opportunity to tailor the interventions, user empowerment and cost-effectiveness. Among the literature, there are concerns about quality, information being intelligible, the digital divide or the risk of potential harms. Most mentioned guidelines for the future are to improve user's health and eHealth literacy, health care providers implication in eHealth development and delivery, and the need of more research about the effectiveness of the eHealth interventions.

Keywords: eHealth; mHealth; Telehealth; Telemedicine; Mobile Health.

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THEME 6: INTERNATIONAL INTEGRATION AND LOCAL DEVELOPMENT: THE ROLE OF UNIVERSITIES IN CONNECTING LOCAL COMMUNITIES WITH GLOBAL KNOWLEDGE NETWORKS

International integration and local development: the role of universities in connecting local communities with global knowledge networks

DISSEMINATION STRATEGY

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Dissemination is the process of making the results and deliverables of a research activity available to the stakeholders and to the wider audience for the sustainability of outputs in the long term. There are different models in public engagement and the choice of dissemination model is determined by the focus of the research and the segment of the public to be engaged. The dissemination is structured to accommodate all stakeholders and it's structured in three different ways: dissemination for awareness, dissemination for understanding, dissemination for action. Starting from this we have defined our dissemination strategy. The success of a good dissemination strategy usually depends on a series of factors, of which the most important one is the involvement of researchers and entrepreneurs. Here is belowed a pratical experiences realized by Institute of Polymers, Composites and Biomaterials (IPCB) of National Research Council (CNR). To improve university and commercial ties with industry, IPCB operate trough the technology transfer office as a vehicle to spread innovation and to support the intellectual property right and the creation of spin-off companies. An effective contribution is given by dissemination activity.

The IPCB challenge is to create the right skill set between the researchers themselves and to spread them at SME. For this reason, it is important to emphasize that dissemination is a process, a series of milestones to be checked in order to transfer research between researchers in and out of the research Institute and later into commercially viable products. With this vision is born CREO: an open, scientific, regional wide network that inter connects 24 research Institute of CNR located in Campania. A network that offers a liaison to help Institutes and their researcher to better cooperate with themselves in order to access new knowledge and expertise to drive innovation through research collaboration, and consultancy, to identify and license new results, new technologies and intellectual property relevant to their scientific field. In order to implement dissemination activities successfully CREO network has established 8 working group: communication, social, project management, intellectual property, monitoring, privacy, information and communication technology, marketing.

Research, SME and local bodies are been involved in dissemination projects carried out during 2021 in partnership with universities, research institute and private firms. For each project is been ensured effectively the triple helix and open innovation effect. From the beginning with the participation in research idea, in relation to the thematic areas of IPCB, to the result management, in preparing documentation on the specific call, the communication plan, in networking, in provision of any other communication, social, intellectual property, monitoring activities. The dissemination strategy, follows four basic public relations principles: be visible, be informed, be consistent, be constructive, be multi-inter disciplinary. Dissemination tools and activities are been designed to promote project outcomes efficiently and reach various target groups in an effective and at the same time productive way. There is need for public engagement of all stakeholders (employees, investors and community) which incorporates all these vital elements. With CREO is possible and the research findings are disseminated systematically.

HOW DOES THE LOCALIZATION OF INNOVATIVE START-UPS NEAR THE UNIVERSITIES INFLUENCE THEIR PERFORMANCE?

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Promoting the creation of innovative start-ups has become one of important components of the policy in many European countries with the main aim of fostering innovation and knowledge-based growth. According to the knowledge spillover theory of entrepreneurship (Acs et al. 2009, 2013), new businesses in general, and high-tech firms in particular represents the valorisation in the market of knowledge spillover that comes from knowledge sources such as university research. Universities in this sense have a key actors' role in developing the competitiveness of Europe's economies (Paleari et al., 2015).

In particular, given the importance of geographical agglomeration (clustering) for the performance of high-tech firms, it can be supposed that the possibility of recognising knowledge spillovers in a specific sector and valorising them in the market would depend on the existence of a critical mass of firms operating in the same sector (or related sectors) within close proximity of the university. Knowledge spillover tends to occur only within limited geographic areas, embedding economic activity based on this knowledge within the local context. The choice of localization of innovative start-ups near the public research centre (PRI) as university from which the knowledge spillover comes could have an impact on their performance. The paper has the aim to demonstrate if the innovative start-ups that are localized near the PRI show better performance in terms of profitability and sales.

In the empirical analysis, we consider Italian start-ups born within 2012-2015 and their performance during the period 2012-2019 and we measure the road spatial distance (in kilometres) from start-up to the nearest research centres in the province of start-up. To take into account the heterogeneity, we include threshold values of sales to see the different impact of distance on different levels of turnover.The dataset refers to Italian start-ups set up between the period 2012-2015. Our sample is composed by 1,128 start-ups.

In the empirical model, we consider some characteristics of the local context that are expected to influence the entrepreneurial. Specifically, we consider four variables: the per-capita income in the province, the rate of unemployment, the density of high-tech firms in the local system, the number of graduates in high-tech faculty per province.

The empirical results show as the choice of innovative start-up to localize the company near Universities has a relevant impact on the performance in terms of profitability and also in terms of sales when the level of income becomes significant. Also, the share of graduates in scientific and technological fields is significant.

The main policy indications that emerge for these important results of our empirical analysis are for both, universities and policymakers. Universities are expected to improve entrepreneurship education for students in science and technology fields to raise the number of graduates in those fields who are willing and able to start-up new companies after graduation; thus providing a more direct link between the new knowledge acquired in universities and its exploitation into new businesses.

The main policy indications that emerge for these important results of our empirical analysis are for both, universities and policymakers. Universities are expected to improve entrepreneurship education for students in science and technology fields to raise the number of graduates in those fields who are willing and able to start-up new companies after graduation; thus providing a more direct link between the new knowledge acquired in universities and its exploitation into new businesses. One of the requisites to be considered an innovative start-up is that the majority of founders must have higher education; this should reinforce the link between the flow of graduates and the start-up of new companies in high-tech sectors. At the same time, the ministry of education can provide incentives to universities for fostering entrepreneurship education through the creation of entrepreneurial laboratories involving students in all fields.

From a policy point of view, in the creation and growth of innovative start-ups policy makers should put effort in the creation of a fertile local innovation and entrepreneurial ecosystem including a variety of actors like firms, universities, science parks, incubators and venture capital. Innovative start-ups and high-tech companies need an entrepreneurial ecosystem capable of supporting their development. The entrepreneurial ecosystem of the region shows elements of delay compared to the regions of northern Italy.

REDESIGNING BUSINESS SCHOOLS FOR THE WEB 3.0 ECONOMY: EXPLORING THE IMPLICATIONS AND PERTINENCE OF THEORY U

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The rise of digitized tools including platform, Big Data, predictive analytics, and AI has impacted all industries (Forster, 2006). Higher education and business programs must contend with the dynamics of the digital transformation economy. Digital transformation, including the effects of Big Data, predictive analytics, AI, and platform technologies, have rapidly transformed the basis of business schools and their programs, thus calling into question historical models of institutional success. Yet, at the same time, we see a limited change narrative arising in how business schools can better reinvent themselves in light of these technologies.

Specifically, within that time frame, and largely because of the convergent effects among digital technologies, now exacerbated by COVID, the introduction of digital technologies has both incrementally and rapidly shifted the landscape of measuring relevance and defining impact in the context of educational and business institutional effectiveness. For the example, Deloitte already predicts that 60 to 70% of skills will be out-of-date over the next decade. In the context of business schools, these issues include how digitized technologies have the capacity to influence enrollment trajectories and financial solvency of business schools and higher education models not just in what is taught, but also in the delivery of knowledge and curriculum models. This is not just a decision as to whether hybrid, fully online, or in-person programs are most appropriate, but also how such digital technologies must address scalability and general accessibility considerations (See Jackson, 2019). Examples here include the entrants of newer market competitors from both established course providers (e.g., Coursera) to private corporates such as Google Certificates that can provide lower cost alternatives to established business degree and curricula programs via general sites and social media that can challenge levels of control in both developing and monitoring business curricula and degree outcomes.

Added to this complexity is now what is called Web 3.0, which reflects a critical transition from just digital tools and service platforms toward heralding a newer emergent area of knowledge transformation and change. Specifically, Web 3.0 is defined as “the semantic” web, which has the capacity to integrate AI, platforms with networks and blockchain technology to “sense’ and respond, allowing tailorized and customized search options and learning solutions on real-time basis (Evans, 2021); this may include DAOs (Decentralized Autonomous organizations, such as Friends with Benefits, which is a group of artists who own their own IP and can sell their work to anyone without an intermediary (See Dabit, 2021). Could professors provide content and certification to students with colleges being the platforms?

The differences of Web 3.0 from Web 1.0 and Web 2.0 is a fundamental difference between just providing general search options toward “smarter solutions” that can rapidly decentralize the accessibility and controllability information and in turn can serve as immediate to long-term institutional threat to business schools and their programs if not properly managed. What newer dynamic capabilities need to be built for them to survive? With the emergence of Web 3.0, known as the “semantic web”, further issues arise, and especially given that Web 3.0 cross-integrates digital technologies leading to the possibility of greater sensing capabilities for individual customization of knowledge and how that knowledge can upend institutional and organizational boundaries traditionally controlled by business school and higher education programs, but which may also inform industry and government research and application. This includes ideas such as Algorithm as a professor or universities as platforms for credentialling or even stackable certificates that are organized around key impact areas.

Applying Scharmer’s Theory U Model, we apply five stages for enabling change in business school programs for it to proactively thrive and enact dynamic capabilities in the web 3.0 era. Specifically, we examine how administration needs to co-initiate, co-sense, presence, co-create and thus evolve to the next model with all stakeholders to realize the potential of web 3.0.

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UNIVERSITY ALLIANCES: HOW TRANSNATIONAL COLLABORATION FACILITATES AND/OR INHIBITS REGIONAL RELEVANCE

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While the idea of cross-border strategic partnerships among universities in the EHEA is not novel, a new wave of transnational university alliances is gaining momentum. This form of collaboration endorsed and supported by the EU as well as national governments is targeted to address the global competition of knowledge economies. The vision of the EU is that among other aims, newly developed alliances under the European Universities initiative will adopt "a challenge-based approach" (EUI, n.d.) in their core tasks of teaching and research to tackle issues pertinent to Europe by engaging with external partners such as industry, government and non-profit sector. This approach is closely connected to the so-called Third Mission of the university (Benneworth et al. 2017; Compagnucci & Spigarelli 2020), its role and importance in the socioeconomic and cultural development of local communities and regions.

The university contribution to the regional development has been extensively studied (e.g. Trencher et al., 2013; Krücken et al. 2009; Mowery & Sampat 2006). However, the influence of the collaborative alliances on such university role has to date received limited attention. This study explores the strategies these networked universities employ to address their Third Mission, how and to what extent they engage with external partners to promote innovations that focus on regional needs. To understand this contribution the Triple Helix Model as well as Quadruple Helix, are particularly helpful (Cai & Etzkowitz, 2020; Leydesdorff, L. 2012; Leisyte & Fochler, 2018). These analytical models theorize dynamic relations among the helices in knowledge-based developments and innovation systems which guide the reconstruction of institutional arrangements. To unpack the role of universities in regional development in the context of transnational collaboration, the study also draws on the concept of institutional complexity (Greenwood et al., 2011). Educational organizations in general and their international activities, in particular, are subject to institutional complexity taking place in multiplex environments (Frølich et al., 2013) in which interests and agendas of multiple actors, need to be balanced and mitigated, and multifaceted aims aligned (Zenkiene, 2020; Rensimer, L. 2021).

Method: In this study, we analyse a case of Lithuanian universities involved in these new transnational collaborative ventures, their contribution to the regional (local) development, and the fulfilment of the Third Mission of universities. We particularly look into the instances where this new form of collaboration and the emerging innovation ecosystems facilitate and/or inhibit regional relevance, deepen and broaden inter-sectoral engagement, and how a 'new social contract' of university role is played out. Lithuanian HE sector offers an interesting example due to a very high participation of public universities in this new European initiative. More than half of major public universities got engaged in European University alliances and networks (6 out of 11). We study five universities that got a label of European University Alliance from the EU. The study is based on the qualitative methodology, including document as well as website content analysis. Further, semi-structured interviews with local coordinators of the EUAs in Lithuania will be drawn upon.

Preliminary Findings: The alliance goals concerning regional development and innovations, the engagement of inter-sectoral platforms of cooperation (government, industry, not-for-profit organizational actors) have been analyzed. The studies of vision statements of the five alliances indicate that universities involved envision their enhanced role in co-creation, innovation, development of sustainable economies and societal transformations. Our preliminary findings indicate, however, that more specialized, research and/or field-specific alliances frame their contributions to the development and policy areas of their expertise and community needs. Whereas more comprehensive university alliances structure their contribution as a response to 'grand' societal challenges, sustainable development of economies and social advancement in more generic terms.

Conclusion: The study has shown the usefulness of the Quadruple Helix analytical model and the notion of institutional complexity to understand how internationalization, competition, innovation and regional relevance are interwoven in the strategic university alliance engagement. The comparison of five alliances within one country context has allowed us to show that the similarities and differences between different foci on regional developments exist in alliances within a similar governmental helix.

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TRIPLE HELIX AND LEADERS OF THE WORLD: A MODEL FOR INTERNATIONAL ENGAGEMENT IN EDUCATION, INDUSTRY, GOVERNMENT, NONPROFIT INSTITUTIONS, AND COMMUNITIES

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In January 1995, Henry Etzkowitz and Loet Leydesdorff started the year by sharing a new model for innovation with the publication of "The Triple Helix, University-Industry-Government Relations: A laboratory for Knowledge-Based Economic Development."

From the mid 90's to the 2020's, the world has experienced a period of rapid and sometimes radical change which have both united and divided communities at local and global levels. Technology driven enterprises challenged governments and industry to keep pace and develop solutions to new political, social, and economic challenges and opportunities. Universities, which traditionally supported Two Missions, "Teaching and Research," found themselves needing to respond to additional societal needs. Some universities expanded to a tripartite approach adding a Third Mission to connect the university to government and industry, which aligns with the Triple Helix. This Third Mission placed the University as the central institution to create collaborations simultaneously with government and industry to address needs of the local, national and global communities the University serves, to improve economic conditions and access to knowledge and skills needed to succeed in a knowledge-based economy.

Since its inception in 1995, the Triple Helix continues to foster innovation amongst government, industry and universities in the form of innovation, research and development, entrepreneur, and advanced technology parks and centers.

This paper outlines the interdependent relationships forms, and functions of stakeholders in building and sharing sustainable development strategies, to create engaged communities and civil society in knowledge-based economies. It describes a Triple Helix model focused on international engagement, called "Leaders of the World" (LOTW). The Triple Helix "Leaders of the World" model builds sustainable international, national, and local partnerships and programs. This model engages five sets of stakeholders in the areas of: Education, Industry, and Government, with active influence and inclusion of Non-profit Organizations, and Communities, LOTW programming provides accessible, high-quality education and dialog opportunities spanning the world through innovative platforms online and onsite.

LOTW programs have established dialog to develop international initiatives and partnerships between leaders of nations, communities, corporations, and universities. Programs and partnerships span various academic, government, and industry concerns including environment, education, technology, arts, public health, public policy, culture, and civil society. "Leaders of the World" has included: Entrepreneurs, small business owners and Fortune 100 company CIOs, CEOs, and presidents; University presidents, deans, faculty, and students; Ambassadors, Consulates, Ministers of Education, Culture, and Environment; Mayors, Governors, Judges, and Presidents; nonprofit organizations including the Institute of International Education, the United Nations, Rotary International, the Fulbright Commission; the Charles Darwin Research Center, and Chambers of Commerce; Artists and designers; City, airport, transportation, and water planners; Faith based institutions and leaders; and Community members and activists.

This unique Triple Helix top down and bottom-up approach has been used in 40 nations creating local to global partnerships among educators, government, industry, non-profit organizations, and the communities they serve. The Triple Helix LOTW model has successfully been used to foster internationalization, support United Nations Sustainable Development Goals, develop access to new knowledge and technology sectors, and activate research and scholarships. Programs and partnerships span various academic, government, and industry concerns including environment, education, technology, arts, public health, public policy, culture, and civil society.

Two in depth Case Studies are presented in this paper to describe this highly scalable, adaptable, inclusive Triple Helix model:

- World vs Island - The Galapagos Islands
- Confluence of Three Nations through Art - China, Scotland, and the United States

The Galapagos case study addresses the cultural, educational, governance, and economic challenges the 25,000 Galapagos inhabitants face living in the small remote archipelago of islands. As a World Heritage Site and UNESCO Biosphere Reserve, 80% of the inhabitants rely on tourism, which paradoxically, creates challenges to maintaining

the natural environment. Some community members actively support the United Nations Sustainable Development Goals, others decry the inability to introduce new crops, animals, and fowl to improve their livelihoods.

The Confluence Case Study describes the process of expanding partnerships and projects through Triple Helix amongst partners with highly differentiated language, governance, culture, size, and geographical location. Partnering with the University of Dundee and universities, cultural missions, mayors, ambassadors, and Ministry of Education in China, evolved into a Confluence: Tradition in Contemporary Art bilingual (Chinese/English) book and an art exhibit in the US, Scotland, and China.

University based Triple Helix international projects spawn multiple specialized partners within a wider web of partnerships. Outcomes from LOTW partnerships were shared and nuanced to address opportunities and challenges in geographically, politically, and/or culturally different communities.

Further study is needed to answer the questions: Will universities maintain leadership roles in Triple Helix based international programs and partnerships? Will government maintain its role in rule of law, or expand its scope to innovation or invention?

This paper spans 10 years of onsite in-country research and program delivery in about 40 nations. Working internationally poses some challenges. Simultaneous translation is required when participants do not have a shared language. Chinese, English, French, and Spanish were the predominant spoken and written languages. Much work and planning took place in a virtual environment due to travel costs and responsibilities on campus.

In closing, to be sustainable, the Triple Helix and Leaders of the World partnership model require building trust among partners, making ethical decisions, and committing to “do good” and provide “service above self.” Using the Triple Helix as a foundation, universities can establish collaborative partnerships in noncompetitive environments to prepare students, scholars, government and industry leaders and community members to thrive in a global, knowledge-based economy.

Keywords: Triple Helix; Innovation; Sustainable Development; International Partnerships; Leaders of the World.

CHALLENGES AND STRATEGIES FOR THE INTERNATIONALIZATION OF HIGHER EDUCATION IN AFRICA TO CONNECT TO GLOBAL KNOWLEDGE

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In today's world, the internationalization of higher education is one of the most important components of the growth and development of societies. The internationalization of higher education is the process of integrating an international, intercultural, or global dimension into the purpose, functions, or delivery of higher education (Knight, 2003, p. 2; de Wit & Altbach, 2021). As it is crucial to push the boundaries of science and to develop new technologies and important global initiatives, internationalization can be a factor in helping underdeveloped countries that need more power to overcome public issues, such as poverty, climate change, and educational inequalities. The internationalization of higher education is like a bridge to connect to the global academic network, and it is an efficient strategy for universities to make the most of academic opportunities, intercultural relations, and global experiences to meet the needs of the local community.

