

GENERAL ASPECTS RELATED TO THE TECHNOLOGY TRANSFER, THE MAIN SOURCE OF INNOVATION AND DEVELOPMENT AMONG ECONOMIC OPERATORS

Felicia Diana Nicoară^{1*}, Dorin Maier², Andreea Maier³

¹ PhD Student, Technical University, Cluj Napoca, Romania and Institute of Research and Development for Isotopic and Molecular Technologies, Cluj, Romania

² PhD Student, Technical University, Cluj Napoca, Romania and University of Economic Studies, Bucharest, Romania

³ PhD Student, Technical University, Cluj Napoca, Romania

e-mail:

*dannifeliss@gmail.com (F.D. Nicoară), dorin.maier@gmail.com (D. Maier),
maier_andreea@ymail.com (A. Maier)*

Abstract

Efficient actions carried out in technology transfer bring major benefits to all parties involved in the process. Increasing the technological endowment through the process of technological transfer from research to industry contributes significantly to the improving of the economic growth rate at the national and regional levels. Universities and research institutions as providers of knowledge are able to supplement their incomes and achieve financial autonomy in order to conduct entrepreneurial activities and research. They can also obtain other collateral benefits such as attracting research contracts sponsored by some economic operators, the ability to hire and retain top personnel and researchers. Romania, in terms of technology transfer and innovation activities among economic operators, is still trying to catch the significant gap compared to other European countries. In these conditions technology transfer processes must be well understood and put into practice both at research institutions as well as at the economic agents.

Keywords: technology transfer; innovation; organization development;

JEL Classification: O32, L20, M10

1. Introduction

Currently, technology and scientific progress, because of research and development is an essential element in providing innovative solutions to socioeconomic problems we face. Economic and social developments depend, of the transfer speed in the production of the technical scientific creation. Technology transfer is a highly topical area of study given the role it has in ensuring sustainable economic development. Currently, both the developed countries, that have already demonstrated the importance of technology transfer as well as the developing countries, are adopting strong policies to support research and development and stimulate the transfer process of research results from the scientific community to industry.

2. Scientific research, technology development and innovation

In the current economic context, the generation of knowledge and its transformation into new and innovative products and services, becomes a crucial process, defining for the economic competitiveness, being the basic premise to achieve a competitive advantage both at the organizational level as well as at nationwide.

Research, development and innovation have a positive impact on the quality of life through various economic and social benefits that they generate, materialized into: application of sustainable and efficient operational processes for energy resources, new materials, new medicines, high performance and non-invasive investigation and treatment solutions, the application of new technological solutions to protect the environment and security of citizens, the emergence of new markets, dynamic evolution and transformation of the existing one, generating regional and national economic development, and so on [1].

The research and development components, including innovation and technology transfer activities, are [2].

1. Fundamental research;
2. Applied research;
3. Technological development with its two components pre-competitive and competitive;
4. Innovation;
5. Technology transfer.

What differentiates the fundamental research from the applied research is that the last one is directed towards incorporating basic, fundamental and empirical knowledge in a product, process or service that may have a market value. When the knowledge is well performed, so that it can support the development of new products, technologies and services, we talk about development [1], [2].

The technological development consists of systems engineering and technology engineering activities through which the application and transfer of the research results to the economic agents as well as in the social plan is realized, aimed at introducing and materializing new technologies, products, systems and services, and improvement of the existing ones [3]. The technology development can be pre-competitive or competitive. Pre-competitive development refers to the transformation of knowledge into plans, schematics, documentation for new products, technologies and services, including the experimental and prototype manufacture, without being sold. Competitive development is focused on transforming knowledge into products, technologies and services, which can respond directly to market requirements [4].

Innovation can be defined as an activity directed towards the generation, assimilation and capitalization of research and development results into economic and social area. Innovation is a product of innovation activity, materialized in a new feature or improving the functionality of a product, process or service in any of the economic and social life areas which can bring economic added value responding to the market in a new and original way [5].

In an economy and business environment, innovation is a catalyst for growth and development. Entrepreneurs constantly seek new ways to meet the needs of consumers through improved products and services in terms of quality, durability, efficiency of use, technical performance and after sales services, which are obtained by innovation technologies and organizational strategies [6].

