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ORGANISATION AND MANAGEMENT OF KNOWLEDGE AND TECHNOLOGY TRANSFER PROCESSES AT RESEARCH ORGANISATIONS: EMPIRICAL STUDY

Key words

Knowledge transfer, technology transfer, commercialisation of research results, research organisation, Intellectual Property.

Abstract

The development of knowledge-based economies is dictated by the intensification of globalisation processes and the emergence of information societies characterised by the growing demand for knowledge and innovations. Effective execution of the knowledge and technology transfer processes is therefore the foundation of the contemporary knowledge-based economy because as a result of these processes novel technologies are brought to the market and the development of better products and services meeting the actual customer requirements is stimulated, and the national innovation performance and the level of competitiveness are improved. The author presents the issues connected with the organisation and management of knowledge and technology transfer from R&D organisations. The discussion is based on international case study analyses whose results helped to indicate the models and procedures

commonly applied by these institutions to ensure an effective execution of the transfer process.

Introduction

In the contemporary world, knowledge and technological innovations are viewed as the drivers of productivity and social and economic development. The changing understanding of knowledge and technology transfer in the knowledge-based economies complies with the priorities of the economic sustainable development. In this new reality it is extremely important for all entities (be it research institutes, universities, or businesses) engaged in the development and commercialisation of know-how and innovations to ensure effectiveness of these processes, and in order to do so, these organisations also need to properly manage their knowledge so as to be able to build and maintain their competitive advantage.

The knowledge management term was popularised by Ikujiro Nonaka [1] and it refers to the systematic creation, dissemination and use of knowledge. Knowledge management is a process involving different kinds of activities that define the objectives of a given system and help to achieve them. The individual functions intertwine, creating a management process within which the hierarchical and functional dependencies can be found. Effective management of knowledge translates into effective execution of knowledge and technology transfer processes, and therefore it decides on the competitiveness and innovativeness of both research organisations and businesses in which research results are practically implemented, and as a result constitutes the foundation of contemporary knowledge-based economies.

From the point of view of an organisation, knowledge and technology transfer are elements of competitive advantage building, and their effective execution is included in a strategic management process. The importance of strategic management was discussed in many works by e.g. A.D. Chandler (1962) [2], K.R. Andrews (1980) [3], H.I. Ansoff (1985) [4], P.F. Drucker (2002) [5], or R.L. Ackoff (2002) [6]. The objective of strategic management is long-term planning concerning the activity of an organisation focused particularly on the issues of effective management and development. In this view, maintaining close and efficient relations between science and industry is a must, and the flow of know-how between universities, research organisations and businesses, should be a strategic mission of all governments, local authorities, and most of all the science and R&D sector, as active participation in these processes helps to generate increased research funding, engages more scientists and business people in the development and diffusion of innovations and brings socio-economic benefits, not only to individual stakeholders engaged in the knowledge transfer project but also to the entire region or the country (Mansfield 1975 [7], Backer 2000 [8]).

The focus of knowledge and technology transfer processes is the dissemination of know-how regarding the scientific and innovative practice to individual organisations so as to help them manage the challenges of using that knowledge and/or its products to create change within their work settings (Backer 2000 [8]). Knowledge and technology transfer encompasses a complicated process involving the complexity of both the technology and the market as well as the complexity of interactions between the transferor and the beneficiary originating from many different sources (Saad et al. 2002 [9]; Lee et al. 2010 [10]; Gudek 2013 [11]). It therefore requires all involved entities to be properly equipped to manage and execute a knowledge and technology transfer process, and thus calls for the application of different models, systems and procedures that could facilitate the effective planning and practical implementation of know-how and technologies, and might also help to manage and overcome the barriers that may impede the success of the transfer process.

As shown in numerous scientific publications and expert reports (e.g. Office of Inspector General, 2012 [12]; European Commission, 2013 [13]), the transfer of knowledge and its material results is still a problematic issue and though nowadays governments, local authorities, science and research institutions and businesses have paid a lot of attention to the importance of the transfer of know-how and innovation commercialisation processes, the diffusion of knowledge is still not at a satisfactory level both in the developed and developing economies (see e.g. performance measures in the Knowledge Transfer Study 2010–2012 by the European Commission, 2013 [13]). The European economy, for instance, still seems to be based on old paradigms, in which insufficient emphasis is put on the market orientation of research results (Matusiak and Guliński 2011 [14]). Despite the fact that Europe has great experience in the execution of both basic and applied research, the ability to transfer its results to commercial use in the form of new technologies, products or services is still much lower compared to the EU's main competitor – the USA (Wnuk et. al. 2014 [15]). In the States, however, the problems of ineffective practical implementation of research results are also a common phenomenon, and even such renowned R&D centres as the NASA battle with ineffective transfer of knowledge and its material results (NASA 2012 [16]). In Poland, despite numerous socio-economic changes and reforms in the Polish R&D sector, which were first triggered by the economic transition process in 1989, few fundamental changes could in fact be noticed as far as the practical application of research results is concerned (Wnuk 2014 [17]).

