INFLUENCE OF FOUNDERS ON INNOVATION ECOSYSTEMS TYPES

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Abstract

The innovation ecosystems are important drivers of research, development and innovation activities in a region. Collaborative systems that contribute to the strengthening of high value-added activities have especial significance in the currently changing technological environment. Based on the findings of the researches, it can be seen that term innovation ecosystem is not an absolute concept, as several forms of its appearance can be found in the practice. Certain aspects of the current R&D&I challenge open new research questions in view of the different types of innovation ecosystems. The features and functions of a given ecosystem are influenced by several factors; they may take different forms depending on the characteristics of the regions, industry, way of cooperation and culture originated from the way of establishment.

The present study builds on earlier research findings, while focusing on further circumstances of founding of innovation ecosystems. There are assumptions that observable correlations can be identified between the characteristics of the actors involved in the establishment of an innovation ecosystem and the type of ecosystem that will emerge later.

After introduction of relevant researches, the paper gives an overview on innovation ecosystems types classified by the authors. The aim of the paper is to assess the typical patterns of the identified five types of innovation ecosystems from the perspective of the stakeholders involved into the establishment. The related research examined data from 93 European innovation and science parks. In the course of the research, the origins of the different ecosystem types were evaluated. The analysis drawn conclusions about the possible relationships between the origins of an innovation ecosystem and the nature of the subsequent ecosystem. Finally, the authors make suggestions for future research directions and processing options for the topic.

Keywords: *innovation ecosystem, innovation, ecosystem founders, ecosystem evolution, ecosystem types*

1. INTRODUCTION

1.1. Term of innovation ecosystem

In recent years, there has been a growing interest in the concept of ecosystems as a form of description of the innovation and business environment. The term has entered the focus of development not only for high-tech companies but also for certain sectors and regions. In addition to the concept of innovation systems, the concept of innovation ecosystems has become particularly popular in related research, typically with a business and strategic background and focus (Gomes et.al, 2018). This differs from the classic political and institutional focus in the literature on innovation systems. The interpretation of the innovation ecosystem thus differs from the usual conceptual approach of the innovation system. The intensified use of the term of innovation ecosystem has accelerated after the publication of Adner's Harvard Business Review article, which contains one the most widely used definition of innovation ecosystems (Adner, 2006). It defines the innovation ecosystem as "collaborative agreements that allow businesses to combine their offerings into coherent, customer-centric solutions".

According to Carayannis and Campbell (2009), the modern innovation ecosystem is a multilevel, multimodal, multi-node, and multiagent system. Its architecture is made up of agglomerations of human, social, intellectual and financial capital sources and flows, as well as cultural and technological objects and modes, constantly evolving and cooperating together. Jackson (2011) described the innovation

ecosystem as a system of complex relationships. According to his view it is created between actors or entities whose functional purpose is to promote technological development and innovation. Still et.al. (2014) defined the innovation ecosystems which is generally seen as entities made up of organizations and the relationships between them, including human networks and interdependent firms.

Oh et.al (2016) emphasized in their paper that the innovation ecosystem can be described through two well-separated economies, one is the research economy, driven by basic research, and the other one is the commercial economy, driven by the market. According to the authors, the cooperation and relationship between these two economies defines the basic framework for innovation ecosystems. Granstrand & Holgersson (2020) pointed out that the innovation ecosystem is the totality of actors, activities and products, as well as institutions and relationships, including complementary and substitute relationships, which are both important for the innovative performance of actors.

The complexity of the concept of innovation ecosystems is also reflected by the specific definitions, which includes the different actors, the importance of their cooperation, the special activity and value creation characteristics of the ecosystem, the role of co-development, co-evolution and output-based results. An innovation ecosystem is therefore always a set of different types of actors with different goals and different operational characteristics. An innovation ecosystem must also be a bridge between the various players while differences between actors provide the basis for complementary collaborations. The wide range of related researches of different innovation ecosystems show that there is no one single model available, but there are many different adaptations. The actual structure and operation of an innovation ecosystem depends on several factors, influenced by the location, the environment, the circumstances of ecosystem creation.