3. Defining the concept of technology transfer

Technology transfer is a relatively new research discipline rather complex which leads to the absence in the literature of some generalized conceptual models able to define very precisely what is the technology transfer and the circumstances in which it is conducted. The purpose of technology transfer is the transfer of research results into the economy. The terms *technology transfer*, through its name suggests that the subject of the transfer is the technology. The expression is very general but because the term technology comes from the Greek “*technologia*” (techno - art, skill and logia - study) is one of major amplitude that needs to be explained. Technology is a scientific and technical knowledge regarding the processes, procedures and work programs, materialized in equipment and / or documentation and the know-how used by people to design, manufacture, exploiting, maintenance and eventual marketing of a product or a category of products or to complete a task or a category of activities.

Technology transfer is the introduction or acquisition in the economic circuit of specific technologies and machinery, equipment and facilities resulted from research, in order to obtain new or improved processes, products or services, required by the market or through which the innovative behavior is adopted, including the work to disseminate information, to explain, to transfer knowledge, to advise and communicate with people who are not experts in the results of basic research and pre-competitive applied in such a way as to increase the chances of application of such results, provided by an owner of the results [5]. The technology transfer involves a series of relationships, whether formal or informal, between R & D units and public or private economic sectors. Entities that participate to the technology transfer aim to accelerate the economic use of research results involving the transition from invention to innovation and dissemination of successful market thus creating added value [4].

Another interesting aspect is that of demarcation *of the technology transfer object*. Technology definitions have in common the recognition that it encompasses knowledge. This knowledge, however, must have three characteristics: it must be transferable, to be standardized and it must satisfy a need, to provide a response to an existing problem.

If the technology is well standardized and can be delivered as a standard socio-technological package the demarcation of the technology transfer object is relatively simple. For the technologies that exist in various

forms, unstandardized, demarcation becomes more difficult and requires special attention not to endanger the transfer success. Most times, however, technology transfer is adapted by custom applications based on specific requirements and tacit knowledge [7].

Another understanding is that technology transfer has as an object not only the technology itself namely *explicit knowledge* but also *tacit or informal knowledge*. The forms of *direct* or *indirect* technology transfer are often associated with the type of information that needs to be transfer. Explicit knowledge is presented in coded, methodical, systematic and articulated form. They are stored in different environments (*disembodied knowledge*) and can be retrieved from media, transmitted and stored [8]. Because explicit knowledge can be codified it can easily be protected by different types of intellectual property protection policies and it can be more easily the object of the technology transfer process [9]. *Tacit or informal knowledge* is represented by knowledge of each individual; they have subjective character and incorporates intuition, experience, emotions, and internalized observations of each one. This form of knowledge is very difficult to formulate and transmitted as it is embodied in the personality of each person (*embodied knowledge*). The transfer of tacit knowledge is a process that requires a good cooperation and interaction between the entities involved in this process and it can be very difficult to quantify and manage [8]-[9]-[10].

4. The main entities involved in the technology transfer process

In essence, to the process of technology transfer participates directly or indirectly a series of entities or groups of interest [1]-[11] :

1. The research and development institutions, public or private, which are the source of knowledge and have the technology transferred object;
2. The agent arranging technology transfer process which may belong or not to the research institution;
3. Entity (company) that receives and implements scientific results;
4. Public or private institutions that provide financing mechanisms;
5. Government through strategies, policies, resources;

All entities that contribute to the achievement of the technology transfer process have the common goal of accelerating the economic use of research results involving the transition from invention to innovation and distribution on the market creating added value. Universities, research institutes and government research laboratories are sources of technology which must be exploited in the interest of society [11]. To facilitate the connection between them and the economic entities wishing to implement and apply technological innovation for achieving a competitive advantage various intermediary organizations have emerged. The role of intermediation is very important, as evidenced by the large number of institutions of this type that occurred in the last 15 years [12].

Worldwide it can be noticed the creation of a network of organizations that aim to increase competitiveness by enhancing and streamlining the process of technology transfer. They act as an interface between research units and industrial companies, being attached to or associated, in most cases, with a public research organization. A European Commission study shows that in 2004 European wide, there were 1393 technology transfer institutions divided into three organizational types [12]:

1. Technology transfer offices. These are defined by the OECD as "organizations or parts of an organization that helps the staff of a research institutions to identify and make available intellectual property management, including protection of intellectual property rights and transferring or licensing such rights to other parties in order to increase the possibilities for development ";

2. Technology parks and business incubators that help staff of a research institutions to create new companies in order to develop and commercialize an invention;

3. A specific research organization providing research services to the private sector, provided that they have specific technology transfer functions located in one or more departments or disseminated within the organization.