Internationalization of higher education can be analyzed at four levels: individual, institutional, national, and international. The individual level includes students, professors, and all academic people as they play a key role in the internationalization of higher education. At the institutional level, there are universities and other higher education institutions that serve as communication bases in this network. At the national level, the policies and decisions of governments as well as the resources and facilities of the country are considered. At the international level, it is the global policies, programs, and initiatives of the United Nations and other international institutions that are active in the internationalization of higher education (Majee, 2020; De Wit, 2018; Kalantari Shahijan, Rezaei, & Preece, 2016).

This study focuses on low- and middle-income African countries and seeks to identify the challenges of the internationalization of higher education and to provide strategies to improve it. The research method is qualitative in that in the first stage, the literature was reviewed, and then to strengthen the data and to discover the hidden angles of the research, semi-structured interviews were used. Semi-structured interviews were conducted purposively with African university professors with experience in international academic activities. The thematic analysis method was used to analyze the obtained data, and the identified challenges and strategies are presented in the main and sub-categories.

The African continent has promising potential. With 54 countries and a population of over 1.3 billion, Africa is the world's second-largest and second-most populous continent. Africa's population is young, with an average age of 19.7, and it is projected to reach 2.5 billion by 2050 (UN, 2019). The initial findings of the study show that African countries face a set of challenges in various fields. The challenges are related to economic issues and resources, including a lack of government funding, a lack of adequate and advanced research equipment, and weaknesses in infrastructure, especially in the field of information and communication technology (ICT). Academic challenges include low educational capacity, low-quality programs, low number of up-to-date skilled researchers, and low attention to research. The most important policy and administrative challenges are the lack of clear and efficient policies, the inefficiency of internationalization offices at universities, and structural weaknesses in higher education institutions and universities. Finally, socio-cultural challenges include cultural differences in communication, low proficiency in foreign languages, brain drain, and some top-down behaviors from northern countries. Strategies and solutions at four levels (individual, institutional, national, and international) can be proposed to take advantage of this important opportunity on the continent and to address the challenges of internationalization.

At the individual level:

- Development of scientific and technical skills
- Development of behavioral and cultural skills in international communication
- Membership in international forums and associations
- Attending international conferences and seminars in person or online
- Using new technologies in education, research, and teaching
- Publication of scientific works in the field of internationalization

At the institutional level:

- Establishment of a research information management system for faculty and students
- Encouragement of faculty members and students to participate in international activities

- Development of clear vision and strategic policies and long-term and short-term plans
- Increase in payments to faculty members for international research
- Strengthening of the cultural and social atmosphere of the university for the participation of foreigners
- Membership in international consortiums
- Continuous communication with different universities around the world
- Holding meetings on the subject of internationalization with professors and students
- Financial support for the international activities of professors and students
- Equipping universities with updated facilities
- Creating formal structures for establishing international communications
- Development of international curricula

At the national level:

- Fundamental changes in higher education planning and curricula
- Changes in the higher education management approach and a move towards decentralization
- Efficient allocation of financial resources and services
- Development of international relations with various countries
- Facilitating the visa application process
- Introducing scientific achievements and capacities
- Holding international symposiums and summits
- Granting independence to universities in international activities
- Development of support and welfare services for international people
- Planning for the acceptance of academic credentials by international universities

At the international level:

- Establishing regional centers on the internationalization of higher education
- Increasing support from developed countries in Africa
- Financial support from the United Nations and other international organizations for the development of internationalization programs
- Encouragement of countries to invest in higher education in Africa

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THEME 7: TH CONTRIBUTION TO SUSTAINABILITY AND RECOVERY PROGRAMMES AND POLICIES

THE RELATION BETWEEN ECO-INNOVATION AND BUSINESSES: A BIBLIOMETRIC ANALYSIS

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Eco-innovation represents the combination of innovation and environmental performance and aims to reduce environmental impacts while having a positive influence in the society and in the economy. It seeks a better thought-out choice of materials, distribution, and processes with lower consumption of energy and resources, thus reducing environmental impacts. There is an increasing array of literature surrounding the interaction between eco-innovation and businesses, as eco-innovation represents an important strategy that companies need to adopt in order to achieve better levels of economic performance, market differentiation and commitment to sustainability. Driven by an increased awareness of the problems posed by climate change, society is pressuring firms and governments to "think green", so this topic has recently emerged as a global effort aiming to implement sustainable development. By addressing this issue, eco-innovation is perceived as a key factor for innovation commitment, a way to achieve prime concerns in business agendas and a viable solution for society, government entities and firms.

The daily operations of many firms contribute to pollution emissions and eco-innovation may represent an important tool for the reduction of such emissions. The concept is also significant for generating competitive market advantages, as the commitment to sustainable practices represents a differentiation factor for consumers who seek sustainability-oriented products and services. As a downside, companies may utilize this trending topic to develop non-sustainable products and services, while marketing them as sustainable, in a process called "green washing".

Businesses themselves face several barriers, internal and external, when committing to eco-innovation. Steep financial requirements, bureaucracy, changes in the decisions and practices represent examples of barriers they face. Governments play a main role in eco-innovation adoption, as the ease of policies and bureaucracy positively contributes to the adoption of eco-innovation, which has been facilitated in developed countries, with OECD members and European countries especially benefiting from related policies.

All these factors explain the large number of scientific materials that academics are developing. Eco-innovation directly involves the triple helix concept with innovation in products and services in firms, new policies and sustainability measures in governments and development and research in universities. Establishing relationships and connections within the triple helix is important as this type of innovation requires communication and social ties. At a quantitative and qualitative level, the increased number and quality of relationships within the triple helix translates in improved eco-innovation results. Relationships within companies are also important for the correct application of eco-innovation as the predisposition to collaborate, pro-activity and increased communication between firms' administrations and workers may contribute to better levels of eco-innovation.

The relation between eco-innovation and businesses is an emerging research topic that is receiving a large number of recent and diverse contributions. It is therefore the purpose of this paper to undertake a bibliometric analysis as a useful tool to abridge and analyze literature on this topic, providing insights in bibliographic coupling and co-citations. In the analysis of bibliographic coupling, authors, articles, sources, and countries will be considered; as for co-citations, references, sources and authors will be examined. The aim of this research is to analyze the scientific contributions present in the theme, related to businesses and eco-innovation, through bibliographic coupling and co-citation analysis. It is also to shed light on the main research avenues when considering businesses and eco-innovation and provide readers and researchers with the current status quo of relevant literature that may be a value for future research.

Keywords: eco-innovation; bibliometric analysis; bibliographic coupling; co-citations.

AHEAD OF - NOT BEHIND THE PANDEMIC: SINGAPORE' STRATEGIES IN THE AQUACULTURE SECTOR TOWARD FOOD SECURITY

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The role of government is significant, across both the Global North and South, to develop local capacity and capability to serve as a critical buffer during supply disruptions. During the Covid-19 pandemic, when most of the countries tightened restrictions to curb Covid-19 surges, a country's reliance entirely on the imports of foods from overseas could be seriously perilous. Adopting a triple-helix framework, this study analysed Singapore's strategies in aquaculture sector toward food security. It argues that the government's strategies must target economic, social and environmental sustainability, even being well ahead of and not behind the crisis e.g. the Covid-19 pandemic. The appropriate strategies must be carefully designed and implemented ahead of the pandemic and hence seriously becoming a springboard for the country to make a swift recovery in post-pandemic time.

Using documentary research, a comprehensive bibliography was compiled from major scholarly databases. This study adopted a historical approach to analyse the Singapore government's strategies in aquaculture sector toward food security. It aimed to understand the development and implementation of the strategies and their impacts in aquaculture sector on food security in Singapore.

The preliminary results indicated that Singapore had to overcome several key challenges and constraints in the aquaculture sector, including the scarcity of its land and sea space, manpower availability and environmental conditions. So, the Singapore government has adopted essential strategies to develop local capacity and capability to enhance local food production through "Grow Local". Local producers can serve as a critical cushion during food supply disruptions, as evidenced during the Covid-19 pandemic. Singapore Food Agency (SFA) targeted the country to develop the capacity and capability of local agri-food industry to produce 30% of Singapore's nutritional needs by 2030 or "30x30". In addition, the government supported its local companies to "Grow Overseas" so that their food produces can be exported back to Singapore.

In the aquaculture sector, the Aquaculture Innovation Centre (AIC) was established in 2019 at Temasek Polytechnic and supported by Enterprise Singapore. The AIC adopted a consortium model to embrace key actors from universities, government agencies and industry to collaborate for development of the aquaculture sector in Singapore. It aimed to advance research and development, create co-innovation models and also offer training and development opportunities to the all levels of industry in the aquaculture sector. In particular, local farms must be innovative and adopt technologies to overcome the local constraints and challenges in order to be highly productive and sustainable. For instance, an integrated approach to farming, combining solar energy with algae production was implemented. In short, the AIC was a platform to close the loop in sustainable super intensive aquaculture to enhance food security and resilience.

While the final target of "30x30" strategy is to be seen, Singapore has already ranked 1st in the food availability category of Global Food Security Index in 2021. It suggests a remarkable achievement. Hence, the Singapore's success story can become a good example for other countries of limited agriculture resources and fragile food security, to enhance their capacity and capability.

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THEME 8: THE FOURTH INDUSTRIAL REVOLUTION, INNOVATION MEGA TRENDS AND NEW CHALLENGES FOR TH RESEARCH IN THE POST PANDEMIC WORLD

INNOVATION POLICIES NESTED IN NATIONAL AND REGIONAL INNOVATION SYSTEMS AND MULTI-LEVEL TRIPLE HELIX DYNAMICS

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Bottom-up regional policies have been the dominant policy rationale since 1990s across EU countries. The principle of subsidiarity that was enshrined in the 1990 Structural Funds reform translated in the delegation of regional development objectives to be designed and implemented within the same regions to respect a principle that endorsed the delegated powers of EU and national governments to regional actors. Smart specialisation policies reinforced this place-based logic over the last two financial rounds of funding. Innovation and technology policies were also pursued within the same framework under the belief that these were also tools to reduce regional disparities and specifically to support technological catch up by lower income member states and to drive innovation performance by high income countries competing on global markets (McCann & Soete, 2020).

With this backdrop, the policy paper is positioned in the current debate on the double challenge that digitalisation and sustainability are posing to EU regions depending on their industrial and technological trajectory (Bellandi & De Propris, 2021). We aim to question, firstly, whether the emergence of disruptive technologies requires a more constructive and strategic coordination between different spatial scales of policy, allowing a twinned transition to be realised fully and equitably at the regional levels (De Propris & Bailey, 2021). In large or medium sized countries, national innovation systems could play a crucial role in creating the necessary *system change*: at the interface between the international and EU scale and regional innovation systems where the local governments may have a too limited ability to set up the necessary resources and reap the benefits of change for local economies (Cooke & Morgan, 1998). On the other hand, in small countries, delimited inter-national cooperation schemes become more important.

EU policy and funding seems to boldly move in this direction, aware of the scale effect of the system change required to allow EU regions to retain the current competitive advantage and create new ones. Secondly, we will discuss the concept of triple helix as a lens both to understand nature and existence of innovation “systemness” at transnational, national and regional levels (Leydesdorff, 2012), and to show the urgency of designing nested innovation and technology policies at both the national and regional levels. The concept of triple helix has been a cornerstone in the debate on regional innovation systems, namely regional development, and innovation. Indeed, it has guided the governance of policymaking by advocating a dynamic and synergetic relationship between business, academia, and government (often intended as sub-national government). More recently, a growing literature has expanded the circle of the interested stakeholders to actors operating in the fields of civil society and environmental protection, to complement business innovation with social and environmental innovation (Carayannis & Campbell, 2009; Cai & Lattu, 2021). Meanwhile, other contributions in the triple helix literature have looked at either national innovation systems or multi-level and even transnational scales of applications (Arranz et al., 2020; Cai & Etzkowitz, 2020).

Firstly, we discuss the nature and objectives of the latest EU funding together with identifying examples around the EU where a nested approach to policies supporting regional digital and sustainability transitions has been tried and possibly tested successfully. This discussion will be based on a meta-analysis of EU documents and of academic papers in a set of selected Journals. A specific attention will be given to papers where this sets of topics are already combined, at least discursively, such as in Grundel and Dahlström (2016). Secondly, we consider some contributions on multi-level triple/quadruple/ quintuple helix models and their relations with the formation and functioning of regional, national, and transnational innovation systems, such as in Carayannis et al. (2017) and Cai and Etzkowitz (2020). We integrate them with the help of a model of digital and sustainability transitions in local productive systems and their contexts (Bellandi & De Propris, 2021). Thirdly, the integration provides a light conceptual framework that is used to showcase and enlighten the EU examples above.

The discussion of EU examples and the conceptual framework suggest the identification of factors that might either hamper or support the take-off and development of effective multi-level multi-actor dynamics of innovation systems and their application to digital and sustainability transitions. Such factors include various types of nested innovation and technology policies targeting national and regional levels within broader transnational and global networks. According to different territories and evolutionary phases, some policies are more-or-less effective and appropriate. Weak or inappropriate nested policies play as a hampering factor; vice versa, strong appropriate ones play as a supporting factor.

Our findings will shed new light to an emerging debate on regional innovation and technology policies in the context of EU's regional policy. We suggest therefore the need for a more systemic reflection on the tensions and connections between global, national, and regional innovation systems and the intrinsic role of triple helix dynamics.

THE CHALLENGES AND TRENDS OF INNOVATION IN THE POST-COVID WORLD AND THE LESSONS FOR RIO DE JANEIRO STATE: AN ANALYSIS BASED ON THE "INNOVATION DIALOGUES – 2021" SERIES OF EVENTS

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The 2021 edition of the Innovation Dialogues, which is a series of events held by Casa Firjan in partnership with FAPERJ, has discussed along six editions challenges and trends on the innovation field for countries and regions, calling in international experiences and its experts to reason upon Rio de Janeiro State reality.

Various themes were discussed: digital government, pharmaceutical industry, unusual collaborations, placemaking and revitalization of cities, energy transition and systemic innovation policies. In this article, based on the syntheses of each edition, we propose to create a meta-synthesis of the great trends for innovation in the post-pandemic world.

Despite the thematic diversity some points of convergence can be highlighted. Firstly, the impact caused by the pandemic and the challenges of post-COVID world were addressed in all discussions held. Furthermore, there was an unanimous perception that the pandemic was responsible for anticipating and accelerating trends which were still flimsy.

Digital transformation is an inevitable trend in all economic sectors and areas of society. I It will be crucial for businesses survival, even traditional ones, and for governments ability to deliver public services effectively, efficiently and efficaciously. In this scenario, the ability to collect and use data in a predictive way emerges as a necessity to deal with the complexity brought by technological advances and the deepening of social challenges.

In decline since the 1990s, the State's capacity to plan, coordinate and execute public policies has once again become not only desirable, but essential. This capacity is vital for several actions: from the strengthening of a local pharmaceutical industry and so decreasing the country's technological dependence, through the decarbonization of the economy and effort to discover new, cleaner energy sources, to the revitalization of degraded areas in large cities, integrated the well-being of the community.

The Innovation Dialogues also consolidated the perception that, despite the social isolation brought about by the pandemic and the growing advancement of information and communication technologies, innovation continues to be done in real territories and to focus on specific geographic areas. The so-called death of geography has not yet been consolidated in practice. In this sense, first of all, it is necessary to create mechanisms that increase the quality of life in cities, allowing for a coexistence that is good for everyone. The pillars must be accessibility, sustainability and equity. The promotion of diversity, through the encouragement of social and cultural exchange and openness to immigration, can be an effective strategy to stimulate innovation, as it occurs from the meeting of differences and unexpected collaborations.

Although the importance of geography remains, increasingly the territory will be physical and digital ("figital") simultaneously. The "metapolis" integrate the territorial dimension, social relations and digital social networks, producing new meanings and collaborations on a global scale. Therefore, territory, as well as governance, becomes multi-scale.

The interactive process with civil society making use of more creative resources with new technological and digital communication tools to enable citizen participation in urban transformation has also been identified as a valuable tool both in Brazil and in international cases.

Considering the main contributions presented above, it can be said that the State of Rio de Janeiro, especially its Metropolitan Region, is in an interesting position to take advantage of open opportunities. However, this involves the modernization of its state apparatus and its planning capacity. Despite still being hostage to the 20th century economy, especially the Oil and Gas chain, its knowledge assets, its insertion in global networks, its vocation for sustainability and its local culture of intercultural coexistence, can be engines for construction of a new development trajectory based on creativity, social inclusion, green economy and smart urbanization.

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THEME 9: GOVERNANCE MODELS AND POLICY DESIGN FOR TRIPLE HELIX INITIATIVES IN THE AFTERMATH OF COVID-19

INNOVATION AND PARTNERSHIPS IN TACKLING THE COVID-19 PANDEMIC: REPORTS FROM THE BRAZILIAN INNOVATION SYSTEM

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The outbreak of the Covid-19 Pandemic in March 2020 led to a worldwide crisis in the supply chain of medical supplies, personal protection equipment, hospital equipment, and spare parts. In Brazil, public and private organizations have mobilized in collaborative initiatives to face this problem. The objective of this work was to map and describe some initiatives that have adopted the interaction and collaboration among different entities of the Brazilian System of Innovation as a strategy for confronting and/or mitigating the lack of stock of hospital materials in the initial moment of the pandemic. These initiatives were confronted with a referential theoretical framework of the development and innovation economy. The methodology used was bibliographical research from literature on innovation economics in dialogue with press news and information from institutional websites. The article presents reports involving the formation of partnerships and interactions to overcome this critical moment in the world.

Worldwide, the exchange interactions made possible the rise of numerous innovations induced by the demands originated by the pandemic. In Brazil, most of partnerships, consortiums or cooperation networks were formed from the initiatives of business associations, which are relevant actors for the national industry, such as CNI - National Confederation of Industry, SESI - Industry Social Service and SENAI - National Service for Industrial Learning. Up to early June 2020, these actors together with state federations of industry, and 380 partner industries had already invested more than R$300 million in actions to combat the new coronavirus (CNI, 2020b).

One of the main initiatives in Brazil was a voluntary network coordinated by SENAI that was mobilized for the repair of mechanical respirators. The network was formed mainly by: Volkswagen, Ford, General Motors, Honda, Mercedes-Benz, Renault, Toyota and steelmakers, such as ArcelorMittal and Usiminas, as well as Science & Technology institutes, such as the Oswaldo Cruz Foundation (Fiocruz), the Technological Research Institute (IPT) and the Polytechnic School of the University of São Paulo (POLI-USP), and supported by the Brazilian Agency for Industrial Development (ABDI) and the Brazilian Association of Clinical Engineering (ABEClin).

