

## TRANSFER OF TECHNOLOGY – MECHANISM OF MODERN UNIVERSITY WITH COMMUNITY CONNECTION

Mihaela DIACONU<sup>1</sup>, Amalia DUTU<sup>2</sup>

<sup>1</sup> Faculty of Economics, University of Pitesti, Romania, [mihaela.diaconu@upit.ro](mailto:mihaela.diaconu@upit.ro)

<sup>2</sup> Faculty of Economics, University of Pitesti, Romania, [pandelica.amalia@yhaoo.com](mailto:pandelica.amalia@yhaoo.com)

**Abstract.** *This study presents, starting from the third mission of the university, a modern mechanism – technology transfer, by which the university can effectively contribute to local and regional socio-economic development and may provide additional sources of income for the research and development work in terms of substantially reducing the financial support by the state. The study emphasizes the role of the office of technology transfer as a means of connection of the university with the business environment able to arrange joint efforts of both sides in economic development. The method used was that of thematic analysis of the content of data published on the websites of the best performing TTO's on technology transfer and the literature referring to the third mission of the university. The study develops a methodology with the procedural approach and the steps that should followed so that the university could become more competitive with the help of TTO. The conclusion is that, in the current conditions of higher education market, the entrepreneurial spirit of the university valued through TTO brings important benefits to society.*

**Keywords:** *technology, technology transfer, office of technology transfer, the third mission of the university, the entrepreneurial approach in the university.*

**JEL Classification Codes:** I23, I25, M14

### 1. WHAT IS THE TECHNOLOGY TRANSFER?

Generally, the technology is the combination of resources, knowledge and know-how used to obtain goods / services. It is a set of information used in order to accomplish certain tasks as well as the useful enforcement action of knowledge and expertise in a particular operation. Technology can be considered a product which makes the subject of trade, since it is a very useful tool for providing economic development to achieve strategic competitive advantage by actors in the competitive market. In the process of obtaining and exploiting in market of this product are involved innovative firms, intellectual property issue consultants, business consultants, brokers in technology, research and educational institutions, private industrial enterprises, financial institutions, NGOs (organizations non-governmental), governments. For the technology to have purpose, namely to add value to all stakeholders in this complex process, resources, knowledge and know-how used to obtain goods / services must be accompanied by the ability to develop the respective technology. This is the motivation for supporting the importance of technology transfer.

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<sup>1</sup> Professor PhD.

<sup>2</sup> Associate Professor PhD.

*Technology transfer* is defined as all activities that transmit information about the physical processes, equipment and facilities, analytical and operational techniques, terminology etc. associated with technology and lead to the adoption of a new product or a new procedure by a group of users. It involves the interaction between a new technology seller and users and results in real innovation (Webster's Online Dictionary, 2009). Generally, patents, manufacturing technologies, product technology, process technology, management techniques (design and management), service delivery methods, etc. can make the object of this type of transfer. The content of technology transfer can be really varied and can include the following components: skills, knowledge, technologies, methods of manufacturing, materials and components that are incorporated into the finished product, technical designs, secret formulas of manufacturing, production equipment, documentation and procedures for design and manufacturing, production equipment, documentation and procedures for design and manufacturing, instructions for use of equipment, transmission of information by direct instruction staff, video demonstrations, workplace training, unpatented technical assistance known as know-how, engineering, franchising, hardware and software, etc. This transfer takes place between governments and universities or research units, on the one hand, and the units of production or service, on the other hand, to facilitate the availability of a wide range of users in scientific and technological developments in the exploitation of new technologies in order to develop. Technology transfer should be understood as a process through which scientific and technological discoveries are incorporated into goods and services capitalized on the market and contributing to the economic development of an area. It involves the transfer of intellectual property through legal means in the license agreements, know-how, franchise, engineering. The benefits of technology transfer processes consist in improving the products, manufacturing processes, development of new products and services required by the market.