No universal technology transfer models (TT models) can be found in literature, therefore, up to date analyses of case studies and good practices seem to be very important as the emulation of certain positive behaviours in this field may turn out to be beneficial for the organisation conducting a knowledge and technology transfer process. For that reason, the scope of the article is the review of literature and the empirical case study analysis focused on the organisation

and management of the knowledge and technology transfer processes at selected research organisations. The author reviews the transfer models and procedures applied at these institutions and also analyses whether any dedicated systems and IT tools are employed to facilitate the successful dissemination and implementation of the know-how originating from these entities. The studies were conducted using a desk research method.

1. Sample selection methodology

In the course of her study, the author analysed seven (7) case studies in knowledge and technology transfer from different public research organisations (PROs) (both research institutes and universities) worldwide, which were selected based on the analysis of global PRO rankings. The main reference point was the Shanghai Ranking 2014 [18], however due to the fact that it only lists the best universities and does not include research organisations of non-academic character, the author also analysed the European Research Ranking 2013¹ [19], in order to add research institutions to the research sample as well. Moreover, a Polish institution was also selected so as to compare international practices with the ones implemented by the Polish PRO. The Polish organisation was selected based on the analysis of the 2014 University Ranking by Perspektywy [20]. Since this ranking only concerns universities and does not include research institutes, as they are not centres of education, and due to the fact that there is no separate ranking of Polish research institutes, the Polish PRO selected for analysis is the top university in the Perspektywy ranking that ranks high as far as the “Innovativeness” assessment criterion is concerned (the only criterion in the ranking that is directly connected to the issue of commercialisation of research results).

Additional criteria for the selection of the above-listed institutions included the availability of information on the organisation of the knowledge and technology transfer and the ease of its procurement, the existence of the TTO, and the implementation of internal knowledge and technology transfer policies and regulations, and systems (tools) facilitating the dissemination of know-how and commercialisation of research results.

The list of research institutions included in the case study analysis is presented in Table 1. A desk research method was employed in the study. The analysis of case studies encompassed the review of documents (e.g. annual reports, technology transfer regulations, guidebooks and procedures, etc.) and the analysis of the web pages of the institutions selected for the study and their technology transfer offices (TTOs).

¹ A more recent ranking is not available.

Table 1. Research institutions analysed by the author

– Harvard University (USA);
– University of Cambridge (UK);
– Swiss Federal Institute of Technology in Zurich (ETH Zurich) (CH);
– Fraunhofer Society (DE);
– Technical Research Centre of Finland (VTT) (FI);
– Netherlands Organisation for Applied Scientific Research (TNO) (NL);
– AGH University of Science and Technology (AGH) (PL)

2. Empirical analysis

a) *Knowledge management in knowledge and technology transfer processes*

The management of knowledge in the knowledge and technology transfer processes is incorporated and embedded in the strategic organisation management and thus plays a crucial role in all the institutions analysed by the author. Knowledge management in knowledge and technology transfer processes in the research organisations analysed is adjusted to the individual stages of the transfer process, e.g. the concept, prototype, verification, and transfer (Mazurkiewicz et al., 2010) [21], at which different types of R&D and organisational tasks are undertaken. A simplified draft summarising the knowledge management procedure applied at the institutions analysed is presented in Table 2.

Table 2. Knowledge management in the transfer process

Stages of the transfer process	Key elements of knowledge management in the transfer process
Transfer	– Knowledge protection, codification and transfer
Verification	– Transformation of knowledge into material results and its verification
Prototype	
Concept	– Determination of the target of the knowledge management process – commercialisation of know-how and/or its material results – Development of a knowledge management strategy – Generation of knowledge

At the concept stage, crucial for the process of knowledge management in the transfer project are elements with a cognitive character, e.g. knowledge location and generation, while at the subsequent stages of the project essential are elements of an executive nature, including e.g. the practical application of knowledge (knowledge transformation into material results) and the transfer of its results for business use. In addition, at each stage, it is important to identify the key technological, market and business steps, implement a proper knowledge management strategy, and design suitable transfer models that will facilitate the effective execution of the transfer process.

b) Transfer models

The case study analysis revealed the existence of two types of knowledge and technology transfer models applied by each of the institutions covered by the research sample, i.e. process models which describe a step-by-step procedure of the knowledge and technology transfer process, and functional (institutional) models which aggregate important actors and activities and describe relationships between them (see also Wnuk et. al., 2014) [15]).