Noteworthy is also the partnership between SENAI, ABDI and the Brazilian Company for Industrial Research and Innovation (Embrapii), a social organization that supports technological research institutions and fosters innovation in Brazilian industry. Thirty-four projects were selected and received investments of 27.7 million reais to bring to market the inventions developed by the SENAI Innovation Institutes and SENAI Technology Institutes throughout the country. Among those approved were proposals to use artificial intelligence to control the spread of the disease; manufacture of an easy-to-handle monitor for rapid diagnosis of patients with pulmonary deficiency; production of rapid virus detection tests; development of a disinfection system for public transportation, among others.
Other innovative solutions resulting from partnerships should be highlighted, such as:

- Decontamination tunnel for health professionals - partnership between SENAI and CIMATEC: a solution of sodium hypochlorite (bleach) is sprayed during the passage of people through the equipment, so that they can then remove the PPE with less risk of contamination (CNI, 2020a);
- Oxygenation capsules for individual isolation of beds developed at SENAI Mato Grosso: they aim to reduce the length of hospitalization of Covid-19 patients and the need for referral to the ICU, in addition to protecting health professionals (CNI, 2020a);
- Antiviral fabric for the production of masks and aprons capable of neutralizing the coronavirus - partnership between SENAI CETIQT, Fiocruz and Diklatex (CNI, 2020c);
- Thickener extracted from wood to produce alcohol gel, as a replacement for imported inputs - a partnership between SENAI in partnership with industries Klabin and Apoteka, considered a world innovation, even generating a patent application (CNI, 2020d);
- Aerator filter that purifies air infected with viruses - partnership between EMBRAPII and the biotechnology company Biotecam: mobile equipment with low energy cost, which can be adapted to different spaces (Embrapii, 2020).

In conclusion, we recall what Lundvall (2007, p. 102) teaches us: "companies innovate in interaction with other companies and that they interact with the knowledge infrastructure, including universities and technological institutes". Crises such as the pandemic tend to accelerate the development of innovations already underway or that would occur more gradually, since the partnerships signed between industry, academia and government to find

solutions that help overcome the crisis contribute directly to this process of acceleration of innovations, given the intense exchange of knowledge, technology and experience.

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A JUSTICE-BASED GOVERNANCE APPROACH FOR TRIPLE-HELIX PARTNERSHIP

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The triple helix model explores the synergies between functions of wealth creation, knowledge production, and government regulation conducted by industry, university, and government, respectively. The quadruple adds society that promotes revenue growth and commercialization, and the quintuple helix makes the model ecologically sensitive (Galvao et al., 2019). Governance, the set of rules and regulations resulting from negotiation or agreement that will coordinate the partnership among participants of the helix initiative, is needed to leverage these synergies. (Schuppert, 2015).

However, achieving alignment between participants related to rules and regulations can lead to governance issues, including schism of rights, disputes of influence and domination, conflicts of interest, and endless contests among participants (Danson & Todeva, 2016). We consider that aligning the governance model is more important than aligning each participant's objectives since industry, university, government, society, and representatives of the natural environment pursue different goals, such as profit, knowledge, wealth distribution, and sustainability (Galvao et al., 2019).

We propose a justice-based governance approach for triple, quadruple, or quintuple helix partnerships to solve this issue. We include four dimensions of justice in our governance model: distributive, procedural, interactional, and informational justice.

Distributive justice evaluates the alignment of outcomes with the inputs in an exchange. Whenever there is an imbalance between outcome and input, people may feel wronged (Adams, 1963). The single rule of equity is simple; rewards distribution should align with the contributions of each actor. However, each actor will judge the fairness of distribution based on its perception and against a referent. If someone understands that a colleague receives a higher outcome but applies the same effort, the feeling of inequality may arise (Colquitt, 2001).

Inequity feeling may lead to some behaviors by the person that fells it, like a) increase inputs that are low relative to other inputs and his outcomes; b) decrease inputs that are high relative to other inputs and his outcomes; c) increase outcomes that are low relative to other outcomes and his inputs; d) decrease his outcomes that are high relative to other outcomes and his inputs; e) leave the field; f) psychologically distort his or other's inputs and outcomes as required; g) force others to leave the field; or h) change his referent other.

Procedural justice is concerned with individuals' perceptions about the fairness of formal procedures governing decisions. For example, how to influence these procedures (Masterson et al., 2000) and adherence criteria such as a) consistency, b) lack of bias, c) correctability, d) representation, e) accuracy, and f) ethicality (Leventhal, 1980).

Interactional justice is related to interpersonal treatment as the procedures are implemented (Bies & Moag, 1986). In addition, interactional justice relates to decision-makers' perceived respect and sensitivity to explain the rationale for the decisions made. Thus, although it may be related to procedural justice, it is a distinct dimension (Bies & Shapiro, 1987).

Informational justice explains why procedures work in specific ways, or the current distribution of outcomes is in particular amounts (Jerald Greenberg, 1993). Measure models that evaluate that interactional and informational justice should be separate components since they have differential effects (Colquitt, 2001).

Using these justice dimensions and the 'reflective equilibrium' method proposed by Rawls (1971), where the participants go back and forth interacting and altering the conditions of the contractual circumstances, it will be possible to establish the governance model which every participant can agree.

The use of justice as a proxy for a governance model for the helix partnership is possible because it includes the four relevant justice dimensions while considering: a) governability, the capacity to solve urgent societal problems; b) legitimacy, the work performed can deliver the goods agreed among participants; c) accountability, every participant becomes accountable; and d) responsiveness, where the governance model will be more responsive to all participant needs (Kersbergen & Waarden, 2004).

Beyond the development of a governance model based on justice dimensions, this approach allows establishing an assessment tool to evaluate the fairness of the governance model to be implemented and continuously check the fairness of the partnership to promote changes in the governance model.

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FIOCRUZ AND ASTRAZENECA - A SUCCESS CASE IN AN ADVERSE SCENARIO

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The purpose of this article, a qualitative and a exploratory case study, is to identify the main institutions that contributed to the results of the partnership among Fiocruz, a very important institute in Brazil, recognized as center of excellence in research and vacines´s production at the global level, the Oxford University, an English University with over 30 years experience in vacines production and AstraZeneca UK, an important English Biopharmaceutical company, in the development and production Covid-19 (SARS- CoV-2) vacine, including the IFA´s supply.

Brazil is recognized for its relevant scientific base and for the excellence of the brazilian universities and research institutions. Such characteristics allow the country to have an expressive participation in knowledge generation at an international level. Several studies endorse the country's great potential in natural resources and the accumulation of knowledge and institutional competences in several areas, inclunding the existence of well-structured public health system and the centers of excellence in vaccine research and production, with emphasis on Fiocruz and Butantã.

In the presente article we intend to analyse the critical institutions related to innovation identified during the process of technological partnership among Fiocruz, Oxford University and AstraZeneca UK, in five different dimensions: systemic, sectoral, organizational, due to technological development and also the activities (specific and systemic ones) that supports the innovation process, during the period of 2018-2021, with emphasis on institutional competences, the ordering and technology transfer contracts clauses and other legal instruments.

It shows that these elements could provide stability to innovation processes, even in adverse global contexts (pandemic event, S,T&I investment cut as we observed in Brazil, since 2014) and also could be adopted as an appropriate approach for the identification of critical elements that contribute to the success of organizations in the technological development processes, to consolidate and foster innovation systems, as well as to evaluate the dynamics of sectoral and national innovation systems in a complementary way to studies of a qualitative nature for these topics and, additionally to support the innovation public policies design and its governance models.

The methodology used was based on an empirical analysis, based on secondary, primary information, contemplating conducting semi-structured interviews.

In a complementary perspective we also intended to highlight how these institutions allow Fiocruz Institute to establish the partnership with the english organizations in a very short period of time in order to answer a public health emergence situation and demonstrate the central role of institutions in the innovation and sectorial systems.

In the authors' view, the effective contribution of public policies to the socioeconomic development of countries should not be associated or prioritized as actions aimed only at financing R&D activities, but also those aimed at improving legal frameworks, creating and reconfiguring the systemic institutionalities intrinsic to innovation processes.

Considering the positive experience carried out between the Brazilian research institute and the english organizations it may be possible to evaluate the possibility of reducing the production costs of Covid 19 vacines in the country for the next years; the chance of exporting it to the region and to developing countries, and, in particular, the chance of develop new technological platforms to combat other infectious diseases.

Keywords: AztraZeneca; Covid-19 vacine; Fiocruz Institute; Oxford University; Technology transference; technological order.

EUE2030: BUILDING GIPUZKOA'S UNIVERSITY-BUSINESS COOPERATION 2030 STRATEGY

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Several studies have demonstrated the multiple benefits that UBC brings to companies, the university sphere and society itself, in relation to the quality of employment, commitment to sustainability, the development of new knowledge and skills, the implementation of new business projects and gender equality. These latter being the basis on which the competitiveness of regions must be built in the future (Provincial Council of Gipuzkoa, 2021).

Along with the development of university's missions, UBC has evolved together with the needs of markets and society, answering the needs brought by events such as the Covid-19 pandemic, the globalisation and the digital, ecological and demographic transformations. Therefore, many governments around the world are commited to UBC (NCUB, 2020). However, research studies indicate that UBC levels are low (Vivar-Simón, 2021). Given this situation and the importance of UBC for achieving a human-scale competitiveness, research into this cooperation phenomenon and the generation of tools for its promotion is essential (Tootell et al., 2020). To this end, this research study seeks to develop an empirical joint roadmap for the Triple Helix of Gipuzkoa (Northen Spain), the *EUE 2030 Agenda*, defining a 2030 UBC strategy that promotes a human-scale competitiviness.

This study, carried out between October 2021 and June 2022, funded by the Provincial Council of Gipuzkoa, applies the following methodology. First, it starts with an exhaustive literature review of the future and current challenges that the Triple Helix has to respond to in relation to (i) future employment and the future of employment, (ii) quality of employment and employability, (iii) lifelong learning, (iv) digital, ecological and demographic transformations, and (v) equality between women and men. Second, the necessary quantitative and qualitative data are collected by means of a series of interviews and a internet-based questionnaire. In this second phase, the perspective of the key agents of the Triple Helix (representatives of academia, business and administration) with regard to the 2030 UBC strategy is collected. Once the information is collected, gathered data is analysed to generate the knowledge that will guide the definition of the 2030 UBC strategy. Subsequently, a series of joint work sessions with the key actors of Gipuzkoa's Triple Helix are held to compare the information gathered through the literature review and the interviews and questionnaires. Finally, a series of working sessions are held to jointly define the 2030 UBC strategy and draw conclusions.

The result of this research is an evidence-based joint roadmap, which collects and empirically contrasts the joint vision of the business fabric, university and administration in Gipuzkoa, regarding the current and future challenges (horizon 2030), to which UBC must respond in terms of (i) future employment and the future of employment, (ii) quality of employment and employability, (iii) lifelong learning, (iv) digital, ecological and demographic transformations, and (v) equality between women and men.

The EUE2030 Agenda is the result of a cooperative exercise of analysis, contrast, reflection and decision-making that shows both (i) the future scenarios for 2030 in terms of quality employment (considering the triple aspect: economic, social and environmental development), (ii) the main milestones to be met and the actions to be carried out in cooperation, and (iii) the indicators to be used to monitor the defined 2030 UBC strategy.

Keywords: UBC, UBC strategy, Triple Helix, 2030 Agenda, Human-scale competitiveness, Employment.

TECNIO AS A POLITICAL ACTION ON TH MODEL IN CATALONIA: A COMMERCIAL MISMATCH BETWEEN GOVERNMENT'S POLICY AND TECHNOLOGY GENERATOR'S REALITY

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Spanish innovation system is decentralised into regional systems (Leydesdorff and Porto-Gomez, 2017), and Catalonia is recognized as one of the main leading regions in the innovative system in Spain.

Catalan government has been developing policies to support industry and business for decades, with the aim to improve the capacity for innovation and competitiveness of companies that are considered as the central core of the economy and a generator of wealth and employment. In this vein, one other main policy is directed towards approaching technology transfer entities to industry, through TECNIO accreditation. This strategy offers support to stimulate the activity in the Catalan technology market among technology generators, buyers, facilitators, and other collaborators in the process.

To obtain a TECNIO accreditation, it's needed a series of documents published in Diari Oficial de la Generalitat de Catalunya (2019). The requirements also specify that it's important demonstrate the group or centre accredited that are doing promotional activities, for example: promotion and commercial action of the group among companies, elaboration, and execution of a plan of actions in technological transfer based on a marketing plan, among others.

This article is focused on providing a micro-level analysis of the reality of the innovation system in Catalonia and, discussing whether the coordination and alignment between Government policies adopted in TECNIO accreditation has a positive influence on TH model to improve relations between university research and industry.

We present a case study (Yin, 2009) to be able to explore this real-time phenomenon within its naturally occurring context, providing a description of actors, situations, and context (Eisenhardt, 1989; Beverland and Lindgreen, 2010). We obtained our data from secondary sources of information and fieldwork that analyse the process of TECNIO accreditation from the point of view of the technology generators of UPC TECNIO research groups as aspirants to the seal.

It's known that the failure of science-business linkages is caused by a lack of customer and marketing focus, and the absence of marketing principles used in the commercialisation of research (Baaken, 2003). So, it's urgent that university policies and practices improve the exchange of knowledge and technology by developing marketing strategies (Morgan *et al.*, 2019; Sozuer *et al.*, 2020), marketing capabilities to enable them to anticipate and act on changes in markets and society (Siegel et al., 2003; Frasquet et al., 2012; Albats, et al., 2018). Designing new organizational and marketing forms from a more professional viewpoint, incorporating marketing experts, because Universities need to apply marketing approaches, strategies, and instruments to develop one of the pillars of the competitive environments in which they are involved are needed (Baaken, T., Rossano, 2016; AL-Ghaswyneh, 2020). Therefore, the importance of marketing strategies has been supported by policy makers (e.g., TECNIO) to be adopted and implemented in universities to improve the capability of knowledge transfer to industry, achieving the alignment between the 3 TH actors. Nevertheless, expectations versus reality are not aligned.

A micro-level analysis raised several asymmetric scenarios; for example: 1) Professional researchers are persuaded to act as both marketing strategist and marketing executors when they are fully aware of their own lack of knowledge and capabilities to develop these commercial tasks successfully. They reported that a specialist in scientific communication was needed, with commercial skills to balance interrelations with industry. 2) There are different typologies of research groups from diverse departments, different dimensions related to the number of researchers and their contractual situations, infrastructures, material resources, organization, among others. This diversity of research groups with the aim to obtain TECNIO accreditation have the same need of seeking funding. They agree that the requirements for accreditation are increasingly demanding and misaligned with the low benefits that it presents to them.

Our findings reveal a commercial mismatch between government's policy and technology generators' reality that it is necessary to identify and align to boost the transfer intent. The development of a marketing plan is one of the requirements during this process of accreditation, however, researchers commonly in charge of this task do not fully understand the specific data needed, making the writing effort on the marketing plan more a fence to jump to get the seal than a useful tool for the development of commercial potential of their innovations.

This study is focused on researchers' point of view, so to understand this accreditation as an "action" to improve relations between university and industry, it's necessary to adopt industry perspective.

Keywords: policy action; marketing; university third mission; case study.

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THEME 10: EVALUATING THE IMPACT OF TH INITIATIVES

INNOVATIVE CAPACITY IN TRIPLE HELIX PLATFORMS: AN ASSESSMENT OF NETWORK EFFICIENCY AND SOCIAL LEARNING

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This research examines the assumption underlying triple helix (Etzkowitz & Leydesdorff, 2000) that the exchange of diverse knowledge stimulates innovativeness. Knowledge exchange occurs through social contacts, which can be represented as a network. Through the triple helix, it is expected that a platform can be established that provides the opportunity for key stakeholders to bring their knowledge, expertise, and resources together towards a common goal. It is expected that they will create a strong and cohesive network in order to come up with innovations that can tackle the value chain challenges identified. Transcending the traditional, top-down, technology-oriented approach (Schut et al, 2016, cf. Table 1 p.541), triple helix platforms aim for inclusivity among all stakeholders and consider institutional, organizational and technological barriers to innovation.

Even if triple helix platforms are established and operational, the degree to which the actors from the three different domains (academia, business, and government) are networked needs to be studied. This can provide important insights on the extent to which platform members, including minorities, are learning from each other and creating a stronger network, and whether this curates a capacity to innovate. Importantly, the Triple Helix model does not make people innovators per se. Rather, it should be regarded as a catalyst for innovation by creating new network ties.

Besides the triple-helix model, this research is rooted in three main theories. First, Interactive innovation theory entails a system approach (Johannessen, 2009) as opposed to the linear approach of innovation. We look at the innovation in the triple helix model as interactive; i.e. that it is a result of a connection between actors from the three institutions: academia, business and government. This yields the following assumption: collaboration between different institutions stimulates creativity, out-of-the-box thinking and novel ideas, leading to innovations. Second, social network theory (Borgatti et al., 2009) will help us understand the extent to which the triple helix innovation platform members are networked to each other, and whether the triple helix platform has contributed to a stronger, cohesive network. Third, social learning theory indicates that it is expected that participants will learn from each other's experiences and perspectives, resulting in the development of a common problem definition and shared vision (Reed et al., 2010).

The study will answer the following research questions: 1) To what extent are the triple helix actors networked? 2) Is social learning taking place among the triple helix actors?. The subjects of our research are five Triple Helix platforms in Ethiopia and Indonesia, all five focusing on upgrading agricultural value chains, see table 1.

Table 1. The Triple Helix cases.

	Name of the triple helix	Location	Innovation type
1	Amhara Dairy partnership (ADP)	Bahir Dar, Ethiopia	Micro-dairy processing, branding and marketing
2	Bako Horticulture Platform (BHP)	Bako, Ethiopa	Franchised vegetable seed production and marketing Tomato Seed production, processing and packaging technologies
3	Arba Minch Triple Helix Platform (ATHP)	Arba Minch, Ethiopia	Fruit cluster development (water efficiency and post-harvest management) Harvesting, transporting, drying, processing, marketing and irrigation technologies (for Banana and Mango)
4	EMoww (Dairy)	Bogor, Indonesia	Dairy tracking app, curricula development, farmer training
5	Poultry	Bogor, Indonesia	Closed house chicken farming, education modules

The study measures knowledge exchange between diverse actors at the individual and organizational level by considering density, diversity, influence, and multi-levelness. Data are collected in spring 2022 using questionnaires and interviews, along with a statistical network analysis where possible. The authors aspire that this study provides a tool for monitoring how well triple helix partnerships live up to their purported goal: Development by collaboration.

