Spin Offs activities and Technology Commercialization Policy at European Universities

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Abstract In the modern world, the goals of higher education - the implementation of teaching and research – added economic development through the technology which is the result of university research. These are among the issues that are actively discussed by development-oriented economies today. The subject of this paper is the innovation policy of universities. Based on the case-study method, the European experience in the formation of a university spin-off company and the main features of the commercialization of university technology are analyzed. The research revealed the main measures of the innovation strategy of the universities, which promote the strong cooperation between the university, the state and the commercial sector. The results of the study can be used in the development and implementation of successful national and university innovation policies.

Keywords:
innovation, university spin off, technology commercialization, university invention, knowledge transfer.

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1 Introduction

Actuality of the problem: In terms of Globalization, the interest in developing an effective innovation policy within and outside the EU is growing. At the same time, the rapid and leapfrog development of the world economy is linked to the Fourth Industrial Revolution. Although, World-renowned research organizations predicted that scientific research will not replace artificial intelligence (Gagnidze & Maisuradze, 2016). The importance of innovation policy is widely recognized in terms of competitiveness and industry development. Globalization has made technology and innovation the main and driving force of the national competitiveness strategy (Erkomaishvili, 2016).

It is noteworthy that, developing countries take into account the experiences of advanced developed countries in solving various problems, including education, science and economics. Although, they must not forget that they face different challenges in the fields. If the main challenge for advanced European, Asian and American universities is to increase international competitiveness, this issue for developing country like Georgia, can only be considered after our universities return to leadership in establishing and strengthening public values and supporting national economic development. So, before turning into an entrepreneurial university, it is necessary to intensify teaching and research and strengthen the social function of universities (Lekashvili, 2017).

The results of the research - "The Role of Universities in Regional Development" (Bregvadze, Gurchiani, Grdzelidze, & Kakhidze, 2017) conducted within the Erasmus + National Office in Georgia, as well as the results of a survey conducted by the International Institute for Education Policy, Planning and Management (2013) provide important information about the attitudes of business, central and local governmental, non-governmental organizations on universities in Georgia. Unfortunately, the researches show, that it is difficult for universities to see their own role in integrating innovation, creating new knowledge, and commercializing research within the framework of the regional development strategy. In their view, the role of universities is ensuring mainly access to education and the formation of a workforce relevant to market demands. It is even more painful to grasp the conclusions that are expressed about the issue of cooperation with HEIs, which at

this stage is at the private, non-institutional level. Business relations with universities are very difficult. They are financially inflexible and have lack of initiations.

In modern conditions, universities as economic players are important: direct and indirect impact on jobs and GDP, regional and local development, mainly through the transfer of knowledge and technology, in cooperation with industry. The new strategy of universities should be based on the development of close ties with the economy, for which universities have only one way: to change the strategy of action - especially in the field of research and development, innovation, which involves the development and implementation of relevant innovative policies.

Based on the above, it is important to study succeeded foreign cases of university innovation policy and identify the determinants of success, which will show us the development opportunities of Georgian universities.

There are three main types of national innovation policies - focused on mission, invention and system (Edler & Fagerberg, 2017). The goal of the mission-oriented innovation policy is to find new ways to solve both global and local problems, the development and solution of which requires a certain combination of relevant resources (Mazzucato, 2018). Invention-oriented policies focus on a narrow area of research. The focus is on research and development (R&D) and on the possibilities of using and disseminating the results obtained from it in the market. System-oriented policies focus on system characteristics such as: degree of interaction between different parts of the system; The need to improve its vital components and / or increase the capacity of system participants. It is related to the concept of the National Innovation System (NIS). Such a systematic approach reflects the diversity of policy participants and the interactions between them are schematically conveyed through a five - spiral model (Carayannis, Barth, & Campbell, 2012). Each spiral involved in the model is unique and represents an important asset of innovation policy, namely: 1. The education system; 2. Economic system; 3. Environment; 4. A society based on media and culture; 5. Political system. The subject of our research is University - one of the main actors of innovation policy and an asset involved in the five-spiral model.