From an organizational perspective, we notice two models [12]:

1. Subsidiary organizations acting outside public research institutions but owned by them or at least one of their departments;

2. Public or private independent intermediaries whom offer their services to one or more public research institution.

The organization mod of technology transfer units is chosen depending on a number of factors such as: legislative specifications on the intellectual property rights, degree of institutional autonomy of public research institution, legal status of the institution's research and amount of public funding available for technology

transfer institution.

Technology transfer offices (TTO) act as intermediaries between researchers, government research institutions and companies in the economic environment, being an essential tool for developing relations with industry. They constantly supervise the results of research and knowledge capital of the institution to identify those results with real potential for recovery and encourage researchers to focus their research towards technological opportunities offered by the market. The activities carried out have strong economic implications because besides the fact that they can generate substantial revenue for the research institution they may lead to local economic growth and job creation. Technology transfer offices act as catalysts in the process of technology transfer, as converts of knowledge and economic impact enhancers [13]-[14].

Through the specific activity performed by TTO, they have the ability to reduce distrust, to overcome the prejudice, diminish resistance or indifference to the commercialization of research and create a collaborative attitude of researchers and industry to the technology transfer process. For this purpose TTO provides assistance and training to familiarize and educate researchers on intellectual property and entrepreneurship concepts, solve administrative problems for the legal aspects of intellectual property protection process, create a network of connections with various other technological transfer centers, entrepreneurs, potential investors and other support organizations, provides advice on the preparation of business plans, establish management teams for the establishment of SPINN-offs and endeavor to attract funds for finance [15]. Through their role of knowledge converts TTO adds value to the relationship between research and industry, directly and positively affecting the congruence between scientific discoveries characteristics and needs of the market. The TTO provides continuous feedback loop between the research and industry [16].

Researchers are informed about certain reactions, requirements, market trends on technological aspects so that they can adapt the results in order to increase the economic value of the invention. TTO are aimed also to the technical assessment of the invention, which determine the viability of the technology and determine whether the patenting efforts are justified by a particular economic potential. Through this evaluation, the costs of protecting intellectual property rights are limited and the involvement in a resource-consuming process where marketing potential is low is avoided. Market research, identifying potential industrial partners and getting their feedback on the outcome of the research is intended to be transferred to another object of the TTO [15]-[16]. A study conducted by [15] revealed that many TTO are not focusing exclusively on a policy of maximizing revenues through economic exploitation of research results but began to focus on maximizing the social impact, focusing on maximizing scale and speed of application. Thus TTO seeks to maximize diffusion of research results through specific measures such as limiting the exclusive licensing and ongoing monitoring of licensing agreements in order to ensure a sustainable relationship between the parties involved in the technology transfer process.

Besides R & D institutions, economic agents and intermediaries from industry in the process of technology transfer also attended a very important actor that decisively influences this process: government by representative authorities. Thus, through policies strategies and resources involved its influence and directing the technology transfer process. Funding mechanisms have in their turn an essential supporting role [5].

5. Dimensions of technology transfer

Technology transfer can be seen in terms of two dimensions: vertical technology transfer and horizontal technology transfer (Figure 1).



Figure 1. The scheme of vertical and horizontal technology transfer [5]

The vertically technology transfer is characterized by displacement of research and development activities

information and knowledge from fundamental research to applied research and experimental development to achieve at the end of the process a technology that is applied to obtain innovative products or processes [5].

The horizontal technology transfer takes place at the moment when a movement of information and knowledge about a product or process between two different organizational entities, or between different departments within the same organization occurs, or basically when diffusion of a technology by applying it to new purposes take place [5].

6. Current developments in the main channels and methods of technology transfer

In order to transfer research results into the economy are being used a number of mechanisms or transfer channels. A first distinction that makes the literature on technology transfer channels refers to formal and informal transfer channels. Formal channels are those that take place based on a contract between parties, which makes clear clauses of copyright, and disclosure of secrets. In the specialized literature there were identified a number of formal channels used for knowledge transfer, seven of the most important beings [17]-[18] :

1. Licensing or sale of a patent (a company buys the legal right to use a specific part of the intellectual property from the research institution or buys a patent from it);
2. Establishment of a spin-off (creating a new business operating license or a patent which has a connection with research institution);
3. Scientific consulting contracts (firm appeals to scientific and technical consulting from a specialized research institution);
4. Establishment of the research consortia (involvement of one or more companies and several research institutions in a major project);
5. Temporary mobility or not of professionals researchers or graduates (employment by a firm the researchers from the scientific environment or graduates of a university);
6. Research and development contracts (a company pays for a specific research work and well-defined command executed by a public research institution)
7. Funding / sponsorship of research (a company sponsors the fundamental research of public research institution).