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EMBRACING HETEROGENEITY ACROSS KIE FIRM TYPES FOR THE EVALUATION OF SBIR-LIKE PROGRAMS: EVIDENCE FROM BRAZIL

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This study discusses the evaluation process concerning the PIPE Program in Brazil. The PIPE Program is a SBIR-like policy that nurtures Knowledge Intensive Entrepreneurship (KIE) firms in the state of São Paulo, Brazil. KIE is a systemic phenomenon that affects overall levels of economic competitiveness and innovative capabilities (Malerba & McKelvey, 2020; Ács et al., 2008; Beckman et al., 2012). KIE ventures often demonstrate heavy reliance on policy instruments, considering the high levels of uncertainty associated with their disruptive nature, the presence of asymmetric information and the lack of venture capital available to fund their operations (Pan & Yang, 2019; Audretsch & Link, 2012; Lerner, 2002).

One of the most notorious entrepreneurship-oriented policies is the Small Business Innovation Research (SBIR) program. SBIR fostered the development and guided the commercialization of many new technologies of KIE firms (Wessner, 2008; Howell, 2017), and has many parallels overseas, like the Brazilian PIPE (Salles et al., 2011; Fischer et al., 2021).

Analytical exercises to evaluate SBIR-like programs have increased over time and are crucial to arm government agencies that undertake similar programs with the right tools to be increasingly effective and to foster innovation. The analysis of findings of different evaluations of SBIR-like programs can be useful to understand differences and to contribute to find out patterns.

That is, it has been recognized by academics and policymakers that KIE firms are fundamentally heterogeneous (Malerba & Vonortas, 2010). Accordingly, they require an appropriate comprehension of particularities to design effective initiatives targeted at fostering these ventures. The heterogeneity inherent to the KIE phenomenon is a rich source of information not always explored and suitable to produce evidence for planning, accounting, advocacy and learning.

A literature review about SBIR-like evaluation indicates that KIE firm heterogeneity is not generally acknowledged when evaluating the SBIR program and similar policies, and few are the studies that focus on this aspect and appropriately address KIE firms' specificities.

Based on this background, our proposal is to unveil heterogeneity of KIE-firms when evaluating the impact of the PIPE Program in the State of São Paulo, Brazil, and to compare data from evaluations of other SBIR-like programs available in the recent literature. It is worth mentioning that this is part of a larger research program in which several STI policies in Brazil have been evaluated.

The methodological approach for impact evaluation was based on the collection of primary and secondary data from grantees - whose projects had started in 2006 and concluded in 2016 – and from rejected proposals in the same period.

The main characteristics of approved and rejected proposals were analyzed, considering the following aspects: companies' age; number of employees; employees in R&D; revenue; exportation; foreign capital; spin-offs; geography; occurrence of partnership with universities, research centers and other companies; and companies' organizational and managerial maturity. The analysis also considered Project Coordinator's characteristics, such as: gender; level of education; background; position in the company; prior management education.

A multivariate analysis was carried out in the PIPE assessment. This exercise allowed us to find patterns of companies with better performance due to input variables (granted project and company profiles) and variables of outputs and outcomes. Analysis considered the following variables of outputs: revenue growth; exports growth; venture capital; domestic and foreign intellectual property; R&D employment growth; qualified employment growth; total employment growth; and RD&I expenditures. A clustering exercise based on Multiple Correspondence Analysis and involving companies with approved and rejected projects will also be presented.

This discussion contributes to the literature of entrepreneurship-oriented policy by emphasizing that KIE firms are fundamentally heterogeneous and require an appropriate comprehension of these particularities to better design interventions whose outputs and outcomes can be improved (Malerba & Vonortas, 2010).

The main findings indicates that patterns can be identified and associated with firm performance on different dimensions. Furthermore, the clustering exercise can help build more robust taxonomies of KIE firms.
These findings have also stressed that academics and policymakers need to recognize that target firms are fundamentally heterogeneous and require appropriate comprehension of their particularities when designing similar programs and carrying out evaluations.

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ACADEMIC-CORPORATE COLLABORATION: THE BRAZILIAN CENTER FOR RESEARCH IN ENERGY AND MATERIALS PROJECT CASE

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This study reports an impact evaluation of the Brazilian Center for Research in Energy and Materials (CNPEM), where the 4th Generation Synchrotron Light SIRIUS is located. CNPEM is a private not-for-profit organization supervised by the Brazilian Ministry of Science, Technology, and Innovation, located in Campinas, São Paulo, Brazil. CNPEM has four national open laboratories: The Brazilian Synchrotron Light Laboratory (LNLS), which operates the only synchrotron light source in Latin America and the new fourth-generation accelerator; the National Biosciences Laboratory (LNBio) that develops research in frontier areas of Bioscience, with a focus on biotechnology and pharmaceuticals; the Biorenewables National Laboratory (LNBR) that researches biotechnological solutions for the sustainable development of advanced biofuels, biochemicals, and biomaterials; and the National Nanotechnology Laboratory (LNNano) that conducts research with advanced materials, with significant economic potential for the country.

A literature review of evaluations of similar large-scale infrastructure impacts, such as the Large Hadron Collider at CERN, highlights that constructing these projects demand close collaboration between laboratories and companies, which may generate economic and knowledge spillovers (Autio, Hameri & Vuola, 2004; Bach & Wolff, 2017; Castelnovo et al., 2018; Florio, Bastianin & Castelnovo, 2018). These assessments also stress the importance of the scientific knowledge creation and diffusion processes triggered by those projects (Bach & Wolff, 2017; Florio, Bastianin & Castelnovo, 2018), enhancing how large-scale infrastructures may function as learning environments for industrial supplier companies (Autio, Hameri & Vuola, 2004; Florio et al., 2018). Our research was conducted with CNPEM facilities and aims to characterize the effects of R&D and innovation cooperation projects between firms and large research infrastructures in a developing country perspective.

Empirical data come from firms that established R&D and innovation cooperation projects with the CNPEM between 2010 and 2019. There were 83 projects conducted with 59 firms from different economic sectors. We employed a probability sampling, with a random selection of one-third (20) of the totality of the firms, with attention to the proportion of cooperation projects with each of the four Laboratories and seeking, whenever possible, to include companies that participated in more than one project.

Interviews were conducted online with the company's managers directly involved in the cooperation projects and focused on three different blocks of information. First block brings general characterization of the company, including location, economic sector, primary clients, competitive dynamics, employee numbers, R&D activities, and revenues. Second block characterizes types of cooperation, when and how it occurred, who oversaw it in the company, and an assessment of the relation with CNPEM from the technical and administrative perspectives. Finally, the third block was dedicated to outcomes and spillovers, identifying differentiation and diversification of products and services by the firm, new markets and clients, intellectual property rights, revenue changes, and new organizational routines due to the cooperation. Interviews were previously prepared with public information of the company and cooperation agreements.

Data were analyzed from a multiple-case study perspective. Findings show that CNPEM leveraged innovation, organizational learning, and reputation in companies with which it developed joint projects. With two exceptions, all firms had previous R&D activities, which means the collaboration did not affect such efforts. Partnerships were both derived from CNPEM or companies' interests. Scientific and technical organization learning was the most critical reported effect. In some cases, this became tangible in joint scientific production between the Center and partner companies. The quality of the relationship with CNPEM's technical staff, associated with professionalism and good ability to lead projects together, certainly influenced these processes.

It is also possible to say that partnerships leverage innovation and the companies' reputation, although it is necessary to look at these aspects with caution. First, projects are not always aimed at generating innovation, but learning and pre-competitive technological development. Second, for large companies – as is the case of some of those consulted – the gains in terms of reputation from the relationship with the CNPEM are incremental since these companies have relationships with many other renowned research institutions.

Regarding the generation of innovation, a group of companies has developed new products, services, or processes on industrial and commercial scale, based on the relationship with CNPEM. These are technologies that have only been on the market for a short time, which explains that the revenue from commercialization is often still low or non-existent. Outputs and outcomes are of different natures and generate economic and social return for the short, medium, and long run.

Big science projects are expensive and can be particularly questionable in less developed countries where public funds are scarce and other "priorities" are always raised as for education, habitation, health and so on.

However, if the articulation between scientific facilities and companies and other organizations is professionally pursued and implemented, positive outputs and outcomes shall occur.

For those reasons, the analytical exercise of evaluating the impacts of large-scale infrastructure projects can also advance the discussion on the relevance of investing in sophisticated scientific facilities to induce positive impacts by legitimizing such large-scale investments.

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PROPOSING A FRAMEWORK FOR DEVELOPING INNOVATION DISTRICTS: A PERFORMANCE ASSESSMENT

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Innovation Districts (ID) are novelty ecosystems development initiatives deployed in urban contexts leading to major impacts in dimensions other than just the economic development of the district – through entrepreneurship, education, and innovation programmes – including the social and urban spheres. ID designed for converting degraded districts into dynamic hubs have attracted interest from policymakers and academics (Piqué, et al., 2019).

These knowledge-intensive areas provide environments and programmes to facilitate the concentration of creative industries integrated into a supportive social environment (Scott, 2000) by offering specialised amenities (Yigitcanlar & Dur, 2013) and infrastructures (Hutton, 2004; Porter, 1995; Utterback & Afuah, 1998). Such an offering attracts knowledge-based companies, in substitution to traditional businesses of old industrial districts of large urban clusters (Hutton, 2004), stimulating the concentration of talented people (Florida, 2008).

Each ID is a complex network of components like citizens, business, transportation, communications, services, and other components of a cluster of innovation (Engel, 2022) with their own unique strengths and weaknesses that face a constant change that generates the permanent challenge of developing new strategies under the development paradigm of the knowledge-based urban development (KBUD) (Yigitcanlar, 2014). Understanding how an ID can change and improve based on these elements is the starting point for it to achieve its vision and objectives; and this can be achieved by refining its most complex link, but at the same time, essential: its strategy. Defining a strategy can help determine where and when to invest, define an integration and optimization schedule across all components and systems, and uncover new opportunities for growth and progress.

Evaluating the main systems and activities of an ID is the first step in defining a strategy towards sustainable prosperity; and developing a set of related indicators is the right activity to do so. Indicators show the changes and progress a program is making towards achieving a specific result. For this reason, it becomes essential that the elements evaluated are directly linked to the main activities aimed at achieving specific goals. Even when indicators in innovation districts have been studied to be able to define a framework that classify these ID (Yigitcanlar, et al., 2020), the topic of indicators evaluating performance (Lerro & Jacobone, 2013) and their evolution through the lifecycle of this spaces, requires still further development.

Following the recent works of (Piqué, et al., 2019), we assume that ID evolve over time, consequently evolution, certain aspects of the dimensions stand out and their performance requires close management and monitoring, as they are essential for the development of the next phase and reflect the more active participation of a certain actor in the ecosystem.

In each of the different phases of an ID lifecycle (Moore, 1996; Etzkowitz, 2005) the triple helix actors assume a diverse configuration in terms of role and leadership of the initiative as well as there are specific characteristics and activities related to the social, economic, and urban dimensions involved (Pique, et al., 2021).

Aiming at shedding new light on how to assess the performance of AOIs along their lifecycle, this study proposes a set of key performance indicators for each of the lifecycle phases of an ID that consider the four main dimensions (a) urban and infrastructure, (b) economic (c) talent and social transformation, and (d) governance. To do so, different conceptual frameworks – triple helix, knowledge-based urban development, clusters of innovation, lifecycle of Areas of Innovation, and performance indicators – are reviewed and used as the theoretical foundations that support our exploratory framework. The framework and its indicators are subjected to validation by a panel of 30 experts through an international fuzzi Delphi survey.

We believe this study contributes to the existing literature providing a set of indicators in ID, specifying the precise timing in which each indicator is meaningful and therefore, is worth of being considered, offering a more nuanced approach that facilitates planning, execution, and the decision-making process.

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BARRIERS OF ENTRY FOR FEMALE ENTRENEURSHIP: THE EXPERIENCE OF THE INLAND RURAL AREAS IN ALMERÍA (SPAIN)

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Population movements from the poorest and most vulnerable areas to others with better conditions is not a current phenomenon and produces a similar impact in all countries, regardless of their level of economic development.

The abandonment of the population in rural municipalities and their traditional agriculture is not only related to economic and social issues but also to something as worrisome as the environment. For example, in certain areas in the southeast of Spain, the abandonment of these lands leads to significant soil erosion and, eventually, to desertification. In other areas, deforestation can lead to lower levels of rainfall. Both events are related to climate change.

One of the limiting factors to female entrepreneurship is the lack of equal treatment when accessing it, which means that although women have the same entrepreneurial abilities as men, access to it is limited. An example of this is the greater difficulties they face when accessing financing.

This article aims to analyze the barriers for female entrepreneurship in Río Nacimiento district in the province of Almería (Spain). This region faces the typical problems of rural areas that experience significant levels of depopulation. Despite the importance of the topic, the principal databases of scientific articles include only a few published articles on this topic.

The methodology used in this analysis is the systematization of experiences from a gender perspective, since it uses qualitative elements that analyzes the behaviors of people who are the object of study. Regarding the results, we found no differentiation in their answers (age, maturity...). Most women work in businesses within the service industry which are compatible with their household chores. Children were considered a barrier for not having started earlier and many have followed similar work trajectories as their parents, relying on family support.

They have felt discriminated against because they are in a rural municipality and entrepreneurship has given them independence and confidence. In conclusion, it is essential for them to develop support policies for entrepreneurship in general and women in particular, as a contribution to the elimination of these barriers that could fight against depopulation and develop the business fabric of rural areas.

The existence of support policies for entrepreneurship, developed in this region, is essential. Through them, additional support for business start-ups can be accessed, and in the case of women, this support is essential to gain the confidence necessary to achieve business success. Likewise, these programs work on topics related to the professional development and change of attitudes and aptitudes that are needed, thus empowering and motivating rural women.

Finally, it should not be forgotten that, in most cases, these programs make financing more accessible. These public financial aids can also facilitate access to private financing. These programs are necessary to achieve full social integration of rural women, working on aspects that are considered fundamental, such as education, employment and associationism.

The problems presented in this article can be extrapolated to the majority of rural municipalities at a national or international level.

27 JUNE
29 JUNE 2022

THEME 11: BOOSTING SOCIAL INNOVATION AND ECOLOGICAL TRANSITION IN REGIONAL INNOVATION ECOSYSTEMS

APPROPRIABILITY OF SOCIAL INNOVATIONS BY INTELLECTUAL PROPERTY RIGHTS: THE CASE OF A SUSTAINABLE BRAZILIAN COMPANY

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The objective of this work was to analyze the process of appropriation of sustainable SIs promoted by a private institution that aims to profit through mechanisms of intellectual property rights (IPR), namely: patent and trademark. Therefore we conducted a case study on the appropriability of a technological and social innovation of the company Natura Cosméticos S.A. in the socio-environmental area: a new process for obtaining raw materials from the waste of two Amazonian species, andiroba and murumuru[8] (Vieira et. al, 2017). The company used several types of appropriability mechanisms for the invention among them two IPR, patent and trademark.

Natura is a large Brazilian company in the perfumery and cosmetics industry that adopts a "proactive sustainability" strategy. It produces innovative products using actives from the Amazon, which are collected by local communities. Hence, they contribute to the sustainable development of the region (Vilha & Carvalho, 2005). It is a very successful Brazilian example of IS and sustainability integrated with the company's business objectives.

The appropriability of sustainable social innovation by green patent

On 04/02/2019, the National Institute of Industrial Property (INPI) granted patent to application no. BR1020170005780B1 owned by Natura Cosméticos S.A. and the Technological Research Institute of the State of São Paulo (IPT) (INPI, 2020). The application was analyzed with priority because it was considered eligible to participate in the Green Patent Program[9]. This was the first of its kind granted to a cosmetics company in Brazil (Natura, 2019a).

The invention "PROCESS FOR OBTAINING RAMNOLIPIDS PRODUCED BY PSEUDOMONAS OR ENTEROBACTER USING ANDIROBA OR MURUMURU SEED WASTE" (Vieira et. al, 2017) allows the reuse of waste assets from the Amazon biodiversity as production raw materials, which were previously used as fertilizer (Natura, 2019a).

Besides being a new technology, the invention has several characteristics of a social innovation: it is a sustainable solution, co-created by IPT researchers and Natura collaborators, from the Innovation Center in Cajamar (São Paulo) and the R&D Laboratory in Benevides (Amazon region). Furthermore, the invention represents an alternative income generation for a traditional population associated to cooperatives that already supply raw-material to the company. They may benefit from a new business model that includes harvesting and/or extraction of the plant actives with their processing (Natura, 2019b).

The patented technology is employed mainly in the production of a specific family of products: the Ekos brand line.

Brands building a reputation for sustainability

Natura Cosméticos S/A is the holder of several trademark registrations. A search of the Brazilian Patent and Trademark Office's trademark database revealed 1077 processes with the CNPJ of the company NATURA COSMÉTICOS S.A. The first thing that stands out is the word mark Natura, which is recognized as highly reputed trademark. Under this trademark umbrella there are quite famous brands of product lines. Among them the mixed sign Ekos, in class NCL (8) 03.

The brands owned by Natura identify product lines with a very specific positioning. The Ekos products brand is the most identified with the company's socio-environmental values. The brand's entire brand equity is dedicated to communicating alignment with social and environmental practices and ideas. However, the alignment with sustainablity goes beyond symbolism or sales argument. The production network favors family agriculture and the rational use of renewable resources, impacting a total of 24,788 people (Natura, 2020).

[8] *Carapa guianensis* and *Astrocaryum murumuru* Mart.

[9] The Green Patents Program is a fast track for patent examination of patent applications related to sustainable technologies adopted by INPI (INPI, 2020).

With meticulous branding work, Natura has managed to transform the Ekos sign into a symbol of sustainable supply chain and social development of Amazonian communities. Building the reputation of the Ekos brand is a valuable asset, which will allow appropriation of profits for the company even after the expiration of the patent BR 10 2017 000578 0 B1. As for the social innovation involved, the Ekos brand enables economic gains for the communities that supply the raw materials and environmental gains for society as a whole.

The case described previously can be considered an example of the Integrated Intellectual Property Management advocated by Al-Aali and Teece (2013). According to the authors, appropriability regime and complementary assets, together with the business model and the organizational design, are the main factors to profit from innovation. In this instance, the appropriation of this said innovation is achieved through patents and some complementary assets such as unique upstream chain, and a new socioenviromental business model that are unlikely to be imitated.

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UNIVERSITY-INDUSTRY COOPERATION WITHIN THE TUSCAN WINE SECTOR: SOCIAL INNOVATION IMPLICATIONS

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The covid-19 pandemic crisis has caused epochal upheavals in society, in the business world and in academia (Donthu & Gustafsson, 2020), going to influence the progress of complex trends such as those of innovation and sustainability (Wang & Huang, 2021).

