ENTREPRENEURSHIP IN UNIVERSITY RESEARCH

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Abstract. In relation with the increased role of research in the context of the knowledge-based society, the paper deals with the development of the entrepreneurship in university research. Initiating new business or improving performances in various areas of economic and social life through the application of the research results can be seen as ways of achieving progress, very important considering the impact on the society evolution. In this context, the development of the entrepreneurship has become a key factor which influences the final results of research, development and innovation cycle, obtaining useful effects more efficient and faster. The paper examines the connection between entrepreneurship and university research valorisation, and aims presenting three relevant issues: increasing role of university research in knowledge-based society; modern ways of transferring results of the university research and the role of entrepreneurship in the successful completion of technology transfer; university spin-offs and the main entrepreneurial activities of their implementation process.

Keywords: entrepreneurship, university scientific research, technology transfer, university spin-offs

1. Introduction

The development of the entrepreneurship is one of the themes extensively promoted in academic and business environment in the last decades, as a key factor for increasing the number of jobs, the competitiveness and economic growth. The terms „entrepreneurship" and "entrepreneur" have multiple meanings, in this regard, authors in a distinct study [9] develop some considerations. In its most general meaning, the term „entrepreneurial" is associated to persons and organisations, and defines a specific behaviour, characterized by the emphasis on introducing new, the exploitation of opportunities [3].

In a practical sense, the entrepreneurial behaviour has multiple materializations: implies creating a firm, achieving a change or a project. In all cases, these approaches are based on new idea: whether to create new organizations or make changes within existing organizations, one starts from a creative new technique - product or technology, new solutions to organizational and working methods whose implementation can generate benefits.

The novelty level of the idea may be higher or lower, but as a general note, entrepreneurship is in relation with processes of research, development and innovation: one can say that entrepreneurship is a key factor in the valorisation of research results by completing the research-development-and innovation cycle.

The collocation Research-Development-Innovation (RDI) - often used in the last decade, comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, and the use of this knowledge to device new applications. The RDI cycle includes [18]:

- **Basic research** - experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.
- **Applied research** - also original investigation undertaken in order to acquire new knowledge, directed primarily towards a specific practical objective.
- **Experimental development** - systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.
- **Innovation –** means activities that ensure the implementation of research and development results in society, in order to obtain monetary or non-monetary benefits. The innovation action includes the implementation of a new or significantly improved product (good or service) or process, a new marketing methods, or a new

organisational methods in business practices, workplace organisation or external relations [19].

Using RDI triad instead of the Research &Development expression emphasizes the importance given to complete creative processes by applying the research results in real world. This is one of the distinctive elements of the strategies and policies pursued in the last quarter century in the context of the growing importance of scientific research as a key factor for competitiveness and social-economic development.

At European Union level, the main milestones of RDI strategy have been established in Lisbon Declaration (2002), with the final goal that Europe's economy to become "the most competitive and dynamic knowledge-based economy". Lisbon Declaration Resolution includes two essential requirements for achieving this goal:

- growth of the research funding: increasing costs of research and innovation in EU in order to reach 3% of GDP until 2010;
- rise of the research and development efficiency, a stronger orientation towards society's problems and quickly achieving real effects, by applying results of scientific research in the economic and social life.

In this context, the development of the entrepreneurship in university research has become a priority action. The aims of this paper are: underlying the increased role of university scientific research in European Research Area; presenting the most important ways to achieve technology transfer from university to the social-economic environment; clarifying the concept university spin-offs and identifying the main entrepreneurial activities undertaken by universities in order to transfer their research results by creating spin-offs.

2. Role of the university research within European Research Area

All over the world, the universities are important components of national RDI systems, joining the great potential among the research factors [2]. Scientific research in higher education institutions entails primarily teachers, but also students, graduate students and other staff members, whose involvement in scientific research is governed by internal regulations and national laws.

Enhancing role of RDI activities in the current context of developed society, characterized by high rates of change, fierce competition, globalization and other phenomena with effects on quality of economic and social life, requires developing scientific and technological potential existing in universities, and, especially, improving performances of the university research.