The theory of innovation ecosystems leaded to the conceptual foundation of science and innovation parks, interpreted through the “Triple Helix” knowledge model, developed by Etzkowitz and Leydesdorff (2000). This model emphasizes three “helixes” that are intertwined in the innovation system: academia/universities, industry, and state/government. The authors explain the relationships and networks between universities, industry, and government, with a particular emphasis on hybrid networks, where each of the helices overlaps. The model analyzes the interaction between academia, government and industry in detail and points to the potentials for joint actions by the three stakeholder groups. In another related publication, Etzkowitz (2003) refers to the "university of entrepreneurship" as a form of bringing academia and the market closer together. This initiative was also further processed by Campbell & Büttel (2005), explaining that the effective link between university research and corporate R&D also requires the attitude of "entrepreneurial universities" and "academic firms". As an extension of the Triple Helix model, some authors (Carayannis & Campbell, 2009) have proposed the “Quadruple Helix” model, which is a kind of complement to the “Triple Helix” with a fourth actor.

Anbari and Umpleby (2006) argued that one of the reasons for setting up research networks is precisely the need to bring together knowledge and practitioners with complementary skills. The review research of Galvao et.al (2019) examined research trends related to the triple-helix model and pointed out that one of its interpretations is to exploit the benefits from different perspectives of each stakeholder. Etzkowitz and Klofsten (2005) proposed a regional knowledge-based development model as a practical application of the triple helix, which can be understood as a set of “multilinear dynamics” based on alternative technological paradigms. According to Leydesdorff et.al (2006), economic growth depends not only on innovative innovations, but also on the structure of innovation, in which basic and applied research are increasingly linked. While universities represent intellectual capital and are tasked with generating scientific knowledge, industries serve to create economic prosperity and reflect corporate strategies. Public institutions represent regulations, policies, industry strategies and actions and decision-makers through control and legal mechanisms. De Fuentes & Dutrénit (2016) conclude that the knowledge channels used should take into account the interactions between different stakeholders in different helix models when analyzing the geographical aspects of the interactions. This is also an important consideration when and why the establishment circumstances of an innovation ecosystem are necessary to analyze.

In innovation ecosystems, the focus is on innovation and the set of components and complements. The basic approach of Adner (2006) sees the ecosystem as “collaboration agreements” through which firms

combine their individual offerings into a coherent, customer-centric solution". The emphasis is on understanding how interacting actors interact to create and commercialize innovations that benefit end customers. If coordination within the ecosystem is inadequate, innovations fail (see Adner, 2012; Adner and Kapoor, 2010; Kapoor and Lee, 2013). The essence of the innovation ecosystem concept is to grasp the relationship between the core product, its components and complementary products/services, which together add value to customers. The company(ies) producing the focus innovation(s) may be directly linked to the complementors. This type of ecosystem is essentially a virtual network of the players and is seen as complex entities of group-related actors (Brusoni and Prencipe, 2013) that are focused (focal) and generate complementary innovations.

1.2. Types of innovation ecosystems

The article by Jacobides et.al. (2018) defined three main types of ecosystems: the "business ecosystem", which focuses on a firm and its environment; the concept of an "innovation ecosystem", which focuses on a particular innovation or new value proposition and the actors that support it, and the "platform ecosystem"', which takes into account how actors are organized around a platform. Business ecosystems view the ecosystem as a community of organizations, institutions, and individuals that have an impact on the firm and its performance (Teece, 2007). This concept defines an ecosystem as an economic community of actors that interact with each other, all of which interact through their activities, while the actors do not necessarily come from a single industry. In this approach, the ecosystem represents the environment that the company must pay attention to and that influences its dynamic capabilities, and thus its ability to build a sustainable competitive advantage. Others emphasize the common feature within the ecosystem, the community as a whole (Iansiti & Levien, 2004).

Several studies have examined how differing collaboration agreements between innovators and complementors affect the ability of both groups to coordinate investment in and commercialization of a new technology (see Kapoor and Lee, 2013; Leten et.al, 2013) or how knowledge sharing affects the strength of relationships between firms and thus the development of the ecosystem (see Alexy et.al., 2013; Brusoni and Prencipe, 2013; Frankort, 2013). Platform-based ecosystems are typically organized around a technology platform. According to this approach, the ecosystem consists of the sponsoring companies and the actors that complement their activities, who together create value for the end customer. By joining the platform, complementors can not only generate additional innovation, but also gain direct or indirect access to the platform's customers. Thus, platform-like ecosystems can be seen as partially regulated marketplaces that encourage entrepreneurial action under the coordination and direction of the platform sponsor (Wareham et.al, 2014) or act as a multilateral market that allows transactions between different user groups (Cennamo and Santaló, 2013).