This forced revolution has led to an ever greater need for cooperation and interaction between universities, industries, governments, an efficient way to support technological and social innovation (Etzkowitz & Leydesdorff, 2000; Carayannis et al., 2012), in line with sustainable development principles (König et al., 2021). In the meantime, the parallel path of technological development in terms of digital transformation (Kiron & Unruh, 2018) continued to be travelled by economic agents (Ghobakhloo, 2020). Furthermore, the convergence of the two trends identified in terms of technological and social innovation, i.e. digitization on the one hand and sustainability on the other, is evident in the agri-food sector (Miranda et al., 2019).

The aim of this research is to investigate to state of the art of the industry-university-government cooperation in the agri-food system, specifically in the wine sector, to evaluate both the technology transfer and the capacity to boost social innovation of universities.

The empirical setting is Tuscan wine sector, identified as a network of several different players that are directly or indirectly connected to each other, namely an innovation ecosystem (Oh et al., 2016).

The motivation for choosing this empirical setting is twofold: first, the management literature offers numerous relevant contributions on the innovation trajectories of wine at cluster and ecosystem level, in which organizational (Giuliani & Bell, 2005), relational (Maghssudipour et al., 2020), and sustainability aspects (Pucci et al., 2020) are deepen; second, the wine industry represents a relevant sector both at national and regional level, having experienced in recent decades not only significant economic performances (Area Studi Mediobanca, 2021), but also paths of technological and social innovation of great importance, especially as regards mature companies (Zanni & Cammeo, 2021).

The paper approach to analyse the chosen topic is to use a case study methodology (Yin, 1994), considering four firms, key players of the Tuscan wine innovation ecosystem. The cases will be first analysed in deep from several perspectives, namely historical (role within the ecosystem), technological (adherence to Industry 4.0 paradigm) and social innovation (e.g. application to innovative process to include education programmes into their business activities, involvement of immigrants and disabled people into work procedures). Then, a qualitative assessment of the relationship between the wine firms, the university and the regional government will be proposed, with the aim to refine a further evaluation of the relationships among different actors using a social network analysis investigation.

Expected contributions of the research are related, but not limited, to highlight the role of universities in regional wine industry growth, and to verify how the leading role in innovation processes at ecosystem level is assumed by companies rather than, as verified in different geographical contexts (Kenney & Mowery, 2014), by universities.

From this research, organizational and policy boundaries that characterize the process of technology transfer at a territorial level (Grimaldi et al., 2021) can emerge; identifying those potential weak points is necessary to avoid the mechanisms that can interfere with the dynamics of social innovation.

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THE EVOLUTIONARY EMERGENCE OF A QUINTUPLE HELIX LOGICS: A CASE STUDY OF PLACE-BASED AGRONOMIC INNOVATION

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The contemporary environmental and social challenges, which have been exacerbated by the pandemic shock, demand collaborative innovation process with a multi-stakeholder's logic. At the beginning of the 21st century, the triple helix model was introduced to analyze the complex mechanisms of collaborative knowledge production and innovation among these different institutional sphere (Etzkowitz et al., 2000). Since then, the model has had a great empirical diffusion, and continuous attention has been given to strengthen its foundations and analytical power (Cai and Etzkowitz, 2020).

The increasing necessity to find innovative solutions to environmental and social challenges are pushing the interest of scholars towards Quadruple and Quintuple Helix models, including civil society and natural environment (Carayannis and Campbell, 2009; Grundel and Dahlström, 2016). However, criticisms have been raised about the theoretical foundation of these enhanced constructs. First, the civil society and the environment constitute in any case the necessary context where the core relations between university, industry, and government (i.e., triple helix) take place. Second, it is not always clear the way in which the contribution of the two added helices to co-innovation strategic and evolutionary dynamics can be identified (Leydesdorff, 2012).

Indeed, while the quintuple helix model has been widely used to address the sustainability issue in innovation eco-systems (Grundel and Dahlström, 2016; Carayannis et al., 2017; Durán-Romero et al., 2020), there is still a lack of empirical studies where the quintuple helix framework helps to shed a specific light to the emergence and governance of complex collaborative mechanisms among actors involved in sustainable development practices at the micro and meso-level of analysis, for examples in local productive systems (Bellandi and De Propris, 2021).

We propose here to consider the fifth helix as a set of actors and functions who contribute to co-innovation dynamics for sustainable development emerge in an evolutionary setting (Cai and Lattu, 2021), where some actors of an eco-system start to explicitly incorporate environmental-sensible challenges and opportunities in their day-to-day practices.

We apply our framework to a case study of agronomic innovation in local food chains where the innovation management process takes place at different levels to deal with institutional lock-ins and enlarge the knowledge base. Specifically, we analyze a local initiative, the short chain of bread from ancient wheat in Montespertoli (Tuscany) which has re-introduced the cultivation of old varieties of wheat. This has led to a systemic innovation both in the cultivation as well as the milling and bread making processes, as the starting point for a sustainability transition (Stefani et al., 2017). This includes the certification of the seeds of adapted old varieties of wheat, within sectoral and regional contexts dominated by conventional wheat varieties that have been developed during the Green Revolution to enhance yields, ease of mechanization and technological properties of flour, neglecting several nutritional traits of grain as well as issues of sustainability (Dinu et al, 2018). In addition, conventional wheat industry is dominated by transnational value chains where milling and processing are managed with industrial methods and cost reducing strategies are put in place (Sacchi et al, 2019).
Ancient wheat varieties, of which "conservation" varieties are the legalized or formal version, maintain the original nutritional traits of wheat, a strong adaptability to the environment in which they developed and lower or no needs of chemical fertilizers and herbicides. These desirable properties come at the cost of lower yields, poorer technological properties, and lack of standardized recipes for their cultivation and processing.

The Montespertoli initiative has been based on a collective action unfolded around the creation of a short food supply chain, involving a local mill and few bakers, able to create and capture the value of differentiated wheat products (flour, bread, and pasta). Both the local university and the municipality of Montespertoli have been involved in an informal partnership from the start.

Members of the University of Florence were residents in Montespertoli and a member of the Municipal Council was a part-time farmer herself. Civil society has been integrated in the project as the nutritional qualities of the bread as well as its supply to school canteens were deemed an opportunity for the local system. However, on the one hand the low yield of ancient varieties posed a threat to the economic sustainability of the chain, on the other hand, national and EU seed legislation was a barrier to the innovation. Farmers had to resort to informal sources of seeds, mainly reproducing by themselves the varieties they cultivated.

Thanks to the “Associazione Grani Antichi di Montespertoli” (Association of the Ancient Grains of Montespertoli) a project to transform one member of the chain in a seed company and legally produce seeds of legally acknowledged “conservation” varieties was funded by the Tuscan Rural Development program. As far as the low yield barrier is concerned, the chain was involved by the local University in the experimental testing of wheat populations (i.e. mixtures of varieties) combining the sustainable characteristics of ancient varieties with higher yields. Overcoming institutional lock-ins such as those posed by seed legislation and producing specific knowledge around the innovations was facilitated by being related (although not part of) to networks of similar initiatives around Italy such as Rete Semi Rurali which provides agency to otherwise too small initiatives and thanks to its international relationships has access to EU funds for participatory research on sustainable agriculture. Commercialization of wheat populations seed was made possible by an amendment to EU seed legislation in 2018.

As other instances of successful sustainability initiatives, production of ancient wheat varieties requires “reconfigurations on human capital and social capital”, the substitution of local knowledge and skills for costly inputs, and the “productive use of people’s capacities to work together to solve common agricultural and natural resource problems” (Pretty, 2005). The process started around an informal triple helix logic and met soon local communities and environmental needs. These needs were subsequently assumed by specific actors and hybrid organizations operating at various territorial levels.

INNOVATION FOR A SUSTAINABLE WORLD: AMAZON STARTUPS

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The aim of this article is to analyze the influence - and consequently the importance - of sustainable startups for the development of the Amazon - and, in a second moment, for other Brazilian regions - and its population, verifying how innovation can affect the maintenance of the standing forest, securing jobs and generating income. An exploratory and descriptive study through quantitative and qualitative analysis will be presented. We intend work with primary and secondary data. We intend apply two online questionnaires to two different groups of companies. First, for a group of Amazonian startups focused on sustainable activities and allied to local and regional economic development. The second group refers to companies listed by Sistema B Brasil, in which similar data will be evaluated so that a comparison can be made. Data such as the company's operation and the respondent's function will be essential for such a comparison to be made. Likewise, we will list the weight that each of the interviewees gives to the university, industry and government for the development of innovation focused on the socio-environmental aspect. We hope that this study can contribute to the development of research on innovation focused on environmental preservation and social inclusion of vulnerable populations. We also expect to confirm the triple helix innovation model in i) the Amazon region, considering the relevance of government, industry and universities for local economic development through sustainable startups and ii) in B Companies, which have operations in the country as a whole. We believe that bioeconomy, which is linked to innovation, has the potential to mitigate the negative effects of deforestation and population marginalization at the regional level, in the case of the Amazon, and at the national level, considering the other biomes that already show signs of degradation.

Considering startups as newly created companies that aim to meet a specific demand for a product or service, the deforestation in the Amazon and consequent marginalization of the population provides the possibility of establishing sustainable businesses specifically focused on the region. There are several Amazonian startups with a sustainable focus, that is, startups created in the Amazon region focused on promoting products and/or services linked to the forest in a sustainable way.

The emergence of these startups, however, may be conditioned to the support of other mechanisms. Thus, we believe in the innovation model known as triple helix, which defends the development of innovation through the interaction between the university, industry and government to promote economic and social development. Through the interaction between these three pillars, it is possible to develop an innovative sustainable business model focused on the Amazon. Roughly speaking, at the university, knowledge is generated; the industry becomes responsible for the development of projects; and the government proposes financing mechanisms for business survival.

The objective of this research would be to verify the direct social and environmental impact caused by the operation of Amazon startups. The specific objective would be the identification of the main actors – and their weights – involved with the development of the activities of these companies, being these from the academic, governmental and/or industrial/business spheres. Thus, the other specific objective would be the validation of the triple helix model in this context, taking into account i) the development of economic activities in the Amazon forest, ii) the maintenance of the forest standing for the development of such activities, iii) the generation of direct and indirect jobs, mainly in the most needy and vulnerable communities, and iv) the contribution of startups' activities in issues such as reforestation, provision of ecosystem services and involvement of the vulnerable local community.

We also intend to contrast the results obtained in the first phase of the research with companies listed by Sistema B Brasil (companies that aim at financial success with socioenvironmental responsibility). Sistema B Brasil currently maps 193 companies engaged in environmental protection and the promotion of social well-being. In this phase, we intended to verify the commitment of B companies to recurring social and environmental issues. As part of the specific objectives –, it is intended to i) verify how many contribute to the social development of vulnerable communities, ii) how many consider the Triple Helix model of innovation in their business, and iii) to verify the weight given by these companies to the academy, government and other industries/companies.

An exploratory and descriptive study is presented here through quantitative and qualitative analysis. We intend to apply two online questionnaires to two different groups of companies. First, for a group of Amazon startups focused on sustainable activities and allied to local and regional economic development. The second group refers to companies listed by Sistema B Brasil. Data such as the company's field of activity, position and function of the respondent, and core activity will be essential for such a comparison to be made.

Through contact with such enterprises, it will also be possible to carry out a qualitative study, which will address i) the descriptive analysis of the collected data and ii) case studies of the most representative companies.

We expect this study to contribute to the development of research on innovation focused on environmental preservation and social inclusion. We expect to confirm the presence of the triple helix innovation model in i) the Amazon region, considering the relevance of government, industry and the university for local economic development through sustainable startups and ii) in B Companies. We believe that bioeconomy, which is linked to innovation, has the potential to mitigate the negative effects of deforestation and population marginalization at a regional level, in the case of the Amazon, and at a national level, considering the other biomes that already show signs of degradation. We intend to emphasize public policies for innovation, which need government incentives so that they can become effective on environmental and social issues, whether through payments for environmental services, tax incentives for sustainable startups, income generation in less developed developed, among others.

Keywords: Innovation. Triple helix. Environmental conservation.

27 JUNE
29 JUNE 2022

THEME 12: RESEARCH IN THE PERIPHERY, STRIVING FOR GLOBAL EXCELLENCE AND SUPPORTING LOCAL DEVELOPMENT

BUILDING LONG-TERM PROSPERITY FOR A METROPOLITAN'S PERIPHERY

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The suburbs and communities at a metropolitan's periphery are generally places of rising economic activity, where sectors such as construction and retail dominate. Even though the completed built environment may be quite attractive, once this activity begins to tail off the local population is generally left with longer daily commutes. That is, longer journey times to either say established industrial precincts, or to where the knowledge and technology intensive jobs and business are. A state of affairs to which local economic development strategies are a contributory factor. This research paper presents a way to improve these outcomes.

Backed by content analysis of the interviews with economic development stakeholders in two continents, and documentary analysis of local economic development strategy, together with statistical analysis of long term. economic data, this paper describes a framework for achieving long term prosperity in these peripheral urban zones. This mixed methods approach to the research maintains the complexity of the economic landscape under study. It also improves the quality of research outcomes, that is its generalisability. This enquiry's interpretive methodological paradigm is classified as a parallel mixed design. At its heart, the question being asked in this enquiry is this: "how does a place-based economic development strategy support long-term peri-urban prosperity in the knowledge economy?" This leads to two operational questions that are asked of the qualitative and quantitative data referred to above: "what is the relationship between strategy and the economic profile at a later date?", and "what is the relationship between the local knowledge economy and the broader knowledge economy?

A total of four lines of enquiry flow from these two operational questions. This series of questions has led to a set of clear understandings from both the quantitative and qualitative data: inputs from stakeholders, collaborators and authors of economic development strategy documents have at best a limited understanding of how their local economies will develop over long time frames; local economies that do neglect vocational and higher education experience relatively poorer economic outcomes over the long-term compared that those that don't; local economic development organisations place a significantly lower priority on the creation and application of knowledge than they do on the distribution of knowledge; the "quality" of economic growth can be illusory as domestic and commercial construction activity masks underlying trends; and the knowledge and technology intensity of local economies falls as it's population grows.

The process of comparative analysis and synthesis that led to this project's conclusions were informed by work in the fields of peri-urban development, place-based economic development strategy, strategic foresight and the knowledge economy. Of note is the work of Buxton with respect to peri-urban development, Barca with place-based strategies, Voros with strategic foresight, and Machlup and Romer with the knowledge economy.

A consequence of the study is a framework to guide the creation of local economic development strategies. It melds the four place-based elements (business ecosystem, innovation and entrepreneurship, local institutions, external understanding) with the three knowledge economy elements (creation, distribution, application) to steer the thinking of the stakeholders, collaborators and authors of local economic development strategies.

TOWARDS AN ENTREPRENEURIAL UNIVERSITY? THE ANALYSIS OF THE FLUMINENSE FEDERAL UNIVERSITY INITIATIVES

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In the current socioeconomic scenario, nations that have not committed to structuring a solid scientific and technological base, like several countries in Latin America, have faced difficulties on different fronts of the development processes. Some of the existing problems are the reduction of participation in international trade, capital flight and foreign disinvestment, recurrent economic crises, and limitations in socioeconomic development. On the other hand, the world has observed the economic development of Asian countries, based on solid foundations of education, technological improvement and industrial development. These aspects confirm the need to structure national innovation systems and implement mechanisms capable of uniting knowledge-generating centers and companies in an effort to generate products, services and processes with a high technological content. In this knowledge society we are living in, it is essential that the university assumes the role of generating knowledge, technology and innovation that allows economic development, both locally and nationally (Etzkowitz, 2004; 2006). Thus, understanding the evolution of the third mission in universities, especially public research in less developed countries, is of paramount importance to understand the transition potential of these economies (Etzkowitz et al., 2008).

This study aims to identify the transformations from a structural and political point of view at the Fluminense Federal University (UFF), Brazil, towards an Entrepreneurial University. To this end, the degree of evolution/maturity of the third UFF mission will be verified, based on a previously developed model that identifies activities, policies, and the degree of institutionalization of innovation and its related activities. Studying UFF's case is interesting because it is the largest institution in the federal public system (in number of students) and is spread throughout the State of Rio de Janeiro.

In order to achieve the defined objectives, exploratory research with an applied nature and a qualitative approach was carried out. Four activities were performed throughout 2020 as part of a master's thesis that is part of a broader research study project on the evolution of the entrepreneurial university in Brazil. The first activity was the development of a literature review, using bibliometric analysis techniques, organizing relevant publications on the themes of entrepreneurial university, university-industry interaction, Triple Helix, among others, from the publications databases such as Web of Science, Scopus and Scielo. The second activity was the generation of primary data, which was carried out through a survey sent to two groups of people in order to identify the transformations from a structural and political point of view at the University. The first group, formed by eleven professors who occupy or have held management positions, such as coordinators of undergraduate and graduate courses, heads of departments and directors of academic units, and also professors who have had experience in university-industry interaction projects. They received the survey via targeted email and were selected for convenience, based on their contribution to third-mission activities at UFF. The second group was contacted through a group of faculty members on a social network. From 600 members, seventeen answers were collected. In the third stage, the analysis of the collected information was carried out, which allowed, in the fourth stage, the application of the model developed by Oliveira and Amaral (2020) which aims to understand the evolution stage of the organization as an entrepreneur.

As a result, it can be seen that the faculty members of both groups studied have relatively low knowledge regarding the themes of innovation, university-industry interaction and entrepreneurial university, as well as the mechanisms to support innovation (standards, rules, laws and instruments support both internal and external). On the other hand, there is a significant volume of interaction activities. Applying the Oliveira-Amaral maturity assessment model, it was possible to place the institution at level 2 on a scale from 0 to 6, which means a low entrepreneurial position. The institutionalization of the innovation agency and of an institutional policy was carried out, but a change in the organizational culture is needed so that the issue is effectively a priority in the strategy and agenda of the university.

The selection of survey respondents was defined by convenience, with no statistical basis. Thus, as the volume of respondents was low. Such selection was made in order to make the research feasible by sending the survey to a sample of the accessible population and within the compatibility criteria of the research target audience.

This research takes a picture of the current moment of the Universidade Federal Fluminense, regarding what would lead it to be understood as an Entrepreneurial University. The institution's limitations are presented, and actions are indicated to accelerate the process of incorporating the third mission.

Keywords: entrepreneurial university; university-business interaction; third mission; maturity model.

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PATHWAY TOWARDS TRIPLE HELIX: TECHNOLOGY DEVELOPMENT EVALUATION IN ETHIOPIAN SCIENCE AND TECHNOLOGY UNIVERSITIES

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Many countries in the Global South have adopted Triple Helix policies, resulting in both success stories and challenges. Ethiopia, which started a rapid expansion of its higher education sector in the 1990s, is no exception. The government established two science and technology universities with a strong mandate to form links with industry as well as the local community. However, university-industry collaboration is a relatively new concept in Africa's second-most populous country with 110 million inhabitants. Both S&T universities, located in Adama and Addis Ababa, have faced numerous practical challenges in implementing their mission, creating technology transfer programmes that would contribute to Ethiopia's socioeconomic development.