In essence, technology transfer is the activity through which the results of basic and applied research from the research-development units (universities, research institutes) arrive in private organizations or other structures of society and contribute to their development. Technology transfer is achieved through the following mechanisms, namely those operations that ensure the dissemination of certain technologies from supplier to recipient: - agreement based on product subcontracting established between the beneficiary and a specialized design firm able to achieve the product based on the specifications of the project; this activity may be accompanied by staff training to ensure the transfer of skills and abilities among the transfer participants; - cooperation in the development of research programs for the introduction of new types of products and services; - patenting and licensing the results of technological development process in an organization to be operated by another organization; - transferring documents such as schemes of technological flows, sketches, documents in the contract of know-how; - selling, purchasing and importing means of production required to obtain new products; - cooperation between two partners in fundamental research for skills training and skills needed to develop products; - cooperation in applied research that are done between new organizations like start-ups and universities; - cooperation in product development as an activity carried out mainly by industrial enterprises; - dissemination of information through conferences, scientific articles published in professional journals, technical reports.

Technology transfer is the activity through which the results of certain structures funded by the state, namely the universities and research institutes that come in productive units that have the capability to produce and sell them in the market. A technology that does not reach finality in

the productive environment has no value. Therefore the transfer of technology is the connection that ensures capitalization of scientific research performance in the social and economic benefit.

The decision of a business partner to invest in the development of a technology or a commercial product based on the results of academic research is influenced by their protection, namely the existence of intellectual property.

The intellectual property is a set of rights related to inventions and other creations and mainly includes patents, copyrights and trademarks. The patent is a document issued by an authority that gives the holder the exclusive right to use, sell, import or offer to sell an invention for a fixed period of time. The patent owner may give permission to another party to use the patented invention through licensing agreements. The patent can also be sold. For an invention to be patented is necessary to cover a step conducted several months and to cover some costs in the form of tax. The copyright is intended to protect and promote the literary and artistic creativity for a limited time.

A trademark is a distinctive sign which is intended to protect the product and service names. May consist of a combination of letters or words, an image, a logo, a 3D form or sound.

Protecting intellectual property rights is performed using the license. A license is a contract whereby the licensor grants under certain conditions, the right to use a patent in order to develop and commercialize products and services based on such patents. License agreements are long-term relationships. The license can be exclusive if is granted exploitation or non-exclusive monopoly when the licensor reserves the right to license also other relevant organizations. In the case of exclusive licenses, is important that the licensee to exploit the technology and to develop it. For the universities the technology transfer is a way to increase revenue for investment and research.

## **2. CURRENT ROLE OF UNIVERSITY IN SOCIAL AND ECONOMIC ENVIRONMENT - THE THIRD MISSION**

According to experts, now the university is the institution that creates and disseminates knowledge, new ideas that can form the basis of innovation and source of knowledge for technology development with industry support to ensure local and regional economic development. Traditionally the university has three responsibilities: teaching, research and providing services to society. These responsibilities have occurred in time due to changes in economic and social environment of which the university had to take into account and in terms of which has adapted. In time, the university has crossed two academic revolution (Etzkowitz 2003): the first revolution of the late 19th century which involved the introduction of research as the core activity alongside teaching and more recently, the second academic revolution consisting in the obligation of the university contribution through its actions to economic development by supply of services for the benefit of socio-economic development. The third responsibility of the university, whose appearance was determined by the transition to the society based on knowledge, involves contributing to social and economic development through increased interaction with business environment. According to British researchers Molas-Gallart et al (2002) the main activities that correspond to the third mission of the university are: the commercialization of technology, entrepreneurship activities, advisory councils, marketing facilities, research on contract, non-academic collaboration in scientific research, mobility of teaching staff and from industry, placements of students and other links with the labor market, non-traditional education and training activities, aligning curricula to social needs, dissemination of research results in nonacademic environments. In European vision, the university-business

environment cooperation should be oriented mainly towards innovation, creating start-ups, transfer and dissemination of knowledge (Șerbănică, C.M, 2011, p.432).