Commercialization of scientific research is an entrepreneurial phenomenon developed in the universities and research institutions. The commercialization of research results based on the patent, licensing and the establishment of spin-offs are transfer channels that have grown dramatically in recent decades [19]. The license agreement is a contract whereby the licensor gives the licensee the right to exploit its intellectual property rights and setting out the rights and obligations of the parties. Through license agreement, it can be granted exclusive or non-exclusive rights to use the intellectual property rights. This phenomenon primarily was associated with the occurrence of a wave of policies having a supporting role in the ownership of research results, through the increasing interest of industry towards exploiting knowledge obtained from external sources and the appearing of the support organizations such as technology transfer offices [11]-[20]. The licensing process is, however very complex and controversial, its success being influenced firstly by: intellectual property issues, the policy of granting rewards and incentives, the nature of the invention, the stage of technology development, institutional context, professional and personal motivations of researchers, the office's capacity of technology transfer, features licensee entities, their ability to successfully commercialize or apply invention [10]-[11]-[19]-[20].

According to the general concept, the creation of a spin-off is a specific business activity of exploitation of research results and achieving technology transfer which leads to the emergence and development of new business. Regarding the definition of a spin-off generated by a public research institution there is no universally valid definition. Following a study conducted, OECD (Organization for Economic Cooperation and Development) concluded that the most common and accepted definition is the following [21]:

Relating to the public domain of research, a spin-off is a company that has at least one of the following:

1. Is a new company and it has as a founding member at least one employee from public sector or from research university;
2. Is a new company operating a technology licensed from a university or public research institute;
3. Is a new company in which a university, a public research institute or a national laboratory research invested capital;
4. Is a newly founded company directly by a public research institution”.

Another integrated definition is based on four major concepts, namely: (1) forming a new company, (2) the parent company, (3) forms of exploitation of knowledge and (4) entity on which the knowledge is transferred. Thus, a spin-off is defined as a new entity (company), legally constituted, established by one or more individuals from a parent company in order to exploit the knowledge gained in the parent company and transferred to the new company [22].

The transfer channels selected can have a direct connection with the type of scientific activity performed. Thus for example the establishment of a consortium of research is the most appropriate method if you want to obtain results directly applicable and the consulting is the most used and where a scientific competence is needed. Type of knowledge required to be transferred may also be a deciding factor on the type of transfer channel used [23].

Thus, in situations where a company needs some well defined technical skills for performing tests, measurements or improvements to an existing product or technology already applied, the best transfer channel can be a research contract on short or medium term. In general to solve some technical punctual problems which also involve staff training activities in the company or require more laborious direct collaboration the collaborative consulting type contacts are being used, or a temporary employment of a research specialist. If it is about incremental innovation activities, namely the application of technical solutions to adapt, refine, simplify and improve existing products and systems, firms wishing to protect as much competitive advantage choose the most reliable methods such as buying or licensing their patents. They use the contract of collaboration or employ specialists only when the complexity of innovation requires. In comparison to the activities of radical innovation, most often research funding or research contracts are the most used transfer channels. The participation of capital companies in the creation of spin-offs is also considered a possibility [23].

In some areas such as pharmaceutical or chemical industry companies wish to expand their technical skills continuously. The most effective thing for it is to participate in the research projects of consortium type with public research organizations. If a company is interested instead in-depth research in a certain direction, it will tend to use the method of funding it to a public research institution or at the research joint venture type [24].

Informal channels of technology transfer, as opposed to the formal one, do not require a contractual arrangement, are based on links and personal contacts that scientists have with various companies in the economic sphere most often referring to the size of tacit knowledge transfer [25]-[26].

7. Technology transfer efficiency and the main influence factors

Due to the positive effects arising from technology transfer, universities, research institutions and all those involved in creating and implementing government policies to stimulate technology transfer are directly interested in studying, evaluating and improving the efficiency of this process in order to create a system for the best practices as a reference system [27].

An intensive study of the literature conducted by Phan [27], led to the formulation of a framework model that suggests the efficiency of technology transfer analysis in three contexts: institutional context, organizational context of research institutions and individual context. For technology transfer to be successful, all three elements must be consistent.