Katri (2015) provides a good overview of different approaches to business, innovation, and knowledge ecosystems (see Figure 1). The positioning and content implementation of an ecosystem is usually not based on a kind of pure model, but it can also carry different characteristics of different types of innovation ecosystems. According to Katri, there are three different types of economic ecosystems. The first type is business ecosystems, focusing on service or industrial ecosystems highlighting key economic performance and business relationships among the actors. The second type is the innovation (eco) systems, discussing importance of regional clusters including mechanisms and policies that accelerate the creation of innovative start-ups. The third type if the knowledge ecosystems with main interest and focus on creation of new knowledge through collaborations, joint researches or the strengthening of the knowledge base.

Gomes et.al (2018) argues that the concept of an innovation ecosystem was developed in part as a response to a pre-existing business ecosystem that focuses too much on value accumulation and competitiveness, and that the concept of an innovation ecosystem already places more emphasis on value creation and collaboration. It seems that the shift from the concept of business ecosystems to innovation ecosystems may have shifted the focus too much from competition to collaboration. Moreover, the substitution of products and resources, including innovative technologies, is more or less left out of the definitions obtained, despite the fact that they are specifically relevant in natural and man-made ecosystems.

Summarizing the above-mentioned sources, the Triple Helix model is one of the mostly accepted approach for the government-science-industry-based innovation ecosystems. As it is reflected by the various researches, several types of innovation ecosystems are available, each of them with different characteristics (see Fig. 1).

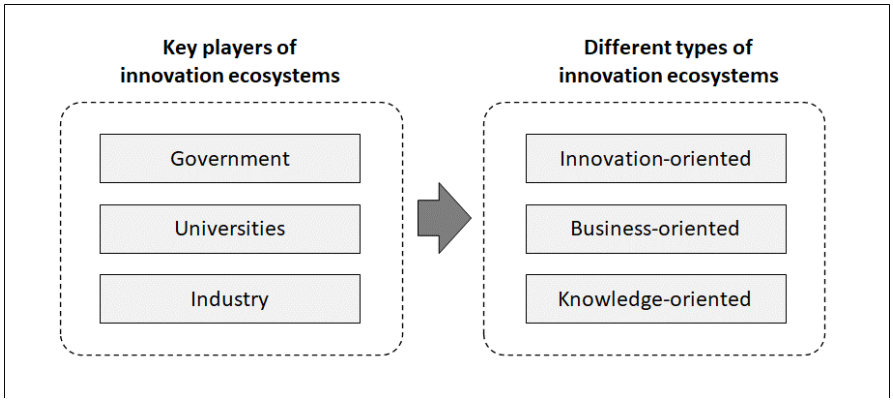


Fig. 1. Innovation ecosystem model through Triple Helix

2. RESEARCH GOAL AND METHODS

2.1. Research goal

After overview of relevant researches, the paper gives a summary on innovation ecosystems types classified by the authors, building on earlier researches. The aim of the paper is to assess the typical patterns of the identified five types of innovation ecosystems from the perspective of the various stakeholders involved into the establishment.

The purpose research of the research is to analyse the typical features in view of the innovation ecosystem type and founder group pairs. There is a supposition that roots of an ecosystem is a key influencer of the current state of an innovation ecosystem. On the other hand, getting to a certain type of an innovation ecosystem might need specific founding characteristics. Based on this two-way direction of conclusions, the paper attempts to outline new considerations for evolution researches of the innovation ecosystems.

2.2. Research methodology

The study was based on the public database of the International Association of Science Parks and Areas of Innovation (IASP, www.iasp.ws). The mission of the IASP is to create a network of science parks and innovation areas in Europe so as to advance the growth potential of its members and help them to internationalize and increase their operational efficiency. The IASP coordinates the network of these parks on a platform and is able to create new business opportunities for its members by participating in international forums, networks and thus developing innovation as a major trend in the parks.

The presented research examined data from 93 European innovation and science parks. In the course of the research, the origins of the different ecosystem types were evaluated. The referenced database supports the present research in such a way that the members of the alliance have similar operating models and characteristics as the innovation ecosystems that are the subject of the research. The information extracted from public data available on the web contributes to the validation of research hypotheses. In order to verify the results of the present research, the public database of the association was used and conclusions were drawn from the available data on the websites of the parks.