This study asks two questions, firstly, what main factors influence the relationship among the main internal and external actors participating on two S&T universities' technology development evaluation. Secondly, we ask, how their technology development evaluation practice can be improved to become more conducive to the development of Triple Helix in Ethiopia.

To answer the research questions, the study zooms in the two S&T universities' technology transfer offices. It looks at the existing process of internal technology development evaluation at the two institutions through the perspective of organizational control theory (OCT). Using qualitative interviews and document analysis, the study finds out that, the two universities' technology transfer offices employ a behavior-based control for budgeting and an outcome-based control for product assessment. The tight financial oversight, generated by a behaviour-based control cascaded from the governing ministry, overlooks the unpredictability of the technology development process, integral to Ethiopia's current situation as an agrarian, developing country. Similarly, the outcome-based product evaluation does not take into account the uncertainty factor that arise during the process of technology development, due to scarcity of human and financial resources.

Furthermore, the study reveals that such practice generates a tension between the main internal and external actors in the technology evaluation system, which is detrimental to the development of Triple Helix relationships in Ethiopia. In order to mitigate this challenge, we propose several recommendations, using the insights of the context, input, process, and product (CIPP) model of evaluation theory, in combination with the organizational control theory (OCT). These are, 1. external expert involvement in the technology evaluation, 2. a more targeted identification of end users of the technology under development and 3. build-up of a support system with stakeholders from external institutions both public and private. We hope such recommendations can increase the effectiveness of the universities' technology development internal evaluation system while maintaining transparent budgeting. We propose this transformation as a way to improve the performance of the universities' technology transfer, as one of the starting points from which the Triple Helix relationships can be further developed.

To sum up, this study proposes a pathway towards the build-up of Triple Helix interactions by taking stock of how technology development evaluation functions at the institutional level within Ethiopia's two S&T universities. It proposes how the internal operations can be improved to enhance the universities' collaboration with local industry and society. As such, it contributes to literature of Triple Helix in developing countries of the Global South.

THE LOCALIZED EXPLORATION TOWARDS THE THIRD MISSION IN BRAZILIAN ENTREPRENEURIAL UNIVERSITIES

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Many countries have reformed their higher educational systems and developed funding programs to promote HEIs' entrepreneurialism. In Brazil, higher education is a highly regulated and political changes influenced HEIs transformation process into entrepreneurial universities. The military regime (1964-1985) pushed HEIs towards technology research, leading to the seminal development of technology science parks and the new Brazilian Constitution (1988) defined teaching, research and 'extension activities' as Brazilian HEIs' mission.

Brazilian HEIs graduates approximately 25.000 PhDs each year and ranks fourteen among most productive countries for academic publications. However, in the transformation of knowledge into technology and innovation, Brazil has been less effective, ranking 70th from 130 countries in competitiveness and innovation effectiveness. This is partially because the late and incomplete industrialization process, when compared to developed economies, being heavily dependent of foreign technologies. Brazil remains a relatively close market with a low competition level. The industry and academic sectors are distant from each other, following distinct research and development logics with few synergies. Exceptions are found in sectors where the technology was not available (e.g. deep-sea oil drilling), not handled (e.g. aircraft avionics and uranium enrichment centrifuge), or based on specific national needs (e.g. tropical agriculture). Thus, Brazil's second academic revolution is an open process and despite efforts to build industry-academia links, the entrepreneurial university phenomena remains emergent.

Brazilian HEIs have lived the entrepreneurial paradigm, creating technology transfer offices (TTOs) and incubation programs, supported by a flourishing venture capital industry. This is a direct result of changes in the legal framework since the Innovation Law Act (2004) and the Science Technology and Innovation Legal Framework (2016) that created innovation technology nuclei (NITs) responsible for: developing the field of intellectual property, guiding HEI's innovation actions; developing strategies for innovation transfer; promoting and monitoring the relationship between the HEI and companies; negotiating and managing technology transfer agreements originating from the HEI; and representing the HEI, in innovation policy debates.

A relevant difference between the traditional technology transfer offices at HEIs and the new NITs is that the later can be a structure, with or without its own legal personality, established by one or more scientific institution (HEIs, innovation or technology centers and research institutions). The establishment of NITs across the country has led to a new dynamic in the innovation landscape, with these units becoming leading intermediaries in regional ecosystems.

There are high hopes for positive outcomes resulting from this new actor that shall support HEIs to incorporate social and economic objectives and play a relevant role in regional economic development through a set of bilateral and trilateral relations (i.e. Triple Helix interactions). Hence, this study aims to explore how the third mission institutionalization is evolving and how dynamic capabilities are employed to advance third mission since the implementation of NITs.

To address these research questions and answering the call for more replication studies in management studies, including the in the field of entrepreneurship and higher education research, we replicated a recent German study that explained how HEIs dynamic capabilities (DCs) were being translated into third mission advancement. In the context of Brazilian HEIs, this study is innovative for collecting data from individuals managing NITs, the new leading intermediary agencies of innovation in Brazilian HEIs that act as technology transfer offices.

In October 2021, we contacted 144 NITs, obtaining 28 complete questionnaires (19% response rate). During the analysis process, we excluded six questionnaires, as the NIT managers interviewed did not self-identify as one of the key individuals driving their HEIs' third mission initiatives. This fact already points to the incipience of the NIT and these individuals' position within the existing governance structure at the HEI.

Our results show that the replicated model, which demonstrate that leadership and agreement on visions and goals mediate DCs translation into third mission advancement in German HEIs is not true on the context of Brazilian HEIs who have implement NITs. Even though the model offers good explanation (R_2=0.484) and acceptable prediction (Q_2=0.263) levels, the direct path from DCs to third mission advancement is more significant than the mediated paths.

To explore further this interesting result, we segmented the dynamic capabilities construct items into exploration and exploitation constructs to understand how ambidexterity in Brazilian HEIs is directly leading to third mission advancement. This model offers higher explanation and prediction power than the mediated model (R_2=0.564 and Q_2=0.365), clarifying that, in Brazil, explorative actions, related to national benchmarking, engagement with actors from the regional ecosystem and internal monitoring of third mission initiatives are responsible for third mission advancement.

All tested constructs, for both models, presented good internal consistency reliability, convergent validity and discriminant validity, with measurements (composite reliability, Cronbach's alpha, and rho_A) loading above the satisfactory threshold of 0.70 and the average variance extracted above the threshold of 0.50. The dynamic capability, leadership and vision & goals constructs were derived from literature, while the third mission advancement construct was novel, being conceptualised by the German study. This novel construct proved to be reliable also in our study (α = 0.733). Nevertheless, in Brazil, competitive performance is not as relevant as in Germany for third mission advancement. Rather, the HEI's stage of third mission development, discerning change strategy conceptualisation and implementation is central for third mission advancement. We believe this is because of strong regionalization in a large country, like Brazil. There is a lower population mobility, in Brazil, in comparison to Europe and HEIs localize their efforts in the local level, even larger public institutions focus on interactions around the metropolitan region of the city where they are located.

In light of this study's results and discussion, its contributions are threefold. First, it empirically confirms the relevance of DCs in advancing HEIs' third mission. Second, it justifies the need for more replication studies to re-conceptualize the phenomenon of entrepreneurial universities, accounting for national contexts. Hence, improving the confidence on generalization of studies' results across countries. Last, it offers policy and managerial insights about Brazilian HEIs third mission advancement since the creation of NITs.

SATELLITE UNIVERSITY CAMPUSES AND STRUCTURAL CHANGE IN ITALY

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The contribution of universities to regional development is widely recognized (Fonseca et al., 2021). By collaborating with industry and government, universities trigger regional knowledge dynamics. This collaboration has been emphasized by the literature on the Triple Helix Model of innovation (Etzkowitz and Leydesdorff, 2000). Furthermore, universities are key agents in Smart Specialization Strategies (S3) as they contribute to driving entrepreneurial discovery processes (Foray et al., 2012). Thus, along with education and research, academia has embraced a novel Third Mission (TM) which includes the transfer of knowledge from university to industry; lifelong learning; and public engagement (E3M, 2010). On the other hand, universities must comply with regulations regarding their financial responsibilities, demonstrating the validity, efficacy of their spending. Moreover, universities are facing a growing competition in the global market of education (Guerrero et al., 2015).

To address these challenges, several universities have started some form of geographical diversification. Indeed, satellite university campuses are springing worldwide (Charles, 2016). These campuses are established by parent institutions to decentralise their activities, to serve areas lacking an academic institution and to support regional economic growth (Pinheiro et al., 2016).

Despite the fact that the literature has assessed the economic impact of universities on their regional economies (Valero and Van Reenen, 2019), there is a lack of studies dealing with the impact of satellite university campuses (Rossi and Goglio, 2020). Existing research has mainly focused on single degree courses (Hays et al, 2021), students' performance and skill development (Craft, 2019), and university staff experience (McKinnon and Lowry, 2012).

In Italy, university branches have started spreading, even in small municipalities, since the university system reforms of the 1990s (Bagnasco, 2004). According to the Ministry of University and Research, university degree courses were 2444 in the academic year 1999/2000 while they increased to 9364 in 2006/2007. Moreover, the number of cities with at least one university campus has increased from 62 in 1990 to 248 in 2006. In 2021 there were 5432 courses. The diffusion of peripheral campuses has been portrayed as an important policy tool to improve equity among regions; graduation rate; and the Italian industrial system (Seri, 2014). However, there is a lack of empirical evidence about the impact of these reforms at national level.

A pioneering study of Animali and Seri (2009) has focused on satellite university campuses in Marche Region, in central Italy. The analysis has sought to assess the impact of knowledge production on graduates' employability and the absorptive capacity of local production systems. Seri (2014) has evaluated the knowledge impact of satellite campuses of Marche Region, by measuring the human capital produced, absorbed and utilized within the local production systems. Goglio and Parigi (2016) have investigated the rationales behind the proliferation of university branches. Rossi and Goglio (2020) have recently focused on the impact of a satellite campus in the Province of Cuneo.

These studies show some limitations. First, they usually focus on a single region or campus, thus lacking of generalisability. Second, existing studies are mainly built on small samples, drawing on primary sources. Third, they consider a short time frame and do not provide an understanding of the extent of the national reforms' effects.

This paper represents the first attempt to assess whether and how Italian satellite university campuses have affected local economic systems in terms of structural change. The aim of this study is twofold: first, it seeks to contribute to the literature on universities as drivers of regional knowledge-based development, by providing empirical evidence on national scale. Second, the study aims at suggesting a selection of implications for supporting the design of degree courses, research activities and TM, which might adjust to match with S3 and the National Recovery and Resilience Plan.

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THEME 13: ACADEMIC ENGAGEMENT, THIRD MISSION AND THE SOCIAL IMPACT OF UNIVERSITIES IN THE AFTERMATH OF COVID-19

UNIVERSITY SOCIAL ENTREPRENEURSHIP AND TRIPLE HELIX

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The Triple Helix (TH) model posits that innovation can be fostered by the collaboration of business, government and academia (Etzkowitz & De Mello, 2003). These spheres are seldom equal, with often one of them acting as innovation organizer with the other two revolving around (Etzkowitz, 2003a). Traditionally, it was either the government to lead the process (statist TH) or the industry (laissez-faire TH). A TH approach is necessary to govern complex interactions meant to design and implement vocational education programs useful to the industry (Coletti, 2019).

However, a third paradigm has emerged in the last decades, the entrepreneurial university. Indeed, many universities not only focus on teaching and research but also valorize their knowledge through the creation of spinoff firms and the competition for public funds (Etzkowitz, 2003b). Clark (1998) identified five elements of an entrepreneurial university: 1. collaboration with industry through research centers, joint ventures, spin-offs, tailored training programs etc. 2. Other income streams besides tuition fees and public subsidies. 3. A certain level of autonomy in decision-making. 4. Purposeful scholarly work as well as collaborative research are encouraged and rewarded. 5. Entrepreneurial beliefs, principles and practices.

Collaborative research, R&D contracts and technical services are sometimes defined as engagement activities, and together with the commercialization of know-how through Intellectual Property Rights and spin-offs, they are considered to be the third mission of the university (Sánchez-Barrioluengo & Benneworth, 2017).

However, these classifications have been developed for profit-maximization as the goal of entrepreneurial activities. This is not the only goal of enterprising: social entrepreneurship has been touted to address issues social issues that neither public policies nor the market can tackle. Social entrepreneurship combines resources to stimulate social change or meet social needs (Mair & Martı´, 2006). Social entrepreneurship is said to have the following three components: 1. Identification of a stable social issue such as exclusion, marginalization, or suffering of certain people. 2. A value proposition to address this issue. 3. Stable processes to improve the situation for those people (Martin & Osberg, 2007).

An entrepreneurial university may engage also in social entrepreneurship activities. This is the case of the Data Asperger launched in 2019 by the Grenoble Ecole de Management to train young people affected by the Asperger syndrome to become designers and developers of data analysis applications.[10] This is an impairment in social interaction, due to a lack of social or emotional reciprocity and failure to develop appropriate peer relationships. Depending on the adopted criteria, the Asperger's syndrome regards between one in 33,000 and one in 1,100 children (Attwood, 2006).

We will analyze this case through the lenses of a theoretical framework developed for rural social enterprises but that we believe relevant also to university social enterprising. The framework posits the existence of three levels: the regime, the intermediary and the community levels (Richter et al., 2018). These levels reflect power differences and the vertical links that social enterprises need to establish. The regime level is the governmental and institutional one, though large corporations could be part of it. The community level is that of stakeholders that cooperate to solve the problem, and it may be related to the civil society that often it is said to be the fourth helix (quadruple helix model or QH) of the TH framework (Bellandi et al., 2021). In the intermediary level, there are the organizations that can mobilize resources from the other two levels. This is the level of social enterprises, but municipalities and development agencies can also be part of it.

The contribution of this paper is multifold: first, it identifies social entrepreneurship as a new form of third mission of the university. Second, it provides a detailed case of social enterprise carried out by a higher education institution and proposes the novel model of a socially entrepreneurial university explaining what is the context needed to make it work. Third, it shed light to the links between the spheres of the TH/QH models adding the dimensions of vertical and horizontal bond and relationships that so far the literature has neglected.

[10] https://www.grenoble-em.com/concepteur-developpeur-dapplications-specialisation-data-analyst-data-asperger

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PROPENSITY OF ACADEMICS TO TAKE PART IN THE THIRD MISSION – INDIVIDUAL, ORGANISATIONAL, AND SOCIETAL PREDICTORS OF SOCIO-ECONOMIC ENGAGEMENT

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Traditionally, academics devoted their time to research and teaching. However, with the introduction of an entrepreneurial university in the last decade socio-economic activities have been added to the responsibilities of academics (Addie, 2017). Academics are therefore increasingly interacting with industry and society, and thereby taking up a third role (Westnes et al., 2009). This role is also sometimes specified as a "regional development role" (Jaeger & Kopper, 2014) in accordance to the triple helix model of universities (Etzkowitz, 2002; Leydesdorff & Etzkowitz, 1996). We will hereafter refer to this role as a "third mission" (TM). Besides, there is a tendency that universities try to incorporate formal and informal commercialisation activities (Perkmann et al., 2013) which allows for increased knowledge and technology transfer to society, enhancing innovation and opens up the possibility for a wider income range of universities.

In order to design policies and university reward systems, and to evaluate different types of socio-economic engagement, it is important to know which role academics play when it comes to engagement and which factors have an impact on the extend and frequency of their engagement. Therefore, we pose the following research questions:

1. *Which individual, organisational, and societal factors influence the propensity of academics to engage in different types of third mission activities?*
2. *What is the relative influence of individual and external (organizational and societal) factors?*

With these means, different individual and external aspects are taken into consideration such as differences regarding personality traits, gender, academic rank, location of university (urban or rural area), and academic discipline. By presenting a new way of TM analysis, we are answering a call by Huyghe and Knockaert (2015) as in our model individual-level and organisational/societal-level determinants are considered together in a multilevel analysis.

This research makes thereby several contributions. First, it considers conditions specific to a country or university, that is geographic location and academic funding, in order to understand how to optimise the university support infrastructure (Dahlborg et al., 2017). Second, it considers various background variables of academics connected to academia, such as rank, discipline, time in academia, and industry experience as well as academic performance (Dahlborg et al., 2017; Holmen & Ljungberg, 2015). A novel aspect of this research is the inquiry of mutual effect of individual and external factors, thereby considering personality traits as crucial in the individual context. In this context it is considered how individual factors (e.g. traits, gender) and external factors (e.g. department/discipline, funding, location) influence researchers entrepreneurial and societal engagement (Fogelberg & Lundqvist, 2013). Third, no prior research evaluates all academic disciplines (or compares STEM and health disciplines towards all other scientific disciplines) and propensity of researchers towards TM. Most research has been conducted in engineering and natural or medical sciences with an emphasis on commercial aspects of TM (D'Este & Patel, 2007).

For data collection a large-scale survey among Icelandic universities was conducted in the beginning of 2021 in order to obtain information about academics' engagement in TM activities. The target group was the total population of permanently employed academics at all seven Icelandic universities.

The total population at the time of data collection consisted of 1.034 permanently employed academics at all Icelandic universities. When taking only completed questionnaires into account the response rate was 15,3% (27,3% when including also incomplete responses). Multiple regression was applied in order to see if individual or external factors predict TM engagement best.

Based on a principal component analysis we defined five dependent variables as different types of TM activities: Exploitation, Commercialisation, Environment, Education/Training, and Science Communication. Multiple regression was applied in order to see if individual or external factors predict TM engagement best. Thereby, four different models for each dependent variable were created: one, which included only individual factors (gender, industry experience, and all five personality traits), a second with organisational factors (teaching, rank, time in academia, performance, and discipline), a third with societal factors (academic funding and location of university), and a fourth model which included all fourteen variables. This method ensures a comparison of different effect of individual factors on the one, and external factors, on the other hand.

Overall, regression results for innovation and commercialisation are very similar. Factors influencing engagement are primarily openness, belonging to disciplines in STEM or health sciences, previous or current industry experience, and academic funding. For science communication high scores in extraversion, research performance, and funding are important predictors. Being engaged in environmental activities is influenced by openness, extraversion, and agreeableness, as well as academic funding. Results for predicting engagement in education/training outside academia were statistically not significant. Academic funding is the variable which is a significant predictor in all models. High scores in openness are further important predictors for all TM activities except for science communication.

Regression results in our model show that individual factors do not have a higher influence on TM engagement than external (organisational and societal) factors with the exception of education/training. Gender was thereby in no case a significant predictor for TM engagement. However, personality traits, first and foremost openness and extraversion, are good predictors in our model.