In institutional terms, the research entity must establish clear goals, strategic objectives and priorities should be transparent, firm and reflected in resource allocation policy. Establishing priorities should take into account an economic orientation of interest and technological features necessary to meet the need of innovative businesses [27]. The organizational context has been an influential factor often highlighted by specialized literature. Technology transfer centres as organizational structures designed to facilitate and streamline the technology transfer process are influenced in their work by a number of factors highlighted in the specialized literature: organizational structure, management, reward system, quality and specialization of employees, the level of funding and self-financing, managerial, legal and marketing capabilities of employees, bureaucratic flexibility [28]-[18]. The size of the budget allocated to technology transfer centres, in turn, affects the number of staff employed for evaluating inventions and marketing activities, the number of trainers and consultants, which have direct effects on the success of transfer activities undertaken [18]-[29].

Individual context, considers matters relating to professional ethics, the individual objectives of researchers, their professional and entrepreneurial skills. All these issues are factors that influence the effectiveness of technology transfer. The specialized literature has identified two key motivators for researchers in universities and research institutions: academic recognition awarded through publications, patents applied, presentations at conferences and winning research grants and the opportunity to obtain additional financial income both personal as well as funds to support further research by engaging in technology transfer activities and entrepreneurship [25]-[30]. To avoid, however, the use, by the researchers, of the informal channels of technology transfer in

detriment of the formal ones, that can lead to loss of potential profit, is very important the policy adopted by the research institution regarding remuneration and reward of those who patent and involved in licensing activities. This phenomenon should be carefully considered especially by the top rated universities that focus highly on the patenting activity [25].

The main barriers encountered in technology transfer activity that may adversely affect its efficiency are: the deficiencies of the firms, the cost, the risk and uncertainties of weaknesses in research institutions, institutional and organizational barriers and lack of information. The firm's ability to absorb the knowledge transfer as measured by the quality and experience of human capital and the existence of research activities are preconditions of companies involved in technology transfer activities [31].

A study conducted by Arvantis [31] on a number of 2 428 Swiss companies engaged in technology transfer revealed that more than 50% of them considered informal personal contacts or various forms of informational activities (research articles or references, participation in conferences and workshops, participation in training courses offered by universities and employment of young graduates) as the most important technology transfer activities so that they are oriented mainly towards them. Only a percentage between 12 and 18% turns to consulting activities and cooperation agreements with public research institutions. And this study shows that firms often combine the use of informal and formal channels. 65% of companies analyzed have indicated that the main reasons that determine participation in technology transfer are given by the access to specific knowledge held by specialized staff, the training opportunity and the possibility of graduate recruitments. For companies involved in production, the need for technology transfer and collaboration with public research institutions is imposed both by the financial factors - insufficient own funds for research and by economic nature - lack of time and the need for innovation.

Landry [32], shows in a study conducted on a sample of 4,000 Canadians researchers with expertise in 25 research fields grouped into six major categories: chemistry, physics, mathematics, computer science, earth sciences and engineering that the main factors influence the process of knowledge transfer for all six main areas are (1) the links between researchers and users of knowledge resulting from the research and (2) research projects focus on the specific needs of users [32].

National culture, the level of academic socialization, influences the involvement of researchers in the development process of technology transfer. The existence of their previous experience in the marketing of research results and the existence of previous experience of the same academic rank colleagues also favours the involvement of researchers in technology transfer activities. The mode of collaboration and communication with external research institutions is very important for the effectiveness of this partnership. Integrating new technologies and new knowledge in the company's portfolio is the main step towards innovation process desired by him. Company's ability and willingness to engage in the complex process of transfer affects the success of the whole action [18].

The cooperation connection between the entities involved in the process must include a permanent feedback, monitoring and continuous evaluation of the intermediate results. Both sides should judge collaborative work in a long-term strategic manner that should be favourable and generate bilateral benefits. A poor institutional collaboration may lead the firm to opportunistic behaviour by direct contacting with researchers for consulting services thus shorting research relationship with the institution [18]-[31].

Right partner features to whom is transferred the technology, such as its perception concerning the usefulness of technology transfer, interest and involvement in the running of the transfer, ability to assimilate new knowledge and the confidence which it has for the research team of research institutions, are key factors influencing the effectiveness of technology transfer [28],[33]. Since there is a multitude of technology transfer channels many studies have analyzed the mechanism and factors influencing the choice of a given channel from industry and from research institutions. It was found that the choice of a particular type of technology transfer channel is influenced by factors such as basic characteristics of knowledge, scientific discipline and organizational or individual characteristics [18]-[28]-[33].