As the research is closely related to the “Triple Helix” knowledge triangle model (see explanation above), the research evaluated different ecosystem types in light of the founding forms derived from the triple-helix model and their combinations. The analysis drawn conclusions about the possible relationships between the origins of an innovation ecosystem and the nature of the subsequent

ecosystem. Finally, the authors make suggestions for future research directions and processing options for the topic.

2.3. Clustering of founders

Using the above-mentioned database, the authors established the following starting point of the research. Along the three groups in the "Triple Helix" triangle, three innovation founding categories have been created: the governmental founders, the industrial founders, and the university founders. Thus, in the course of the research, the authors classified into these three groups the relevant organizations that emerged as founders in the study of 93 innovation ecosystems.

a) as the group of governmental founders, local and city actors, regional government actors were defined, or in some cases, the country-level government (e.g. by a ministry) was the active player of ecosystem founding.

b) as the group of university founders, it was meant that the innovation ecosystem was initiated by a specific university, usually as special extension of the existing university campus.

c) as the group of the market-oriented players, it includes those private entities which decided to initiate or take park in an innovation ecosystem project establishment (industry-specific or neutral).

However, the study found that sometimes these three types of founding groups could not be clearly distinguished, because it became clear from publicly available data that not only one type of founding organization was present at the start-up of an ecosystem. The so-called mixed structure is even more characteristic and, in some cases all three types of founding stakeholder group appear. Thus, an innovation ecosystem could be established jointly by a government actor, a market participant and a university-level institution, or any other combinations might be found as summarized in Fig. 2.

Triple Helix aspects	Players
Government	Local (city)
	Region
	State (country-level)
University	University of research institute
Industry	Private person
	Market player (companies)

Fig. 2. Deployment of Triple Helix players

The six players of Fig. 2. can create innovation ecosystems in various combinations. Fig. 3. lists all possible options, so there can be distinguished single-player, double-player and triple-player set-up.

Players	Single-founder						Double-founders										Triple-founders					
Local government	X						X					X			X		X			X		
Regional government		X						X					X			X		X			X	
State government			X						X					X					X			X
Universiti(es)				X			X	X	X	X	X						X	X	X	X	X	X
Private person					X					X		X	X	X			X	X	X			
Market player						X					X				X	X	X			X	X	X

Fig. 3. Combinations of various players in innovation ecosystem establishment

The summary shows all the theoretical possibilities of how the six actors can work together to create some kind of innovation ecosystem. The specific actors might act as founder individually, during research, there are proven examples for such cases at each of the six players. However, the options of the paired mode is more typical. During the investigations of 93 parks there were not any examples identified in the combinations marked with grey-shadow. In the sample examined, innovation ecosystems were not created by state-university, a private person-university and a market-based player-university combinations. The explanation for this might be that an individual person cannot create a joint entity with a city (e.g. municipality) or regional government or state type actor for legal reasons. Furthermore, it is also apparent that none of the founding players went into co-operation with private persons so as to create an innovation ecosystem. Similarly, state was a founder either as itself or co-operating with a market player, but no mixed with university or local governmental bodies. This might be due to the different scope of goals or institutional purposes.

2.4. The used innovation ecosystem types

In the present study, the authors distinguish five different types of innovation ecosystems, taking into account the theoretical considerations of the introductory chapter and also using the authors 'previous research findings. These types are also consistent with the main elements of the innovation ecosystem model representing potential functional areas for science and innovation parks. The used types of innovation ecosystem and its main characteristics:

- Business Park: market-oriented services, industrial and research and development activities are dominant,
- Innovation Hub: mainly SME-related activities and start-up services are dominant,
- Technology Park: the technological and professional focus is dominant, the knowledge background (local, industrial, scientific and innovation skills) is crucial,
- University Park: featured by one or more dominant university presence and international researches as well as educational activity,
- General Science Park: each of the four characteristics mentioned above is present in a balanced way.

3. RESULTS

3.1. Survey database

Based on the above explained principles, the founders of the examined innovation ecosystems were mapped and the results were illustrated in two types of graphics, reflecting two ways of conclusions:

- From one perspective, the research examined what types of innovation ecosystems were created by the various stakeholder groups (Aspect 1).
- The other perspective is the opposite one, what kind of founders did the different types of innovation ecosystems create? (Aspect 2)

3.2. Aspect 1

Fig. 4. shows the different types of innovation ecosystems as outcomes of the various establishment actors.