The research cooperation of the universities with the public and commercial sectors is conditioned by the ongoing processes in the market. Studies need to be adapted to the needs of rapidly growing innovative technology markets (Lekashvili, 2019). It is beneficial to work in an environment where technological innovation is stimulated. Enterprises that cannot find such environment need special efforts to eliminate this blemish (Gvelesiani, 2015).

In such case, the enterprise may apply to the university for assistance and / or cooperation. The value created in the form of a technological product and / or service based on the university resources, which is aimed at solving a specific problem, creates the need for commercialization of scientific knowledge. This can be achieved by setting up a university Spin Off and / or by issuing licenses through technology transfer centers.

Aim and objectives of the research: The aim of the research is to study the international experience for the development of recommendations for the commercialization policy of Georgian universities. Based on the goal, the following tasks were set: 1. Determining the essence and importance of the University Spin Off Company; 2. Discuss the theoretical guidelines for the formation of a university spin-off and identify the main features; 3. Study of foreign experience and formulation of conclusions and main findings based on it.

Specific universities from EU countries (Brussels (ULB - Belgium), Dublin (UCD - Ireland), Tartu (UOT - Estonia), Kaunas (KTU-Lithuania), West Bohemia (UWB - Czech Republic) and Ljubljana (UL - Slovenia) were selected as the object of research. They actively cooperate with Iv. Javakhishvili Tbilisi State University (Georgia) and at the same time is distinguished by a successful innovation policy. This selection shows the differences that exist in the direction of the formation of innovation policies of universities and at the same time creates the opportunity to share the experience accumulated by the target universities.

The study contributes to the existing research in successful university spin-offs. The approaches that characterize European University innovation/ commercialization policies are clearly defined, which may differ from American or Asian approaches.

The information data is diverse and combines the theoretical and applied works of foreign economists; Studies and publications of various international organizations. In the process of information processing, the introduction of relevant Georgian terminology related to innovation was introduced. It is a carrier of marketing content and accordingly is presented in the text in this form, including: 1. Scientific entrepreneur (Academic entrepreneur - surrogate entrepreneur); 2. Internet technology of items (Internet of Things - IoT - connected devices, sensors and activator networks); 3. Centers of Excellence (Centers of Excellence - research laboratories with a high degree of competence); 4. The Country of Excellence. 5. Excellence of Science. Data analysis, synthesis, comparison, deduction and induction methods were used for the study of the present paper. From a methodological point of view, the evaluation of universities' innovation policies was carried out according to three models of university spin-off forms.

2 Theoretical Background

In the 21st century the main mission of the University, based on the target universities is implementation of teaching (theory) and research (fundamental, applied and developmental). Research and teaching can be considered achievable when created value is based on the university resource: in the form of a technological product and / or service, which creates the need to commercialize scientific knowledge.

Based on the university invention, it is possible to: 1. Create an independent organization in the form of a university spin-off and / or 2. Find an organization in the market that will be ready to acquire it. Such activities contribute to the commercialization of university technologies and the opportunity for economic development. There are many successful examples of university spin-offs in the United States, including Silicon Valley and Route 128, which developed on the basis of the prestigious Stanford and Massachusetts Universities of Technology.

There is no common universally accepted definition of a university spin, as we see various definitions of it, suggested by scholars at various times (Phan & Siegel, 2006) (Klofsten & Dylan, 2000) (Bellini, et al., 1999) (Weatherston, 1995) (Klofsten & Dylan, 2000) (Lockett, Siegel, Wright, & Ensley, 2005). Based on the proposed variety of definitions, we can conclude that the University Spin Off is an

organization based on research conducted on the basis of the university, and its future development is worked on by representatives of the same university: lecturers, current students or alumni. Its purpose is to meet market demands based on the commercialization of research results. University Spin Offs, technology transfer centers, etc. are the tools of the University Innovation Policy. The main goal of the University Innovation Policy is the creation and use of technology for economic development.