When looking at differences among academics, findings give evidence that academics from STEM and health disciplines which receive high academic funding, have gained industry experience and are open to experience are more likely to be engaged in exploitation and commercial activities. This is in line with previous research where academics from engineering, technology, and natural sciences contract significantly more than academics belonging to e.g. social sciences and humanities, and where academics are senior faculty members, and male (Azagra-Caro, 2007). Most important factors are here discipline and openness. On the other hand, academics belonging to disciplines other than STEM and health sciences are more likely to disseminate their knowledge to a wider audience outside of academia (Science communication). Further, they are characterised by a higher degree of extraversion, have spent less time in academia, and have a higher publication rate.

HETEROGENEOUS EFFECTS OF SPINOFF FOUNDATIONS ON THE MEANSOF TECHNOLOGY TRANSFER: THE ROLE OF PAST ACADEMIC-INDUSTRY COLLABORATIONS

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Focusing on the Italian population of academic entrepreneurs, we analyze the effect of establishing a spinoff firm on researchers' attitudes towards carrying out other activities in collaboration with firms, namely, co-publishing and co-patenting. We investigate the heterogeneity in this effect in terms of existing collaborations with firms in the pre-spinoff period. Using a counterfactual analysis on subgroups, we verify that academic entrepreneurs with previous publications with firms diminish their co-publishing and increase their co-patenting after founding a spinoff. Conversely, academic entrepreneurs who had no previous publications with firms increase their co-publishing and decrease their co-patenting. We maintain that such results are related to academics' learning processes connected with their previous technology transfer activities. In particular, this paper highlights the potential interconnections existing among some of the different technology transfer channels and clarifies the extent to which they are mutually complementary or substitutive. Our findings suggest that a certain degree of substitution between founding a spinoff and other knowledge transfer activities such as co-publications and co-patenting exists. More specifically, our evidence shows that the features and the extent of such a substitution differ across individuals, depending, among other factors, on their previous experience with the entrepreneurial environment. We believe that these results contradict the idea that promoting spinoffs is an appropriate "one-size-fits-all" initiative and that they have important implications for policy design. Our analysis suggests the need to tailor technology transfer initiatives to scholars' features, paying specific attention to which kind of transfer is the right target for the policy strategy. Suppose the goal of the policy is to generate larger gains in knowledge dissemination and open innovation. In that case, the measures implemented should incentivize forms of technology and knowledge transfer with nonrival and/or nonexcludability features such as co-publishing. According to our results, such a policy design should target a specific group of academics, e.g., those with no previous experience in the entrepreneurial environment. On the other hand, such a measure might be detrimental to different, more marketable activities, such as technology transfer through patenting with firms. Conversely, suppose policymakers aim to generate gains in knowledge commercialization in order to increase, for instance, financial resources for universities and scholars. In that case, they may need to push academics that already interact with companies towards founding a spinoff. On the other hand, this may decrease the degree of knowledge diffusion through negative effects on co-publications. This implies careful policy design and the comprehensive gathering of information and knowledge about the academic environment and its existing linkages with industry. Finally, we argue that future research lines can be further developed from this contribution. First, given the emphasis on academic entrepreneurship in the European Union since Lisbon 2020, understanding whether the results achieved in this paper differ depending on Europe's national contexts might help identify policy implications at the European level. Second, the trade-offs and strict interconnections from the individual's point of view among various forms of technology transfer also call for an analysis of the possible benefits or damages that incentivizing such academic activity may have on the other missions of universities. In particular, while the mutual influences between research and technology transfer have been explored, there are at least two further points that we believe are worth studying.

INDIVIDUAL AND ORGANIZATIONAL FACTORS IN ACADEMIC ENGAGEMENT: A LABORATORY-LEVEL ANALYSIS

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Beyond teaching and research, universities have been encouraged to embrace the third mission, related to the creation and transfer of knowledge that produces value for society (Abreu et al. 2016). The Triple Helix model considers the universities fundamental actors for socioeconomic development, technological innovation, and the generation of new knowledge, emphasizing their multipurpose nature alongside industry and government (Etzkowitz and Leydesdorff 2000).

Literature has highlighted the role of academic engagement (AE) as a mechanism of university-industry collaboration (UIC) that includes formal and informal activities (Perkmann et al. 2013) and involves the knowledge co-production rather than a simple transference (Rossi et al. 2017). Such activities comprise collaborative research, contract research, consulting, providing ad hoc advice, and networking with practitioners (Perkmann et al. 2013). Besides technology commercialization, AE brings together a set of activities that is significantly widespread among universities (Zhao et al. 2020), reason why it is important to understand the aspects that support them.

The literature highlights that AE is determined by individual attributes and organizational/institutional factors of universities. As Tartari and Salter (2015) reveal, there is a positive association between the researcher's gender and the intensity of UIC. Male researchers are more likely to interact. Non-academic professional experience, in general, also plays a relevant role in the propensity for collaborations (Abramo and D'angelo 2021). D'Este and Patel (2007) also emphasize that the behaviors established by university departments influence the willingness of researchers to establish collaborative networks with other agents.

Despite the substantial increase in studies on AE and university-industry collaboration and academic knowledge transfer at macro (i.e. political) and organizational levels (Rajaeian et al. 2018), in general, organizational constraints were analyzed with a focus on companies, universities and technology transfer offices. These studies contributed to improving the understanding of the individual and organizational conditions of university students at UIC. However, there is still a gap in the existing literature regarding an organizational analysis that considers the laboratory level.

Based on an exclusive sample of 229 laboratories from Brazilian public universities, we investigated how individual and organizational attributes were related to distinct levels of involvement in AE activities. By adopting the Multiple Correspondence Analysis (MCA) followed by the Hierarquical Cluster Analysis (HCA), the results showed that the sample can be distinguished into three groups. The first, called “Low AE Intensity Laboratories", is characterized by having a low involvement in AE activities. The group called “Laboratories with High AE Intensity” is composed of laboratories highly involved in different types of AE activities. The last group, called "Medium Intensity EA Laboratories" presents an intermediate involvement in EA activities, close to the sample mean.

The proposed typology emphasizes that laboratories vary in terms of the strategies they adopt to interact with firms through AE activities. Gender, as highlighted by Tartari and Salter (2015), is positively associated with the intensity of the laboratory in carrying out EE activities, as well as the researcher's non-academic experience. We found that the second cluster with laboratories highly involved in AE activities is predominantly composed of male researchers (72.73%), with more than 77% having previous non-academic experience of an average of 5 years. Among the organizational/institutional aspects that stood out, is the average of non-researchers (4.00), represented by the technical and administrative team, in the laboratory setting, in addition to the average of non-permanent researchers (12.27), since it is the most expressive labor category. Another relevant point is the strong support of university bodies for KT (40.91%), which are also related to a greater propensity and intensity of AE activity.

Keywords: triple helix; academic engagement; third mission; university-industry collaboration.

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EXPERIENCE OF UNIVERSITIES IN PHARMACEUTICAL UNIVERSITY-INDUSTRY R&D COOPERATION: THE CASE OF ISTANBUL

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Research and Development (R&D) activities encompass innovative initiatives across various sectors, aimed at enhancing the quality of life. R&D is of great importance as it produces results that directly impact human health. Notably, pharmaceutical companies have a primary mission to research, develop, and manufacture new drugs. In other words, the pharmaceutical industry needs intensive R&D activities and collaborations. One of the types of cooperation for these R&D activities is university-industry cooperation (UIC) where universities contribute theoretical knowledge, experience-based research, applied R&D, and development studies to support the industry. This article investigates how universities experience R&D collaborations with pharmaceutical companies for the R&D activities. The main objective is to examine the experiences of universities in university-industry R&D cooperation in the pharmaceutical industry in Turkey. In this context, it examines these experiences, shedding light on both successful and unsuccessful aspects of these partnerships as perceived by faculty members, and elucidate their role in R&D activities. Related to triple helix model of innovation, the basic premise of the research is that successful UICs positively contribute to R&D activities. Therefore, the research problem centers on the question of what are the experiences of universities in R&D cooperation within this industry. In this regard, it is aimed to receive evaluations from universities and to discuss the prevailing problems inhibiting their contributions and growth or leading to failures. Because, the literature indicates that issues such as uncertainties, risks, conflicting priorities, inadequate communication, legal complexities, financial constraints, and institutional problems often undermine these collaborations, hindering their potential to serve R&D activities effectively.

R&D within the pharmaceutical industry encompasses basic R&D studies, including the discovery of new molecules, clinical studies that transform discovered molecules into safe and effective drugs through various stages, and the development of value-added products. This underscores the industry's heavy reliance on R&D efforts. Continuous studies are carried out to find new drugs in pharmaceutical industry organizations as well as in academic institutions. It can take an average of 10-15 years for a molecule to turn into a human drug. So it's fundamental to focus on how to improve efficiency in R&D processes. Because of that particular reason, R&D cooperations gain prominence.

R&D serves as the lifeblood of the pharmaceutical industry. That is why pharmaceutical companies account for nearly half out of the top 20 largest R&D spenders in the world. Moreover, the global COVID-19 pandemic has underscored the strategic importance of pharmaceuticals. This crisis has further emphasized the importance of domestic production in the pharmaceutical sector in the sustainable economic performance of a country and has led to serious steps towards the sector. The governmental projects was quickly announced by public institutions for the supply of necessary technology and equipment, as well as for the production and development of domestic products. Related examples have also emerged in Turkey.

In Turkey, urgent measures and incentive packages have been put into practice on UIC in public project calls. During this process, the emphasis on national technology move and fostering collaboration among public institutions, organizations, industrialists has garnered significant attention. A prime example of successful collaboration is the domestic synthesis of Favipiravir, a drug used in the treatment of Covid-19. This achievement was realized in just 40 days through the collaborative efforts of a team comprising 32 individuals in cooperation including ministries, public research council, Istanbul Medipol University, and Atabay Pharma Company.

Most of the R&D investments to develop new drugs take place in the phases of clinical research. Turkey's development and growth in this field is still far below its potential. Notably, no new drug molecules have been developed within Turkey to date. However, the government expects that, thanks to the strengthening of the UIC, an environment that supports R&D and innovation will develop and a rapid growth in the field of pharmaceutical R&D will be achieved according to the 2023 vision of the pharmaceutical industry. Furthermore, this sector holds a prominent position within Turkey's 2023 Industry & Technology Strategy and the Technology-Oriented Industry Move Programme. The overarching goal is to foster greater cooperation and coordination among industry stakeholders, government bodies, universities, and entrepreneurs. Recommendations include enhancing university capacity for generating high-quality knowledge and facilitating the commercialization of this knowledge. Additionally, statistics reveal that the rates of academic and commercial research applications within the last five years (2017-2021) have remained relatively stable. In essence, both pharmaceutical companies and universities continue to invest with a comparable level of intensity in the development of new drugs.

The social world under examination in this research comprises universities that have engaged in R&D cooperation within the pharmaceutical industry in Turkey. Within this world, the optimal stakeholders for the research objectives, due to their qualifications and needs, are universities possessing entrepreneurial, innovative, and research-oriented qualities, and expertise in pharmaceutical technologies. Accordingly, the sample selection employs a purposeful sampling approach, focusing on universities with prior experience in pharmaceutical R&D collaborations. The following sources are employed for sample determination: Research Universities Performance Monitoring Index, Entrepreneurial and Innovative University Index, and Field-Based Competency Analysis of Universities. Based on the evaluation of these sources, faculty members from nine universities in Istanbul are selected for interviews. Prior to commencing the field research, a focus group meeting is convened in April 2022 to refine the questionnaire based on group discussion feedback. Expert input from Technology Transfer Office (TTO) specialists is sought to identify suitable participants. Additionally, snowball sampling is employed with the assistance of initial interviewees. The choice of Istanbul as the research location is significant, given its concentration of pharmaceutical company R&D centers. This reinforces the likelihood of fruitful interactions in university-industry cooperation and reaffirms the region's relevance to the research.

The research adopts a qualitative methodology, emphasizing comprehension rather than discovery. This approach is invaluable for elucidating research questions and gaining a deep understanding of the subject matter. The final sample size is determined based on data saturation. Data collection involves conducting in-depth one-on-one interviews with all participants. In total, 30 individuals, including 13 from three state universities and 17 from six foundation universities, participate in the research. A semi-structured questionnaire is employed, framed as a case study research, with a preference for the embedded single case study research design. To ensure validity and reliability, the study employs researcher reflexivity, depth-oriented data collection, purposive sampling, and appropriate participation strategies. The field research is conducted during May and June 2022, with data analyzed using qualitative analysis software.

The findings of the field research highlight the difficulties and limitations posed by university conditions within the research context, specifically addressing the research problem: the experiences of universities in R&D cooperation within the pharmaceutical industry. Notably, participants bring diverse experiences and backgrounds, including (i) collaboration, consulting services, and clinical studies with national and international pharmaceutical companies, (ii) involvement in international research networks, (iii) conduct of publicly funded research, (iv) serving on publicly funded project panels and governmental boards, (v) extensive, long-term experience within pharmaceutical companies and (vi) development of new products within the field. Additionally, some participants are scientists who have returned to Turkey from abroad in recent years in response to government calls and the calls for R&D support.

Participants in industry collaborations derive several notable advantages, including: (i) Networking opportunities with graduates employed in the industry. (ii) Access to personnel who have received postgraduate education and gained industry experience through public cooperation programs. (iii) Access to support and solutions for problems, such as shortages of raw materials, through social networks. (iv) The ability to focus on commercializable research rather than low-yield syntheses. Conversely, participants also report negative experiences from their professional interactions: The primary challenge stems from financial constraints. Unrealistic deadlines and budgets are often imposed on innovative research in the field, making it difficult to secure funding for the next phase of their research. There is some time period wasted on seeking suitable industry partners and navigating procedural and financial problems and inadequacies in the process of developing their research into marketable products, often resulting in lagging behind competitors and not the first but late one in the field. Ironically, participants express a perception of lower trust from domestic companies compared to foreign counterparts. Consequently, they resort to covering expenses out of their own pockets, selling patents abroad instead of in Turkey, or transitioning their scientific focus to different fields to alleviate financial limitations.

General problems that affect all organizations within the triple helix model include disparities in their understanding of science, time management, work pace, and career progression for their partners. A second common issue is the frequent turnover of staff within Turkish institutions. Additionally, there is a lack of mutual awareness between universities and industries regarding the benefits of research and information exchange. Participants note self-confidence problems and a failure to cooperate effectively on both sides. A mutual shyness to engage with one another and a lack of sufficient feedback further hinder collaborations. All participants concur that the culture of collaboration and teamwork remains unfamiliar and underdeveloped in Turkey, partially due to past discouraging experiences. Repetition of the same or similar research unintentionally or carelessly within the field results in wasteful budget distribution. Participants generally perceive that individual efforts, particularly through personal connections, play a decisive role in establishing and maintaining collaborations.

Lastly, the subsequent paragraphs delve into the specific challenges faced by universities, primarily revolving around financial and institutional issues. Most participants emphasize the inadequacy of basic resources (energy, funding, and time) and the tendency to abandon innovative research initiatives. In state universities, with a few exceptions, the essential technological infrastructure required for research is often lacking. Even when multiple devices of the

same type are available within an institution, their utilization is hindered by the notion of “private property.” The insufficient financial strength results in lagging behind international developments and technology. Researchers lose their motivation and abandon projects due to the burden of technical and bureaucratic obstacles, as well as administrative duties assigned in the name of “rewarding.” A significant shortage of research personnel exists, with the most critical factor being the low salaries of young researchers, hindering their training and contributing to the loss of trained talent. Temporary and short-term grants further exacerbate this issue, impeding effective in-house collaboration and research team progress.

Beyond financial concerns, other key challenges center on research culture and interpersonal relations. These difficulties are particularly pronounced for scientists who have returned to Turkey or have been called back due to reverse brain drain and experienced disappointment in the research environment in Turkey. Formal decisions and rules within universities often leave researchers feeling weary and “disheartened.” They express frustration at being evaluated by individuals with lesser scientific knowledge in project applications. According to the scientists, their colleagues prioritize academic criteria and metrics over genuine scientific research and public welfare. Academic evaluations, regrettably, tend to rely on quantitative rather than qualitative criteria, perpetuating a misguided definition of “desirable” academics. An academic mindset characterized by a substantial ego can hinder the integration of “outsiders”, leading to reluctance in trusting or delegating tasks to colleagues based solely on academic titles. Most of these limitations and difficulties ultimately result in the loss of institutional memory & research infrastructure, and a deficit in scientific knowledge in the medium term.

The overarching conclusion drawn from these findings underscores the critical importance of key factors such as financial stability, technical and institutional infrastructure, and a cohesive research team, alongside fostering a supportive research culture and mindset for conducting innovative research. As in a developing country, there is an anticipation that the government in Turkey should adopt a more supportive stance. Despite the government’s stated goals and strategies for R&D in drug development, further regulatory measures are needed to bring these objectives to fruition.