8. Conclusions

Technology transfer is a very complex process and therefore for an efficient implementation all parties must work strategically together. From the analysis of the literature on technology transfer some important aspects that should be considered when initiating such a process can be:

1. Entities directly involved in the technology transfer process (research centres, intermediaries and companies) must cooperate in order to use effectively its own resources. The specific form of cooperation that they choose should focus on meeting specific needs effectively;

2. Before engaging in a process of technology transfer it should be considered and analyzed the opportunity and the need to transfer a particular technology;

3. A technology transfer process must be well grounded through a feasibility study because the resources involved are numerous and often the costs are high for all parties involved;

4. All responsible factors involved in the process of technology transfer must consider multiple aspects of environmental characteristics in which the technology is transferred, legislative framework and general policies in the field.

5. The economic agent to whom the technology is transferred is very important to be involved in the early stages of the transfer process.

6. The partners involved in the transfer process should have specific technical and managerial capabilities and communication process to be very effective, based on getting feedback.

7. Transfer mechanisms selected depend on the features and capabilities of the parties directly involved in the transfer, on the technology characteristics and life cycle in which it is found, on the degree of involvement and interest of the company, which adopt the technology, and on the necessary of intellectual property protection.

Although a number of studies were initiated to analyze and improve the efficiency of technology transfer, literature does not provide sufficient answers and solutions especially regarding the management of organizational processes related to technology transfer.

Considering all aspects regarding technology transfer: the entities involved, resources allocated, influence of internal and external factors, and the expected results, a future study might consider developing a flexible technology transfer model.

This model can be created based on a procesual framework adapted to every organization involved in the technology transfer process. Depending on the resources available, these entities can choose based on this model, what process they can performed, what process should be outsourced or which processes may be carried out by the partner institution, which may have the resources and skills that are required. In this way it can be organized a distribution of resources to support this process effectively.

Acknowledgements

This paper benefited from financial support through the “Increasing the quality of doctoral studies in engineering sciences to support the development of knowledge based society” project, POSDRU/107/1.5/s/78534, a project cofounded by the European Social Fund through the sectoral operational program of human resources development 2007-2013.

References

- [1] OECD (Organization for Economic Co-operation and Development), (2009), A Forward looking response to the crisis. Fostering an Innovation –led sustainable recovery. <http://www.ioe-emp.org>. Descărcat de pe internet la 01.03.2011
- [2] Agachi, S., Curaj A., Dumitrache I., Filip F., Popa G., Stănciulescu I., Szabolces L., (2006), Sistemul Național de Cercetare Dezvoltare și Inovare în contextul integrării în Aria Europeană a Cercetării. Editura Academiei Române, București 2006.
- [3] Năstase, I.G., (2004), Managementul Inovării. Inovarea științifică și tehnologică în contextul dezvoltării durabile. Editura Performantica, Iași 2004.
- [4] Badea C., D., Mocuță G., Radu, M. (2008), Politica științei-o nouă viziune. Editura Performantica.
- [5] Brad, S., (2010), Note de curs. Ingineria și managementul inovării. Universitatea Tehnică Cluj Napoca.
- [6] Heyne, P., Boettke, P. J., Prychitko, D. L. (2010), The Economic Way of Thinking. Prentice Hall, 12th ed. pg. 163, 317–318.
- [7] Bozeman B., (2000), Technology transfer and public policy: a review of research and theory. Research Policy no. 29, pg 627-655.
- [8] Stoica M., Suciū Rațiu C., Grigoriu C., (2005), Evaluarea performanțelor umane prin prisma cunoștințelor explicite și tacite. Economia seria Management, anul VIII, nr.1
- [9] Wright, M., Vohora, A., Lockett, A. (2004), The formation of high tech university spinout companies: The role of joint ventures and venture capital investors, Journal of Technology Transfer, vol. 29, pg. 287–310.
- [10] Agrawal, A., (2006), Engaging the inventor : Exploring licensing strategies for university inventions and the role of latent knowledge. Strategic Management Journal, vol 27, 63-69.
- [11] Foray, D., Lissoni, F., (2009), University research and public privat interactions. Journal of Technology Transfer.
- [12] European Commission (2004), Improving Institution for the Transfer Technology from Science to Enterprise. Technology Transfer Institutions. An Overview.
- [13] Godinho, M., Cartaxo R., (2011), University pateting, licensing, and technology transfer: how organizational context and available resources determine performance. Institut De Economia de Barcelona.