The university spin-off technology involves an inventor in the commercialization process, which is an important precondition for the development of a university technology product and / or service (Hindle & Yencken, 2004) (Jensen & Thursby, 1998). The process of creating technology by the university is complex and requires high involvement / funding from the government, industry and / or investors (stakeholders) (further used to support research in science and engineering).

There are the three most common models of university spin-offs. In particular:

1. The first model combines four important stages of creating a spin-off, namely: 1. Generating a valuable business idea based on research, 2. Transforming an idea into a business, 3. Creating a spin-off firm, 4. Generating economic value through a spin-off firm (Ndonzuau, Pirnay, & Surlemont, 2002);
2. The second model combines the five stages of creating a university spin-off (Shane, 2004): 1. Research. The university uses funding from both state and private companies to conduct research. The main purpose of this stage is to create new scientific knowledge and not the interest of its commercialization. 2. Invention. If new knowledge is considered to enable the formation of new technology, then the University Technology Transfer Office will be activated. 3. Protection of intellectual property. In some cases, researchers believe that their new technology is an invention that must be commercialized. At this point, the university must apply for a patent and work on a license in the future. 4. Technology Marketing. The University Technology Transfer Office is looking for a company in the private sector that is interested in licensing and commercializing similar types of technology. If a new firm is formed to obtain a license, it means that a university spin-off is being set up. 5. Technology licensing. The last step is to determine what type of license should be issued: exclusive or non-exclusive.

3. The third model shows the five phases of university spin-off development and the separation of four critical points (Lockett, Siegel, Wright, & Ensley, 2005). In particular: 1. Research; 2. Capabilities; 3. Pre-organizational; 4. Phases of re-orientation and 5. Sustainability. According to the authors, critical points arise when moving between phases, creating the need for additional resources and capabilities, namely: 1. Capacity recognition; 2. Entrepreneurial obligation; 3. Achieving credibility in the business environment and 4. Sustainability.

After Overcoming the critical phases can create a spin-off. If the research identifies the opportunities that meet the market demands, it is possible to form a new technology.

The next critical node is the entrepreneurial commitment, which requires the academic-entrepreneur to expand his/her business activities. A common characteristic of academics is the unacceptability of uncertain situations created by the commercial environment. Most of them find it difficult to delegate or share responsibilities when it comes to commercializing their intellectual property.

Attracting sufficient funding at the pre-organization stage is a key requirement for acquiring the necessary resources. Finance is the main resource without which the formation process cannot be continued / completed, and the last critical node is - sustainability: if the academic community cannot

show that it has the ability to trade, then there is a risk of losing financial investment and potential market share. Ultimately, risky university spin-offs need sustainable returns to survive. When this barrier is overcome, the process of creating a university Spin Off is completed.

A holistic (multi-stage) model for the creation of a university spin-off in 2007 was added to these models. Compared to the models discussed above, this model relies on capabilities (Newbert, 2007). Newbert notes that capabilities act as preconditions in any research setting. The model focuses on issues such as:

- Intellectual Property (IP) rights. The IP system affects the degree of involvement of researchers and universities in patent and commercial

activities. For example, in the US since 1980 works the so-called Bayh-Dole Act (the 96th United States Congress, 1980), which gives universities the right to intellectual property. Such an approach can encourage patent and licensing activities on university inventions.

- Research and development (R&D) and other investments in innovation. Entrepreneurship cooperation with universities has practical importance. This form of cooperation enables the business sector to compensate for limited internal resources in both innovative and highly skilled workforces.
- The market simplifies the process of commercialization of inventions for technologies and the quality of cooperation with companies. Universities today are the suppliers of the latest technologies in the market. As Prof. In countries characterized by political, legal and macroeconomic instability, firms prefer to focus on solving short-term tasks. This creates a technological trap where the firm prefers to use outdated technology (Papava, 2020).
- Business support infrastructure such as incubators, knowledge transfer centers, science parks, etc. allows university spin-offs to market and commercialize ideas.