To successfully fulfill these responsibilities is necessary for universities to make changes in terms of culture, governance and management and to adopt entrepreneurial approach as a strategy. (Box, 1999; Caruana et al, 2002; Mentoor and Friedrich, 2007; Morris and Jones, 1999; O'Shea and all., 2005, 2007). Entrepreneurial approach is described as a set of actions by which there are identified innovative solutions to many problems faced by public sector organizations (William Todorovic et al, 2011, .p.129). According to researchers Etzkowitz, Webster, Gebhardt, Terra (2000) universities that develop activities which are specific to the third mission are entrepreneurial universities with an important role in innovation and economic growth processes.

Given that the number of universities is increasing and financial support from the state is in decline, entrepreneurial approach mainly related to scientific research responsibilities and contribution to economic development are build in the successful approach for modern universities. Van Burg et al. (2008, p.121) recommend that universities “shape a university culture that reinforces academic entrepreneurship by creating norms and exemplars that motivate entrepreneurial behavior”. “The entrepreneurial response” has become a growing necessity for all those universities that want to be a viable, competitive part of the rapidly emerging international world of learning ( Clark,2001, p.11). ”The entrepreneurial university becomes an organizational version of civic society, one that mediates between state and market rather than be dominated by either.” (Clark,2001, p.23). Adopting the entrepreneurial orientation of the university should begin with its implementation at departmental and faculty level to create from bottom to top an innovative entrepreneurial environment. William Todorovic et al. (2011, p.134) has devised a scale for measuring the entrepreneurial orientation of university departments for spin-off and certification. Its components are: - the ability to raise knowledge and their application to individual, group or community level; - identifying new opportunities for scientific research to be useful for stakeholders; - connecting teachers from the structure of the department, faculty and students with the industry to increase their performance in research; - perceiving the university policies and encouraging the entrepreneurial orientation at department level so as to harmonize the university policies with the objectives of the department. Allen Gibb (2005, p.29) in his work named "Towards the Entrepreneurial University Entrepreneurship, Education as a lever for change", presents an integration of entrepreneurship model in higher education with the following structure: - introduction of the entrepreneurship in the university curricula; - creating a technology transfer office; - creating an innovative pedagogical support for each department; - lifelong learning approach in all departments; - establishing research themes in all departments; - cultivating professional status for excellent research and development; - allocation of time for researchers who wish to engage in intellectual property marketing; - organizing meetings with entrepreneurs to identify new ideas for research; - social integration of entrepreneurs and offering appropriate status; - collaboration in the practice of teachers through working visits; - management of academic activities in partnership with external stakeholders; - motivating material research and development activities in all departments; - the participation of stakeholders in joint ventures; - open approach to intellectual property and investment in university associations; - the training of academic staff to develop and offer entrepreneurship courses.

A viable way today through which universities can contribute to increasing social and economic benefits is commercializing research results. The first forms of trading approached by the universities were special consultancy to which were added later patenting and licensing of

research results, business incubators, start-ups, university spin-off activity. In the research on the interaction between university and industry through trading of scientific research was found that there are different tools for regional technology transfer (Hussler al., 2010), and a variety of business models available to transfer an innovation from the academic world in the public domain. Some researchers, Prodan and Drnovšek (2010) talk about academic inventor with strategic role in the flexible transfer of academic research results to the private productive environment. Recent studies conducted at the level of major universities in the United States with regard to technology transfer and commercialization of research results (Breznitz et al, 2008) have shown that success in the science and technology policy which allows the transfer of knowledge and innovation is related to the institutional and procedural approach.