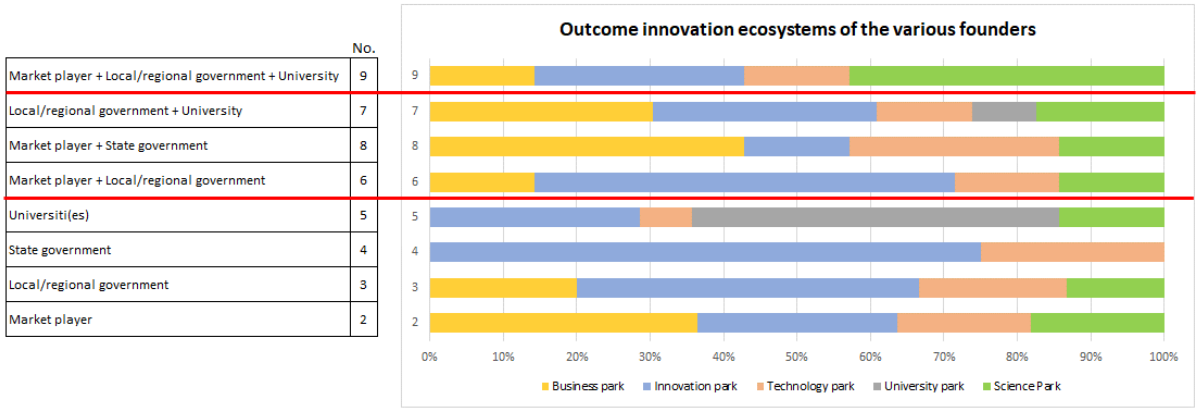


Fig. 4. Research results – 1st perspective

Looking at the results, it can be seen that single-players are closer to establishing a typical type of innovation ecosystem, while combined players result in most various types of ecosystems.

Universities are mostly affected in creating university of innovation parks, but also active in general science parks and some business parks. The role of government is different in country-level and local level. State is mainly involved into innovation or technology park creation or business park establishment. Local governments are mostly partner in heterogenous co-operations, also with universities or with market players. These wide-range collaborations used to result in innovation parks of science parks.

3.3. Aspect 2

Fig. 5. shows the different types of innovation ecosystems in view of them to be set up by different types of actors.

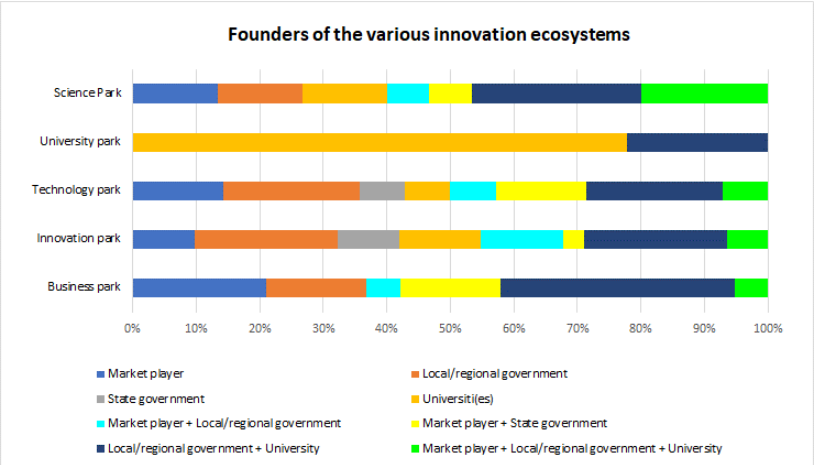


Fig. 5. Research results – 2nd perspective

Similarly, as to the statements above, it is rather evident that university parks were created by university players or, in some cases in co-operation with the local governments.

As it can be seen, the other four types of innovation ecosystems are very diverse from the point of establishment players. Nevertheless, certain typical patterns are possible to recognize. the founder structure of the technology parks and innovation parks are quite similar with some differences. The

business parks are usually university and local government-driven, also with presence of market players in this structure type.

The classic science park-type ecosystem is the most diverse, but majority of them were established following the triple helix approach or that without the market player side.

4. DISCUSSION

4.1 Single establishment

University actors mainly create a University Park, which is a clear assumption and fact, as the essence of a university park is that being built around a university, using the available knowledge base and opening it up for external use. After that, mostly innovation-type parks are created by universities, followed by general science parks and little number of technology-oriented parks. Technology parks are usually based on some kind of industrial technology, so it is more typical in industrial districts.