Thus, based on the theory, we can distinguish the following features typical of university spin-offs: 1. The university or academic institution is the creator of innovation; 2. The University Spin Off is a body legally separated from the University, an independent legal entity and not a controlled body; 3. The spin-off uses knowledge that is derived from academic activities and / or is the result of academic activity; 4. The purpose of the spin-offs is to generate benefits and commercialize technology.

3 Conclusions and Key Findings

The review of foreign experience has shown that universities' innovation policies are focused on addressing issues such as: joint research projects; University consulting activities; Opportunities for collaboration between creators and users of new knowledge; Knowledge creation - by publishing research results and obtaining intellectual property rights; Entrepreneurial activities of faculties and students (Spin-offs, incubators, technology transfer centers); Mobility of highly-qualified students from universities to the private sector and vice versa.

As we have seen, the goal of innovation policy in universities is to transform existing academic knowledge into a valuable technological product and / or service. The main means of achieving this goal are: university spin-offs, patent and licensing activities. At the same time, the target directions for innovation activities are defined. The successful implementation of the goal depends on: 1. the legal framework that gives universities the right to intellectual property; 2. Existence of research infrastructure, including incubators, accelerators, technological laboratories, knowledge transfer centers; 3. Access to financial resources, which integrates the finances of government, university, commercial and international institutions. All this is directed not only to the implementation of research but also to their future development; To the human resources created by the university itself (raising the qualification is a priority); To strengthen interdisciplinary connections, to integrate knowledge and experience in different areas in the best way and to solve the existing problem.

In this paper, we present several models of university Spin Offs formation. One of the models discussed, does not name a study phase as an initial stage, it is important for the next two, and for the fourth model. The initial stage is to identify capabilities and competencies. As we know, research is done to solve a certain problem, so research planning is preceded by the issue of problem solving. Therefore, the first stage of Spin Off formation is to identify the problem; Second stage: problem research (fundamental or applied) and generating new academic knowledge (identifying capabilities and competencies); Third stage: transformation of the opportunity defined in the second stage into innovation (at this stage the university research infrastructure is involved: incubator, accelerator, technology park); Fourth stage: protection of intellectual property and announcement of innovation (technology transfer center is involved. At this stage, it is determined whether a spin-off will be formed or the created technology will be licensed); Fifth stage: Generating economic value.

In turn, the degree of incentive for university technology depends on how the national innovation system is structured and how well it can ensure collaborative relationships between different stakeholders and the science sector. Other knowledge flows such as informal contacts, consultations are actively used in the knowledge transfer process.

As we have seen, academic knowledge is transformed into innovation in such a way that we either face a new combination of existing knowledge or create a whole new one that is geared towards solving a specific problem. The part of the business sector that collaborates with the university remains profitable because it has the opportunity to use research results from higher education systems or research centers

and laboratories as a source for potential innovation or product development. And knowledge transfer mechanisms such as patents, technology licenses and research collaborations, on the one hand, make the enterprise competitive and, on the other hand, the main goal of the university's innovation policy - to transform knowledge into innovation and increase economic and social prosperity based on it. The human resources used in this process, again provided by the university, determine the pace of further development of the country.

Benefits of joint projects include access to highly qualified human resources and the emergence of new opportunities, different approaches to solve existing problems based on them. Access to university research and discoveries and the development of their commercial potential are based on the innovative activities carried out by the companies by the University. Access to scientific knowledge increases the firm's ability to find, assimilate technological information and ensure its use in real space.

The potential benefits we derive from the University's innovation activities, which are largely generated through collaboration, may be reduced due to a number of factors, including inadequate infrastructure for knowledge generation and transfer (university and science parks), firms' inability to absorb new knowledge and low conversion ability).

It is important to focus on providing a legal and administrative framework that encourages universities to commercialize intellectual property. Researchers need to be stimulated / trained to be able to generate their own ideas and develop inventions. Collaborative processes between the university, business and the public sector make a great contribution to achieving this. Joint activities facilitate the formation of institutions such as: technology transfer offices, business innovation centers, science parks and technology hubs, government-sponsored patent funds, etc. Joint large-

scale projects are also being set up to ensure diversity of participants and strengthen links between disciplines.

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