Technology transfer from universities to industrial environment is a useful tool with which new technologies and products reach the market causing economic and social development. Universities receive copyright of allowing economic units to use scientific discoveries into products that address to market in important areas like medicine (imaging), tests for medical diagnosis and treatment, pharmaceutical, automobile production, IT, etc. Universities can use the revenue generated from the results of scientific research to develop scientific research infrastructure and to motivate the teacher researchers.

For industry, technology transfer is the best way to acquire basic technological research results, given that the research activity is very low or non-existent in small and medium enterprises. The research activity carried out through the industry – university collaboration may be also considered an important tool for identifying scientific talent, whereas research projects funded by economic agents are made with students who, after graduation, they go to work for former sponsors or investors. With the transfer of technology, the university helps accelerate innovation activities and to support the process of obtaining competitive advantage for both industrial and academic environment by cooperating with the industry. Technology transfer from universities can boost global economic growth and regional economic development.

### **3. OFFICE OF TECHNOLOGY TRANSFER - INSTRUMENT OF MODERN UNIVERSITY ENTREPRENEURIAL ORIENTATION**

For a new technology to be exploited in the industrial environment is necessary for it to be sold in the market. Most often the organization that develops technology as the one that uses technology is different from the one that sells it since it doesn't always have resources and logistics necessary for capitalizing properly this product on the market. Thus arises the need for a structure to facilitate networking of research teams with industrial partners interested in the results of scientific research conducted in universities. According to the experience found in the market, this structure often called office or center, office of technology transfer is being developed either as an university internal environment part, either as an independent structure detached from the academic ecosystem.

TTO tehnology-trasfer office or center is „an essential intermediary between research teams, industry partners and other components of ecosystem innovation”. His role is to go through additional steps separating knowledge of industrial technology laboratory. It must be a professional service (as a functional structure), bringing added value in evaluating inventions, patentability, economic value, defining intelligent patent strategy, cost optimization, marketing and negotiation" (Catană A, Căbuz A.I., 2013, p.315,317). The central mission of Transfer Offices is to increase the chances that university discoveries and research results be turned into useful products and services so that the public shall benefit. (Capart G, Sandelin J, 2004, p.2).

Transfer centers or offices mission is less adequately understood by all parties involved in the process of intellectual property or universities, researchers, industry, governments and the public in general, although there is an increase in their number, especially in the USA, but and in Europe. The philosophy of operating a TTO should be based on the needs, interests of the parties involved in the transfer of technology respectively inventor, university, industrial partners, government. TTO manages all activities that relate to using in the industry the industrial property rights belonging to the university or the state in case the results of scientific research have been funded from government sources.

TTO's role as an instrument of connecting the university with the industry can be described as:

- promote efficient usage of scientific research results in increasing competitiveness of the university;
- increasing the attractiveness of the university as a research – development partner for industry;
- encouraging entrepreneurial spirit in university to exploit intellectual property rights in the socio-economic environment;
- create useful products and services for society as a result of exploitation scientific of research results;
- job creation through the establishment of spin-off companies and collaboration with other institutions;
- providing additional financial resources for the development research activities in universities.

The activities performed by TTO are:

a) *management activities of scientific research*, respectively

- identification of research and development results;
- evaluating the inventions;
- the initiation of the approach to intellectual property protection;
- patent administration of the portfolio;
- transferring material and knowledge agreements;
- signing research contracts;
- sale of intellectual property rights and the management of conflicts of interest.

b) *typical activities of technology transfer*

- counseling in technology transfer area;
- counseling in the allocation of intellectual property;
- counseling in granting of licenses;
- counseling in the management of spin-off companies;
- innovation marketing activities;
- establishing systematic links with the industry activities.

c) *complementary activities*- marketing communication on research and innovation activities in universities, teaching and training activities of professionals to work in the TTO.