Despite some minor differences, the process models applied at the institutions analysed look more or less the same and include the stages presented in Fig. 1.

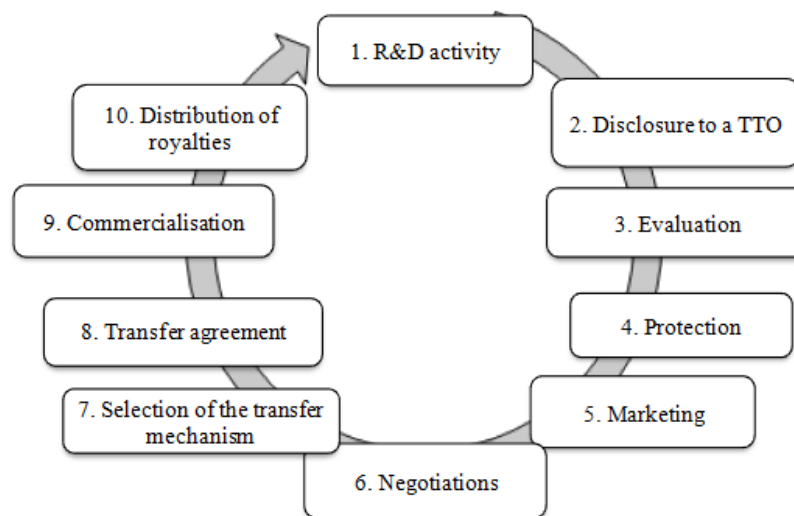


Fig. 1. Knowledge and technology transfer procedures as implemented at institutions analysed

The researchers are obliged to disclose the results of their research to the technology transfer office (TTO) which then takes control over the commercialisation process. Once the invention is disclosed, the rights are transferred onto the parent institutions (PRO or university) and then IPR is protected (patented in all the cases analysed). Following that, the market demand is analysed, the commercial potential of the invention assessed, and the product valued. At the next stage of the transfer process the market is segmented and the marketing campaign tailored to the character of the innovation and the industry branch is launched, as a result of which the potential end user is selected, the commercialisation mechanism chosen, and the negotiations with the transferee initiated. Once the contract is signed, the royalties are distributed between the parent institution and the author of the invention.

Though the process models applied at the PROs and universities analysed do not significantly vary in terms of their stages, there are however discrepancies between the functional models that are in place. The following three models emerged from the case study analyses conducted by the author of the paper (Fig. 2–4).