- Working papers. <http://www.ieb.ub.edu>.
- [14] Macho-Stadler, I., Perez-Castrillo, D., Veugelers, R. 2006, Licensing of university inventions: the role of technology transfer office. *International Journal of Industrial Organizations*.
 - [15] Tahvanainen, A., J., Hermans R., (2011), Making sense of the TTO production function: University technology transfer offices as process catalysts, knowledge converters and impact amplifiers. Discussion papers. The Research Institute of Finnish Economy.
 - [16] Oliveira, D., M., Teixeira, A., C., (2010), The determinants of technology transfers efficiency and the role of innovation policies: a survey. Working papers. www.fep.up.pt
 - [17] Gils, M., Vissers, G., Wit, J., (2009), Selecting the right channel for knowledge transfer between industry and science. *European Journal of Innovation Management*, vol.12, no.4, pg. 492-511.
 - [18] Bercovitz J., Feldmann M., (2006) Entrepreneurial Universities and Technology Transfer A Conceptual Framework for Understanding Knowledge Based Economic Development. *Journal of Technology Transfer*, vol 31, pg. 175-188.
 - [19] Buenstorf G., Geissler M., (2009), Not invented here: Technology licensing, knowledge transfer and innovation based on public research. *The papers on Economics and Evolution*.
 - [20] Belenzon, S., Schankerman, M., (2007), Harnessing Success: Determinants of University technology Licensing Performance. London School of Economics and Political Science. EI/44.
 - [21] Benedicte, C., (2001), Generating Spin-offs: Evidence from Across the OECD STI Review (publicată de OECD) (26): 18. ISBN 9264175806.
 - [22] De Cleyn S., Braet J., (2006), The evolution and performance of spin-off ventures: integration and elaboration of existing models, University of Antwerp, Belgium.
 - [23] Gils, M., Vissers, G., Wit, J., (2009), Selecting the right channel for knowledge transfer between industry and science. *European Journal of Innovation Management*, vol.12, no.4, pg. 492-511.
 - [24] Patton, D., Warren L., Bream, D., (2009), Elements that underpin high-tech business incubation Processes . *Journal of Technology Transfer* vol. 34 pg. 621–636.
 - [25] Grimpe C., Fier H., (2010), Informal university technology transfer : a comparison between the United States and Germany, *Journal of Technology Transfer* no. 35 pg. 637-650.
 - [26] Odigie, H., A., Li-Hua, R., (2008), Unlocking the Channel of Tacit Knowledge Transfer, Management of Technology Study Centre of University of International Business and economics. Working paper.
 - [27] Phan, P., H., Siegel, D., S., (2006), The Effectiveness of University Technology Transfer: Lessons Learned from Quantitative and Qualitative Research in the US and UK. *Rensselaer Working Papers in Economics*.
 - [28] Rothaermel, F. T., Agung, S., Jiang, L., (2007), University entrepreneurship A taxonomy of the literature. *Industrial and Corporate Change* 16(4), 691-791.
 - [29] Swamidass M.P., Vulasa V., (2008), Why university inventions rarely produce income? Bottlenecks in university technology transfer. *Journal of Technology Transfer*, vol 34 pg.343-363.
 - [30] Bekkers R., Gilting V., (2006), Determining Factors of the Effectiveness of IP- based Spin-offs Comparing the Netherlands and US. *Journal of Technology Transfer*, vol 31, pg. 545-566.
 - [31] Arvantis, S., Kubli, U., Worter, M., (2005), Determinants of Knowledge and Technology Transfer Activities Between Firms and Science Institutions in Switzerland An Analysis Based on Firm Data. Swiss Institute for Business Cycle Research. Working Paper nr. 116.
 - [32] Landry, R., Saihi, M., Amara, N., Oiumet, M., (2010), Evidence on how academics manage their portfolio of knowledge transfer activities. *Research Policy* nr.39, pg.1387-1403.
 - [33] Siegel, D., S., Veugelers, R., Wright, M., (2007), Technology transfer offices and commercializations of university intellectual property: performance and policy implications. *Oxford Review of Economic Policy*, vol 23, pg.640-660.