There are several reasons for focusing on academic research and the most important are discussed below. To invest in university research has become increasingly important in order to assure the economic progress, considering the concentration of intellectual capital in higher education institutions, especially highly skilled human resource. To this aspect, one can add that the development of university research contributes directly to training human resources for research, primarily in the PhD training cycle. Emphasizing the role of university research is a phenomenon caused in part by the fact that, with the increasing complexity of RDI processes and consumption funds, the firms' investments on fundamental and long-term research are falling. Even in USA, at the multinational and large companies, like Bell Labs, IBM, Xerox Park - once bastions of research, the trend is limited to applied and short-term research. In this line are the pharmaceutical companies too, more oriented towards clinical trials, the last stage of the drug whose efficacy is proven [10].

These arguments in favour of development of the university research are important in European Union too, where universities focus more than 80% of European basic research, and creating conditions for them to be able to play better this role it is necessary. Relatively low performances of academic research in the European Area of Higher Education, compared with US and Japanese universities, add to [1].

The policies promoted in this area in the last decade are circumscribed to overall objective of creating an European Research Area (ERA), being guided by a series of strategically documents elaborated by the European Commission in 2000-2007. Basic philosophy of EU research policies is to increase the quality of research - achieving excellence in research, and that research excellence can be promoted through increased cooperation and investments. Closer links with business and industry, strengthen of the knowledge transfer processes are also required.

3. Knowledge and technology transfer – strategies and actions

Knowledge transfer consists of the range of activities which aim to capture and transmit

knowledge skills and competences from those who generate them to those who will transform them into economic outcomes. It includes both commercial and non-commercial activities such as research collaborations, consultancy, licensing, spin-off creation, researcher mobility and publication.

„Knowledge transfer" is a wider concept than "technology transfer" is, it includes other transfer channels, such as mobility of staff or publications.

The collocation **technology transfer** defines the process of transfer of knowledge, rules and methods by which results of the technical and scientific activities are available of users, to develop new products and services, processes, applications and materials.

Globally, the process of marketing and exploitation of research results is performed under a variety of forms, differentiated in terms of both financial support and the structures created.

a) The structures of technology transfer can work in research institutions, governmental or multinational organizations. In recent years, many universities have developed specialized structures for technology transfer, technology parks and business incubators being the most popular in this area.

Technology parks (or Science Park) are non-profit organizations, usually formed in addition to a university in collaboration with companies, public administration, employers' associations, etc. A concept that is now 60 years old, technology parks aim to encourage greater collaboration among universities, research laboratories, and large and small companies, providing a means to help convert new ideas into innovative technologies for the market To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through spin-off and incubation processes; and provides other value-added services together with high quality space and facilities [5].

Structures set up **business incubators** are public and/or private, usually attached to universities, sometimes in science parks, in order to support the development of new business through resources and support services. Business incubation is a flexible combination of business development processes, infrastructure and people designed to nurture new and small business by helping them to survive and grow through the difficult and vulnerable early stages of development (UK Business Incubation Limited, 2009). The manner to carry this support may vary from one incubator to another and from one customer to another, the successful completion of the incubation program increasing the chances of new businesses to remain in business long term.

b) The financial support of technology transfer means ensuring necessary financial resources to apply the results of scientific research in economic and social life. This involves licensing agreements or establishing partnerships or associations, which both parties share profits and risks in the market launch of new products and/or technologies.

Often these approaches are associated with the use of risk capital or to "business angels". The expression "risk capital" defines funds for development or investment in companies located in emerging market phase one; "business angels" refers to investors who have significant personal financial resources and management experience, which provide financial support to small projects. Usually the investment in a new business is based on ownership of the new company in exchange for money give up. Another possibility is to achieve technological transfer of funds raised - government funding for SMEs and national and European funding programs.

Accelerating technology transfer is one of the central axes of the strategies and policies pursued at European, national and institutional levels, circumscribed to the concerns for the European economy become more competitive. Analyzing the knowledge transfer at European and national levels (2006), the European Commission determined that it is necessary to identify new areas of action and, in particular, to introduce more focused strategy to facilitate the creation and marketing of new innovative products and services, in established areas. Some measures have been suggested (Europeean Commission, 2007b), which include:

- elaboration of guides and guidelines that help improving knowledge transfer related to the management of intellectual property;
- development of university structures and resources specialized in technology transfer (with the certification of skills and accreditation);
- developing entrepreneurship culture in

universities and stimulating researchers to participate in technology transfer activities.