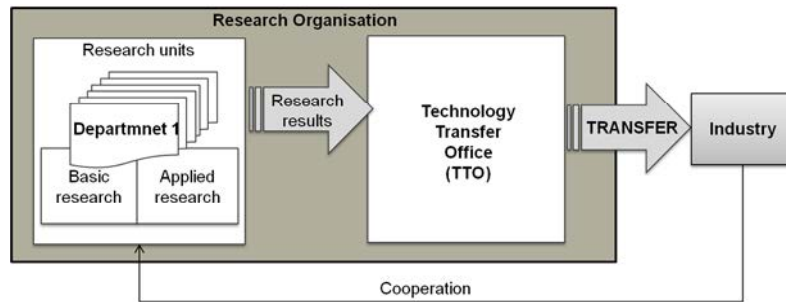


Fig. 2. Functional model I

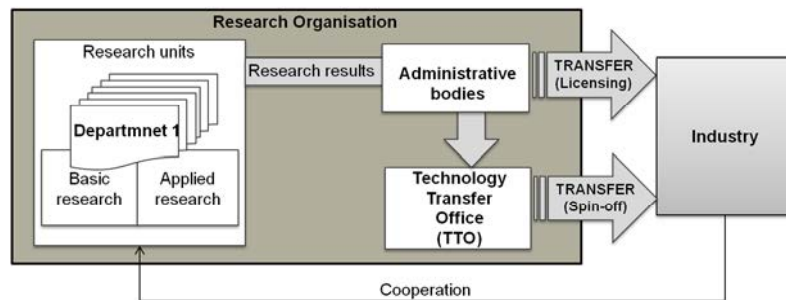


Fig. 3. Functional model II

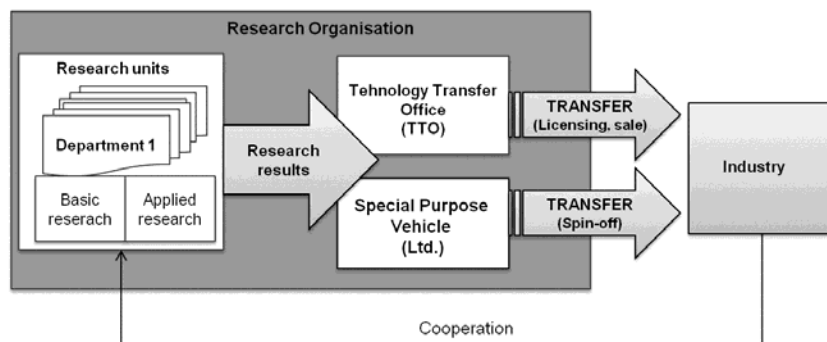


Fig. 4. Functional model III

Functional model I is implemented at the Harvard University, the University of Cambridge, the ETH Zurich and the VTT. The Fraunhofer Society and the TNO utilise model II, while AGH has implemented model III.

In all models a TTO is established to commercialise the results of research conducted at the individual research units of the parent PRO or university. However, the scope of responsibilities of this unit varies in the three models listed above.

In the case of the first model, this body is responsible for the management and execution of all transfer processes, regardless of the types of TT mechanisms selected. In the second model the TTO commercialises research results only by means of the establishment of spin-off ventures. In this model, commercialisation by means of external licensing lies in the hands of the administrative bodies of the research institution. In the third model there are two bodies responsible for the commercialisation of this university's research results. One of them is a technology transfer office, responsible for invention protection and commercialisation by means of licenses and sale, and the other unit, a Special Purpose Vehicle, organises and manages the commercialisation process by means of spin-off ventures.

Conclusions

The review of the selected 7 case studies indicated certain similarities as far as the organisation and the management of the transfer process is concerned and showed that knowledge and technology transfer constitute one of the strategic areas of activity of the institutions analysed. The PROs in question actively seek to make the transfer processes more effective by means of the following activities:

- The introduction of the tailor-made transfer policies and procedures, as well as clear commercialisation and IPR laws and TT guidebooks;
- The establishment of designated technology transfer units which support researchers in the complex issues of know-how dissemination and innovation commercialisation by offering specialist financial, business, and legal advice. Their active participation in the transfer of know-how and technologies lies in assessing their marketability opportunities, seeking potential customers, preparing procedures for the protection of intellectual property rights, and preparing business plans for spin-off ventures;
- Popularisation of different channels of non-commercial and commercial knowledge and technology transfer mechanisms

In all cases analysed, the success of the transfer processes is also based on strong industry orientation and connection, substantial autonomy of the individual departments of the PRO or university, or units affiliated to it.

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Organizacja i zarządzanie procesem transferu wiedzy i technologii z jednostek naukowo-badawczych: badanie empiryczne

Słowa kluczowe

Transfer wiedzy, transfer technologii, komercjalizacja wyników prac B+R, jednostka naukowo-badawcza, prawa własności intelektualnej.

Streszczenie

Rozwój gospodarek opartych na wiedzy podyktowany jest intensyfikacją procesów globalizacyjnych i rozwojem społeczeństw informacyjnych, w których znacząco wzrasta zapotrzebowanie na wiedzę i innowacje. Skuteczna realizacja procesów transferu wiedzy i technologii stanowi zatem podwaliny współczesnej gospodarki opartej na wiedzy, gdyż w rezultacie tych procesów rynek zasilany jest innowacyjnymi rozwiązaniami technologicznymi, systemowymi i procesowymi stymulującymi rozwój lepszych produktów i usług odpowiadających faktycznemu zapotrzebowaniu konsumentów i jednocześnie odgrywa kluczową rolę w kreowaniu innowacyjności gospodarki i podnoszeniu poziomu jej konkurencyjności. W artykule omówiono zagadnienia organizacji i zarządzania procesem transferu wiedzy i technologii z jednostek naukowo-badawczych. Zaprezentowano wyniki przeprowadzonych międzynarodowych studiów przypadku, które pozwoliły na wyłonienie modeli i procedur powszechnie stosowanych w celu zapewnienia efektywnej realizacji tych procesów.