A study made by Jay P. Kesan A. (2009) on the annual reports of the 94 institutions in the United States, AUTM-Association of University Technology Managers members, on the licensing process in conjunction with fiscal partners established that the universities, through TTO, are not engaged in a wide range of activities that would lead to technology transfer with beneficial

implications in the industry. The author suggests universities to use alternative methods of technology transfer such as (Kesan ,2009, p.2207): open collaborations, free participant use agreements, increased focus on commercialization activities, and royalty free licensing- that would result in university innovations being adopted and disseminated throughout society.

#### **4. THE METHODOLOGICAL TRANSFORMATION FRAMEWORK OF THE TECHNOLOGY TRANSFER OFFICE IN WORKING TOOL OF MODERN UNIVERSITY**

To fulfill the mission assumed, the TTO technology transfer office should consider the following **strategic objectives**:

- supporting the dissemination of scientific results;
- supporting the absorption on scientific research results;
- stimulating the development of scientific research in relation with the requirements of private actors in the production of goods and services area.

*Hypothesis of the methodological framework on the use of the office of technology transfer as a means of connecting the university with the economic and social environment*

To develop the methodological framework of *using the office or technology transfer center as an instrument of connecting the university with the economic and social environment* we have started several assumptions:

- increasing the role of the university in the current European context through the use of technology transfer as a means of connection with the economic environment. This is a project of change that will lead to institutional responsibility and staff regarding the use and appreciation of scientific research results through empowering the industrial environment. The ultimate goal of this work is providing financial resources necessary for the development of the logistics of research activity and proper motivation of the researchers.

- implementing entrepreneurial orientation in universities using as an instrument the technology transfer through TTO by considering this concept as a strategic issue. In this respect, is necessary to create the organizational framework (technology transfer office), to transform the teacher – researcher into an inventor-entrepreneur one, who is properly motivated and counseled and establishes an appropriate strategy to meet a flexible business model.

The strategic activities necessary in the process that makes the technology transfer office or center the binder between interested stakeholders are:

- activities to disseminate the results of university research to aware economic actors of the existence of scientific result and sustainability, the competitiveness of the university and their clients
- activities to improve the absorption capacity of the economic actors of scientific research results
- monitoring activities of scientific research results and information to the functional structures of research of the university on the needs of the private sector
- implementation activities of university marketing orientation and entrepreneurial orientation in university as an integrated system given the need of the university to meet its new missions in the present educational market conditions
- adaptation activities of the university's global product for accomplishing the third function by developing attractive commercial relationships with the business

environment from optimal exploitation of scientific research results and existing research resources in university

*The stages of implementing the concept of technology transfer office as a means of connecting the university with the economic and social environment:*

1. Analysis of university resources on research and innovation, development and identifying opportunities to exploit the scientific research results;
2. Establishing appropriate strategic and operational objectives that would lead to the commercial exploitation of scientific research valuing excellence, success identified in university respectively:
  - the identification of the scientific that can be traded with industry;
  - identifying the needs of the private sector on innovation and development;
  - establishing ways in which you can scroll through cooperation with industry on research-innovation-development line;
  - motivating and empowering teachers in terms of their own resource use of research-innovation-development to meet the need of economic agents interest and to contribute to local and regional economic development.
3. Creating functional structure of technology transfer – office or center of technology transfer which will ensure effective collaboration and correspondence of academic and business environment in terms of research, innovation and development
4. Procedural system organization, designing system and operational procedures by considering information on its own possibilities of developing the research-innovation activity related to business environment needs.

## **5. CONCLUSIONS**

Technology transfer and commercialization of university research can be important elements of the industrial development strategy of a country with a positive impact on increasing the number of jobs with high added value. With the support of technology transfer office, the university can become a major player in regional development because it will determine the content of technology transfer from the university to the business environment through a careful assessment of the region in which the university operates and the conditions for economic development. The success of the technology transfer from the university environment to the business one is secured by real change of the organizational culture of the university with the focus on developing the entrepreneurial spirit at the level of department and a strong connection with the industry in the region where the university is through TTO.

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