In this context, the development of integrated RDI strategies and their financial support by European programs are important. May be mentioned:

- European FP7 program launched for 2007-2013, which forms the main instrument for funding research and innovation and developing dialogue and cooperation with industry and academics. In this framework, specific program Partnerships ensures the cooperation between different organizations - universities, institutions, business companies, public administration - in order to conduct complex RDI projects. The projects carried out include the application of research results, usually within partner organizations.

- Operational Programs, including specific programs for Human Resource Development (POS DRU) and for Economic Competitiveness Growth (POS CCE). In this context, the most important are: the 3th POSDRU priority axis – „Increasing adaptability of workers and enterprises", promoting entrepreneurial culture, and the 2nd POSCCE priority axis – „Competitiveness through Research, Technological Development and Innovation" which main objective is developing organizations - innovative start-ups and spin-offs.

The above examples show the general framework for achieving transfer of research results at EU level, and the diversity of the action ways. The application of these solutions is associated with entrepreneurial behaviour, which manifests itself as an important factor to reduce the distance between university research and its development into products and processes.

The last part of the study presents some aspects of the entrepreneurship development in university research, in relation to the spin-offs creation.

4. University spin-off and entrepreneurship

Spin-off concept is used in the literature with different meanings [10]; the understanding given in the paper is, newly created or to establish company, based on results obtained from a research project of a public research organization or university [20].

The above definition highlights three distinctive elements of a spin-off: 1) it is a new organisation; 2) it is an innovative organisation; 3) spin-off values the results of public research institutions or university research. Creating a university spin-off is based on patents or other protection mechanisms of intellectual property, but it can be created also to valorise the results of the design that are not or cannot be protected. In this last category, scientific creations, new forms of organization, new methods of management etc. are representative.

Spin-offs are forms of technology transfer used by over half a century by U.S. universities For example, the famous Massachusetts Institute of Technology (MIT) is engaged in the process of technology transfer from its laboratories in entrepreneurial firms after World War II. More recently, in the 80s, the process was formalized. Since then, the MIT Technology-Licensing Office created over 250 new companies. The effects are notable, measured by creating jobs, introducing new products to market, increasing local value, entrepreneurship development in the region [10]. This is no a singular case in USA. The watershed event in university technology commercialisation in the USA was the passage of the Bayh-Dole Act in 1980, that gave universities greater incentives to license their technologies and made the process easier to undertaken. The law allowed universities and researchers themselves to have ownership and potential profit from their scientific work [6].

In the last decade, this pattern of exploitation of university research results was implemented in universities from Canada, Australia, and European countries too [12]. The importance which is given is determined by the key role of university spin-offs in relation to local economic development, creating jobs - particularly for highly educated people and better satisfying customer needs. In addition, university spin-offs have positive impact on university: provide financial support for university research and help universities achieving better their mission of research and learning.

Studies on this subject show that existing spin-offs operates a diverse range of technologies, but primarily such businesses technologies aimed at turning highly technical. After the spin-off activity object, there are companies carrying out new products or new services. The increase of the spin-offs capacity varies depending on type of organization, field of activity, funds available, and market relations. University spin-offs are usually created around the parent university, in technology parks. There are also different manner to valorise the university intellectual property:

typically, universities derive incomes as royalties, but there is also the possibility of the university participation to the capital of the newly created organisation.

The process of creating spin-off is complex, involves a series of scientific, technological, organizational, financial and commercial activities. The starting point is a new idea - product or technology, which would be implemented by creating a new organization. Creating a spin-off requires, then, the existence of an initiator or initiative group, finding funds to support the project, negotiating the license with the university. The next step is to develop technology and includes, as critical step, identifying the best users, and finally drawing product marketing and alliances/ agreements with other companies.