TRIPLE HELIX IN INNOVATION IN THE MANAUS FREE TRADE ZONE: AMAZONAS STATE UNIVERSITY AND THE UNIVERSITY-STATE-COMPANY PARTNERSHIP IN THE DEVELOPMENT OF INNOVATION PROJECTS TO FACE THE COVID-19 PANDEMIC

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The problem of the present research is to find out if the Covid-19 Pandemic was responsible for creating a favorable environment for innovation, aiming at its confrontation, through the triple helix, between the University of the State of Amazonas, Government of the State of Amazonas and private companies in the Manaus Free Trade Zone. The problem here is to analyze the data available in the various interactions and agreements between these institutions, in order to verify whether the emergency event was responsible for creating an environment favorable to innovation, as well as for the strengthening of relations between them, with the aim of to set a new direction for future interactions in this area. The present research, through the methods exposed here, obtain answers to such questions. The relevance of the present research is presented as the world is immersed in an unprecedented tragedy, which leads to the formation of new alliances, new interactions, new contributions and new products, all in an emergency character, evidencing the need for innovation in technologies and in the use of available resources, in order to discover new solutions to this global problem. When university, industry and government representatives, as well as other protagonists, are convened to discuss regional problems and potential, a new dynamic of innovation and entrepreneurship can be born. The presence of an entrepreneurial university, whose professors and students actively seek useful results from their research, is a key factor in regional innovation. When it comes to knowledge-based societies, the university is the fundamental institution, just as government and industry were the main institutions of industrial society. Industry continues to play a leading role in terms of production and the government is still the source of contractual relationships that guarantee stable interactions and exchanges. In this configuration, the role of the university is seen primarily as providing people trained to work in other spheres. It may conduct research, but it is not expected to play a role in the creation of new companies. In statist societies, changes are driven by the need to accelerate the innovation system, with the introduction of new sources of initiative. The approximation of people and institutions, with the intention of innovating, in order to save lives, makes the present work reveal itself as current and relevant, in the search for new models of relations between institutions that, traditionally in this region of the country, do not have a history of cooperation that is visible and accessible to a large section of the population. The methodological and academic contribution of this research took place through extensive bibliographic research on the subject, and had the aim of clarifying this subject little discussed in academic productions, especially in the case of Northern Brazil, representing a gap in the literature, with dissemination of the researched topic, resulting in a base that can serve as a foundation in future relations between institutions, and not just in emergency situations. The formulation of the research problem consists of: “Was the covid-19 pandemic responsible for creating a favorable environment for the realization of the Triple Helix in Innovation in the Brazilian State of Amazonas? This study aimed to verify the environment of innovation by Triple Helix, in the face of the COVID-19 pandemic. The specific objectives of the study to answer the research question were: a) To study the functioning of a Triple Helix involving the State University of Amazonas, the Government of the State of Amazonas and the companies of the Manaus Free Trade Zone. b) Analyze the incentive for innovation by Triple Helix, from the outbreak of the Covid-19 Pandemic. c) Identify whether a Triple Helix model is possible, based on the interactions forged during the pandemic, for future innovative relationships between the institutions involved. This research is structured in five chapters, including the introduction as Chapter 1. Chapter 2 presents a literature review about the institute of innovation, its historical aspects and world panorama, also attesting to the difficulties and challenges in its financing, in an increasingly competitive market, the obligation of the Brazilian State, in constitutional seat, to foster innovation through its institutions, as well as approach the Triple Helix as a modern and universal solution for innovation, ending, still, with the analysis of certain characteristics of the institute over the years and on the role of the University as Triple Helix´s protagonist. Chapter 3 presents the methodological procedures, the scenario of the triple helix studied, that is, the State of Amazonas, seen through the Amazonas State University (UEA) and the Manaus Free Trade Zone (ZFM). In Chapter 4, the analysis and discussion of the results are presented, as well as a new triple helix model, with UEA playing the main role. Finally, in chapter 5 we present the conclusions and final considerations of the research. From the research problem, propositions were elaborated that seek to answer the problem question. As the present study is a qualitative research, the propositions aim to replace the so-called hypotheses that are used in quantitative research. Therefore, after studying and preparing the theoretical framework, based on the problem question, the following propositions were elaborated: Proposition 1: The triple helix creates a favorable environment for the financing of innovations in the State of Amazonas. Proposition 2: The Amazonas State University (UEA) figures as a protagonist in the Triple Helix of innovation in the State. Proposition 3: The Covid-19 pandemic was responsible for creating a favorable environment for the realization of the triple helix in innovation in the State of Amazonas. Thus, the study is developed, seeking to answer the research problem, as well as confirming the aforementioned propositions.

HOW RESEARCH UNIVERSITIES COULD BE FULLY ENTREPRENEURIAL? THE CASE OF THE NATIONAL UNIVERSITY OF MEXICO UNAM

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Universities have evolved from being focused on teaching to conducting research. Next, the third function of universities involves societal linkages and entrepreneurial activities. However, because in Mexico and in Latin America there is already a third university third function called culture diffusion, the aforementioned third function, is really the fourth function, which consists of the following activities: fulfilling productive and social demands for knowledge through technology transfers; technical services; the processing of intellectual property rights; the construction and management of data banks; continuing education; the promotion of ventures (spin-offs); incubation; and participation in business associations. As a result, Mexican research universities have significant linkages among teaching, research, development of cultural activities in order to fulfil societal needs.

In the intramural university organizations – university departments and research centers - the evolution of interrelationships between these four functions has different trajectories and degrees. There are some entities that are active in teaching, research, proactive technology and knowledge transfers, in addition to entrepreneurial activities.

The aim of this paper is to focus on the fourth function at UNAM and its relations with teaching and research, as well as to identify entities where this fourth function is well developed. A further aim is to propose the ways and means for the practices of these entities to be expanded, so that UNAM could qualify as a Research and Entrepreneurial University.

The hypothesis is that UNAM as a research university, in order to pursue entrepreneurship and technological activities, requires legal, institutional, and managerial changes as well as a matrix organization of interrelationships between the four functions that favour the spreading of good practices to other entities, with specific adaptations.

The first point to be made is that UNAM is indeed a research university that in its 2022 budget devoted 27% of its total allocations to research activities. This indicates that it has a high level of capacity in its laboratories, researchers and infrastructure that produce scientific knowledge and support teaching. It is among the top universities at national level. It is also well positioned in Latin America. However, these are modest achievements because both Mexico and Latin America are lagging far behind the world's top universities (THE, 2021). The explanation could be that they do not generate enough impact from the development of the fourth function, i.e. the linking of knowledge to industry and society.

The second point is that focusing on and comparing research and studying the linking indicators of UNAM's internal organizations that include 30 scientific and 18 humanistic and social research centers, in addition to 29 schools of higher education, could help to identify which organizations are more advanced in the fourth function.

Thirdly, we investigated the legislative framework to see how it relates to the aforementioned four function, examining the academic vs. technology culture. We also looked at the participation of academic staff in the creation and operation of companies whose knowledge is generated by the university.

The UNAM's fourth function is analysed by looking at patents, technology transfers and knowledge services in a variety of entities such as research centers, linkage organizations, entrepreneurship and incubation, in addition to knowledge services.

The 30 scientific research centers are assigned annual levels of academic productivity, averaging from a minimum of 0.62 to a maximum of 4.47 articles per researcher. However, in the indicators relating to the fourth function, we saw that there was a concentration of patents in only a few centers. Ten out of 30 research centers did not apply for patents and 17 centers were not granted any patents. As for international patents, five research centers had applied for 14 patents, of which 6 were granted.

Three research centers have a good level of involvement in the fourth function. These are the Institutes of Engineering, Biotechnology, and Applied Sciences and Technology, whose good linking practices could be emulated and adopted by others. Furthermore, it was observed that the practice of establishing linkages was in place at their creation and continued its course with research and its productive application. Consequently, it is necessary to

consider the entire evolution of the RCs, from their origin to their continued endogenous research culture and technology transfers to industry.

UNAM's organization for external linkages and the incubation of enterprises began with the SIECyT in 1992. A horizontal support model has been operating since 2008 (CID), which was transformed into a central organization in 2020 (CVyTT). However, some earlier decentralised experiences of linking, such as those of the Faculty of Chemistry, the Institute of Engineering and the Institute of Biotechnology, were retained.

The fourth function involves legislative changes that are now in progress in Mexico. The Science and Technology Law (2015) contains reforms designed to encourage the creation of enterprises in universities and research centers. In 2016 and 2019, UNAM published two Guidelines, both with the aim of regulating and avoiding conflicts of interest that may arise from the participation of academic staff.

There is no explicit objective stating that UNAM, as a research university, should become a Research and Entrepreneurial University that would assume the risks arising from innovative solutions and the management of conflicts that might occur in negotiated solutions. Such an objective would require a path that connects the activities of research, teaching and diffusion of culture, as well as the fourth function of providing knowledge services to industry and society.

UNAM has an important teaching and research infrastructure. However, the development of its fourth function is patchy. But some research centers and faculties, and certain groups and researchers, have made encouraging advances that could pave the way to emulation via 1) disseminating good practices, keeping in mind the adaptations that the nature of knowledge may need before it can be applied to industry, 2) interrelating activities and functions to take advantage of the high potential of UNAM's capabilities, 3) flexible and proactive practices for carrying out technological transfers and creating enterprises, and 4) recognizing the need to maintain internal and external critical thinking in an open democratic governance.

27 JUNE
29 JUNE 2022

THEME 14: TH PARTNERSHIPS, CO-PATENTING, AND MARKET POWER RELATIONS

ACADEMIC DIASPORA ENGAGEMENT TO ENHANCE INTERNATIONALIZING OF HIGHER EDUCATION INSTITUTIONS

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To change from isolated entities to more integrated actors in society, higher education institutions (HEIs) must have the capacity to support their staff and improve teaching and research services. Academic and professional requirements for graduates increasingly reflect the demands of the globalization of societies, economies, and labor markets; thus, higher education must provide adequate preparation. Members of the academic diaspora are recognized as reliable mediators for universities in the midst of the unending globalization, transnationalism, and internationalization of higher education (Setrana et al., 2021). This places the academic diaspora in a uniquely important position to not only mediate the relationship between advanced higher education systems and the countries to which they belong, bridging the center–periphery divide, but also to supplement the capacity gaps in higher education (Woldegiyorgis, 2020).

There are many different definitions of and approaches to diaspora, and the previous decades have witnessed an explosion of scholarship across academic disciplines. Scholars invariably emphasize three primary features of diaspora: 1) Dispersion, meaning the dispersion (traumatic or not) of a person/people from a (perceived) 'homeland'; 2) Homeland Orientation, which refers to the real or imagined 'homeland' as a source of value, identity, and loyalty; and 3) Boundary Maintenance, which is the preservation of a distinctive identity vis-à-vis host land(s) (Brubaker, 2005).

Despite recognizing the importance of engaging the academic diaspora with institutions back home, there is extremely limited research examining what such engagements look like, what factors help their success, or what sort of dynamics and challenges they must deal with (Woldegiyorgis, 2020). The purpose of this study is to identify the challenges HEIs in developing countries (low- and medium-income countries) face to engage the academic diaspora in their activities. We build our arguments on empirical data collected from the higher education sector in Iran as an example of a developing country.

In Iran, according to the volume and amount of university resources, professors' experiences, and the different fields of education and research, international cooperation with the academic diaspora is currently performed at different levels. Of course, most international collaborations (joint research, joint education, supervision of student dissertations, and publication of articles) have been done more to be seen in international rankings and increase revenue for universities. The quality of education and research and solving the problems of society and industry with the cooperation of academic diaspora and international researchers have been seen less often.

Given the lack of prior studies and the explorative nature of the current study, we conducted a case study to collect rich and in-depth data to address the research question (Voss et al., 2002). This study used data from semi-structured interviews to explore the transnational engagement of Iranian academics through their own experiences. The other main data source is analyses of multiple sources of secondary data (e.g., university webpages, reports, and regulations). Based on the initial literature review, an interview protocol was developed to provide the structure for the data collection process. We conducted 35 face-to-face interviews 12 faculty members in Iranian HEIs, 9 faculty members abroad and 14 managers in charge of international affairs at universities in Iran. In addition, we held a workshop to explore the challenges and experiences of research and educational collaborations between Iranian professors at home and abroad. The workshop had 42 participants. In analyzing the data, we applied an open coding procedure (Miles & Huberman, 1984) to identify and categorize managerial challenges. The transcripts were reviewed several times, and notes were taken. The codes were extracted and linked to secondary conceptual themes.

According to preliminary analyses, the challenge of academic diaspora collaboration with faculty members inside Iran was that doing international activities was not very meaningful for Iranian faculty members because activities such as attending conferences, evaluating journal articles, being a journal editor, or forming a joint international program were not considered in their promotion regulations. There was also insufficient mastery of international languages in educational and research activities. The research activities of faculty members did not focus on a few specific topics; thus, they did not have an opinion on a specific field. The weakness of faculty members in research skills and the guidance of doctoral students prevented them from attending

international forums. Faculty members did not have enough time for educational and research empowerment. The quality of education and research was not vital to universities, and only the quantity of output was essential.

The academic diaspora also faced challenges in working with faculty members inside Iran. Iranian academics did not have professional attitudes and did not establish purposeful contacts. There were high bureaucratic administrative procedures for formal collaborations. The government did not support cooperation with the academic diaspora, and there was no travel fee or joint working payment or fund. Also, the sanctions against Iran affected the academic diaspora's enthusiasm to cooperate with Iran. Together, these factors forced the academic diaspora to face serious challenges despite their willingness to work with faculty members inside Iran.

Keywords: academic diaspora; internationalization; higher education; engagement challenges.

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IMPLEMENTING THE TRIPLE HELIX MODEL IN THE AMAZON: ISSUES AND CHALLENGES

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The Triple Helix (TH) model, developed by Henry Etzkovitz and Loet Leydesdorff in the mid-1990s, describes the innovation model based on the government-university-industry relationships. Based on such a model, Christopher Freeman, an American economist, created the basic concept of Innovation Environments, aiming to help implementing innovative processes in the space created by the interoperation of TH actors.

TH requires strong interactions among those actors in the common space they share and work together, such as universities registering patents, companies introducing products to the market and government legitimising and fostering the process. Surely those interactions rely on commitments and collaboration of all entities. The academy role shall go beyond teaching and research; it must be deeply involved with innovation-related knowledge, practices, and tools. Governments must act in the articulation and promotion of technology transfer between academy and entrepreneurs, and these, shall provide funds to support the research projects. As widely known, in a knowledge-based economy, innovation plays a fundamental role which includes being part the political agenda of most developed countries. Looking at this scenario, in the mid-twentieth century, the Austrian economist Joseph Alois Schumpeter was the first to tie the economic development of a country to its ability to innovate.

Currently the neo-schumpeterians argue that innovation is the result of relations between the productive sector, government and university, which was called the National Innovation System. This work presents a preliminary evaluation about the implementation of the Triple Helix model in the Amazon region, focused on relevant issues and challenges. Those come from different sources, such as infrastructure problems, lack of innovation culture, deficit of high-quality intellectual capital, historical absence of investments targeting modern industries in the region, just to name a few. This work is based on secondary data, interprets University-Company cooperation as a model of inter-institutional arrangement between organizations that have different natures, but fundamental in the generation of innovation.

The main topics presented here are: (i) analysis of national indicators of innovative activities carried out by Brazilian companies that operate in the HT model; (ii) the regional actions adopted by stakeholders (universities, companies and governments) of the main states that make up the Brazilian Amazon; (iii) identification of the greatest challenges for the implementation of the Triple Helix in the region, which in recent years has shown a relative growth in scientific production, in the first analysis, due to the expressive expansion of academic infrastructure and, in some cases, the expansion of research scientific research, as a result of the implantation of public and private universities in small cities. On the other hand, it presents indicators that prove the low commitment of companies with the generation of innovation, citing as an example the reduced number of postgraduates hired by the companies installed there;; (iv) shows the few private investments in research and development and the small number of patent deposits by universities, research institutes and the private sector; (v) points out the policies generated in order to create the local innovation ecosystem and the huge misunderstanding between the entities that make up the Triple Helix, showing the deficiency in the implementation of the model to generate self-employment opportunity and income generation through the knowledge economy. Finally, based on the appropriate theories and concepts, it proposes ways to support public policies that are more appropriate for the implementation of the Triple Helix model in the Amazon.

THE CONTRIBUTION OF ECONOMIC GROWTH AND UNIVERSITIES TO THE QUALITY OF BUSINESS PATENTS

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DRAFT Version. Please, do not quote.

Motivated by the vast literature on the contribution of universities to business innovation, the main aim of this paper is to analyse the relation between economic growth, the quality of business patents and their links to university knowledge. Relying on patent data, we focus on two channels by which knowledge stems from university to companies: university-industry cooperation and knowledge codified in university patents pon which subsequent business patent may build. These channels are measured by university-industry joint patents (co-patents) and citations included in the state of the art of business patents to university patents, respectively.

There is empirical evidence that co-patenting with universities and tapping on previous patented knowledge has a positive direct effect on patent quality. However, we do not know yet whether this effect is mediated by economic growth. We hypothesize that economic growth plays a role in this relationship since in recession companies usually face stronger financial restrictions and reduced sales and R&D expenditures, lowering their absorptive capacity. Figure 1 and 2 shows our conceptual model and our hypotheses. To test our hypotheses, we estimate two sets of models based on patent information on 11.318 patents applied by Spanish firms containing at least one patent application to the European Patent Office (EPO). The data derives from Patstat database, autumn 2017 edition. The first set of models is estimated using the number of forward citations as dependent variable. We estimate negative binomial regression models. The second set of models use the grant success as dependent variable. This variable is categorical and takes the following values: 1 if the patent is granted in the EP office; 2 if the patent is granted in the EP and US office simultaneously; 3 for triadic patents (US-EP-JP patent office); 0 otherwise. Given the categorical nature of the dependent variable, we estimate these regressions using multinomial model specification.

Figure 1. Conceptual model and hypotheses using forward citation as dependent variable.

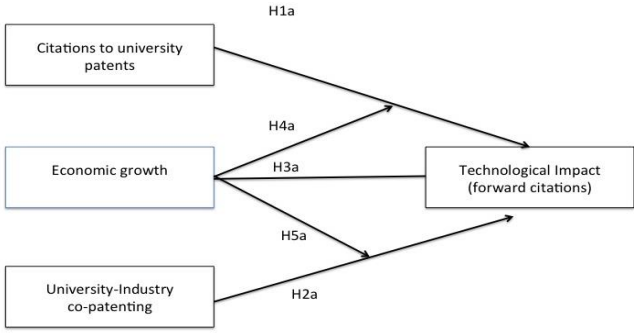
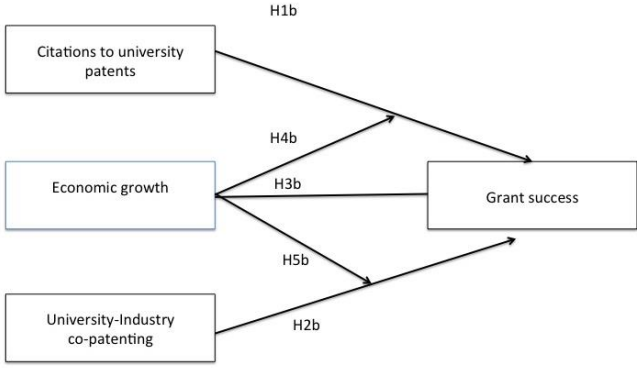


Figure 2. Conceptual model and hypotheses using grant success as dependent variable



Our results provide evidence supporting Hypothesis 1a and Hypothesis 3a, although with an inverted U-Shape. This suggests that academic knowledge spillovers and economic growth enhances technological impact of patents but up

to a certain point this effect turns to be negative. We found a negative and significant effect of co-patenting on university forward citations (H2a is rejected). These effects are not mediated by economic growth (H4a and H5a are rejected).

With respect to the second set of models, there are similarities in the effect of some variables on grant success across offices (only European, European & US, or triadic patents). Co-patenting with universities is not relevant in explaining grant success in any office. Academic knowledge spillovers show a quadratic effect. There are also some differences by granting office. For European Patent Office (EPO) granted patents. Besides, economic growth has a positive direct effect on the quality of business patents but it does not mediate the effect of academic citations and co-patenting. For EPO & USPTO patents, GDP exert a U-shape effect on grant success. The coefficient of the interaction term co-patenting*GDP_growth is positive, suggesting that university-industry patents are at higher risk of being granted simultaneously by the EPO & USPTO as GDP growth rate increases. For triadic patents, the coefficient of the interaction term citations_to_university*GDP_growth is positive, suggesting that business patents citing university patents are at higher risk of being granted simultaneously in the three main patent office as GDP growth rate increases. Several policy implications are derived from our results.

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