State actors mainly create innovation parks, which may be a consequence of a central initiative of a country, for example several innovation parks of the same type have been established across the country as part of a national development projects. In addition, state actors have mainly created technology parks, which reflects the fact that each state has created types of parks that have favoured technological development to meet the needs of industrial actors.

Local government actors (like certain urban or regional local initiative) have mainly set up an innovation park. It can also be observed that the second most often set up structure is either a business park or a technology park, which may be explained by the fact that at the government level, these types of parks represent a greater business opportunity and source of revenue for a local, city or regional initiative. They also used to participate in establishment of science parks, but this is less typical way.

Market players used to create mainly business-type parks, from which they expect higher revenues for their own benefit and create an innovation, technology and science-type park in roughly equal proportions. The creation of university parks is clearly not the typical founding goals of industrial and market players.

4.2 Dual establishment

The figure above depicts the dual founding circles features. It can be seen that a government actor usually prepares a project together with a university, a state actor creates a type of park with a market actor. The composition of the founders also depends on some external aspect, usually government regulations and start-up opportunities. When explaining a local initiative that launches an innovative ecosystem together with a university, it can be observed that the established park is the least necessarily become a university park. Rather, they create a business park or an innovation park. These types of innovation ecosystems can build on university start-up or spin-off initiatives, with the start-up ideas of university students leading to their own or university-sponsored live project initiatives, which may be complemented by advisory or mentoring activities.

When a market player goes into cooperation with a state-level government, they mainly create a business park, followed by a technology park. By implication, the university park is not one of the focus areas in this case either. The creation of a business park is more likely in this case because the market player sees the opportunity to move forward, usually focusing on business-type matters.

The goals of establishing a park with a market-type actor are mainly innovation parks, as the topic of innovation currently plays a very important role in development and research and development.

4.3 Triple establishment

And in the case where three actors (market, government, university) create a park, it is likely that it will become a science-type park at the end, which mainly reflects the operation of joint collaboration. In the case of science parks type ecosystems, the “Triple Helix” approach is particularly valid, and it is is well reflected in the operating model of this type of parks.

4.4. Roots of various innovation ecosystems

In the case of a university park, it is the evident statement that this type of park was created mainly by universities, sometimes in collaboration with some local government actor (city or region). These parks are built on the knowledge focus of the given university and this is the main catalysator of the ecosystem development.

Business parks have been set up mainly by governmental actors (either country-level or local ones) and market participants, sometimes involving universities, too. These types of parks usually operate with an operation advantage focus of offering competitive environment with several services.

It can be said that in the case of a technology park, an innovation park and a general science park, the group of founders is very mixed, as reflected by the various operating model of these parks. However, the science park-type ecosystem is mainly set up by a (local) government actor, a university actor, or three players together (university, government, market participant) based on the "Triple Helix".

5. CONCLUSIONS

The survey made among 93 European innovation ecosystems has not found establishment structure in cooperation of private person(s) and governmental players. Limited examples for collaboration of country-level government (state), university and market players were identified. However, the governmental side of the "Triple Helix" is well-represented by local (city or regional) governments.

State-level actors are mainly involved into creation of innovation parks or technology park (alone), and business park or technology park in co-operation with market players. Without any doubt (and it is also evident), universities are the key players of university parks, in some cases in collaboration with the local governments. Market players can be partner of any type of establishment structure (single, double or triple).

The business park establishment is typically local government-driven and/or market player-driven. The technology parks and innovation parks show rather similar pattern from the perspective of establishment stakeholders.

The general science park-type ecosystem is established dominantly either as following the triple helix approach (with no state-level but local governmental participation) or created by a local governmental player cooperating with a university.

The paper is new in analysing the establishment players and the types of the innovation ecosystem in their relationship and correspondence. The importance of the research is that the conclusions stated allow setting up establishment strategies for the innovation ecosystems. This way the research contributes to the successful innovation ecosystem development projects, helping to reduce pitfalls originated in the establishment circumstances.

The research built on the triple structure of the triple helix model and used a five-type innovation ecosystem classification. In the following researches, further classification (both on establishment players and ecosystem types side) can be made to gain further conclusions. Possible researches to continue this survey is extending the establishment factors with other variables (location, local economy, etc.) or understanding the root causes of the identified patterns.

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