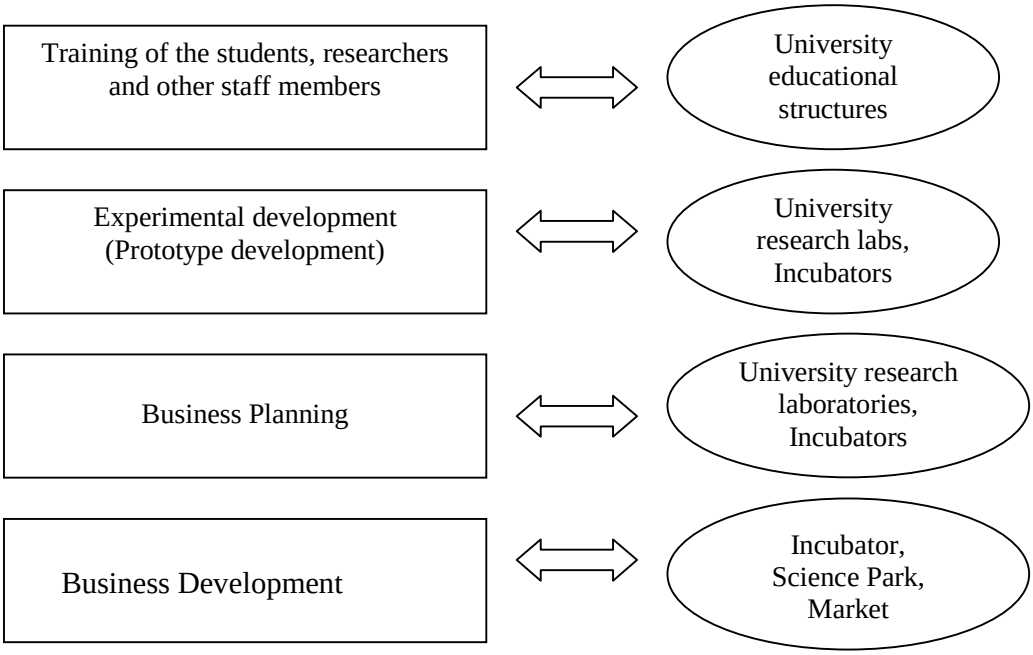

Figure 1. Main sequences of the development process of university spin-offs.

All of these sequences are complex and involve, on the one hand, giving of the new organization sufficient freedom to operate and provide rewarding investors; on the other hand, providing for the university sufficient investment for technology development, protection from risk, recovery of money. Making decisions is influenced by several factors, internal and external, objective and subjective.

Finally, is carried out feedback, which highlights the positive and negative aspects. Positive consequences include university-industry partnerships, development of entrepreneurship education of researchers and students, providing its own resources to fund RDI. Cannot be neglected possible negative aspects such as distortion of research directions, the existence of conflicts of interest, etc. The attention to these shortcomings is well justified, providing necessary information to determine the top management strategies and policies for technology transfer.

It must be said that promoting this form of technology transfer is not accessible to any university, depends on several factors.

First of all, the university must have notable results in scientific research, in top fields of knowledge.

Secondly, university must support the protection activities of the research results, not only financially, but organisational too, by developing specialized structures. It is also important for the university to provide technical assistance for implementation of the prototype and technological development, where appropriate, specific activities in the development phase of new products/ technologies. In this regard, the incubation and coaching activities are important, and can be made within the university structures (laboratories, incubators) or in partnership with third parties.

Finally, it is important to develop the entrepreneurial culture of university researchers, which requires training them through systematic actions in order to develop entrepreneurial and management skills and abilities, on: creation of new companies, market research, intellectual property protection, business management. These issues can be found in Figure 1, which shows the main sequences of the spin-off development process.

5. Conclusion

The paper focuses on the relationship between entrepreneurship and valorisation of the results of university research.

Accelerating technology transfer, entrepreneurship development in scientific research, creating university spin-offs are the result of concerted actions at several levels.

The changes relate primarily that the university research to be finalised by new products and technologies. Then, it must make the protection and transfer of research results, by which the university contributes to economic development and job creation, and also ensures RDI sustainability. Another key factor that contributes of the efficient operation of technology transfer is entrepreneurship education of the academic community members - teachers and researchers, students and other staff categories.

The entrepreneurship development in university is performed under a variety of forms, from developing projects and training programs in entrepreneurship, business clubs for students, resource centres, competition for business plans, partnerships with economic actors in the region that can support business, guides for student entrepreneurs and other training materials on entrepreneurship and promoting entrepreneurship

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