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GOOD PRACTICE IN INFORMATION PROCESSING IN NETWORKS OF SCIENCE AND ECONOMY COOPERATION BASED ON THE PARADIGMS OF OPEN INNOVATION

Abstract
The article focuses on the phenomenon of open innovation (OI), which is a peculiar contrast to so-called closed innovations that assume that the process of creating new values requires control to guarantee success. The main assumptions of Open Innovation are the creation of multi-departmental capitals that bring together businesses, organizations, and research units dedicated to the common goal of creating and developing innovative products. The role of networks and stakeholders was discussed in the context of the introduction and use of external knowledge, access to new markets of skills, knowledge and others. The text focuses on the determinants of the implementation of open innovation and clusters as a source of innovation and synergy of benefit. In the context of the essence and assumptions of Open Innovation, the Bioenergy Cluster for the Region and the deENnet Network were analyzed.

Key words
Open Innovation, Cluster, Bioenergy Cluster for the Region, deENet Network

Introduction

The phenomenon of open innovation (IO) was described at the end of the twentieth century. This idea is a peculiar contrast to the so-called closed innovation, which assumes that the process of creating new values requires control as a factor for success [1]. In other words, innovation would be fully integrated into the structure of an organization and would contribute to the generation of new products or services. By the end of the twentieth century this model became obsolete because mental mobility increased, which made intellectual property protection difficult. In addition, private capital increased significantly, allowing the commercialization of solutions developed by research institutes. Furthermore, technology has developed significantly, which has contributed to an increase in R&D expenditures while reducing the life cycle of new solutions.

The idea of Open Innovation (OI) assumes the creation of multi-stakeholder capitals, which include companies, organizations, and research units whose common goal is to create and develop innovative products. OI has two important features [2]: network and stakeholders. The network aims to meet the needs of shareholders to introduce and use external knowledge and access to new markets [3]. The network thus provides participants with access to skills, knowledge, and other measurable benefits. OI is a complex means of development. Due to the nature of many OI stakeholders, it cannot be considered only on differences at the organizational level, and attention should also be paid to individual and social relationships. It can be said that knowledge and information is an important resource and a motivating factor for the context of Open Innovation. However, if they are not shared they cannot be used, and therefore will not contribute to creating new values. Sharing information is a difficult process, especially if this is the case in an OI environment. These difficulties can be described within four problem areas: adequate motivation to share knowledge, protection against free access to information without own contribution, ensuring the appropriate flow of information, and individual, organizational and social barriers.

The above-mentioned problems can, however, be offset by the transfer of staff and knowledge brokers, or by direct communication [4]. The following table outlines the principles that should apply when sharing information within Open Innovation projects.

Table 1. Rules for sharing information within Open Innovation projects

	Efficiency	Motivation	Breaking Barriers
Transfer of staff	Awareness of different competences and knowledge	Knowing the process of creating from a different perspective. Increasing network identity	New Relationships
Multimedia materials	They support the exchange of detailed knowledge However, problems with the clarity of the message may occur		
Knowledge brokers			Initiation of cooperation Creating links between networks
Direct communication	Enables the transfer of sensitive knowledge	Increasing the identity of building trust	
Specific goals	Target orientation increases acceptance	Stimulation of trust	
Interpersonal relations	They increase the ability to absorb knowledge	Stimulation of trust	
Rules and agreements	They create a bureaucratic barrier	Stimulation of trust	
Choosing the right partners	They increase the ability to absorb knowledge	Stimulation of trust	

Source: own study based on [5]

Nevertheless, despite the above, processing information in line with the Open Innovation concept is difficult. There are many tools that can stimulate this process, but their matching and selection should be done individually to meet the requirements of the network members.

Determinants of the implementation of open innovation

According to the OECD definition, a modern knowledge economy is one that directly relies on the production, distribution and use of knowledge and information. Innovative companies make inventions in their own laboratories, but increasingly use the research potential of universities and research institutes, financed from public and private sources.

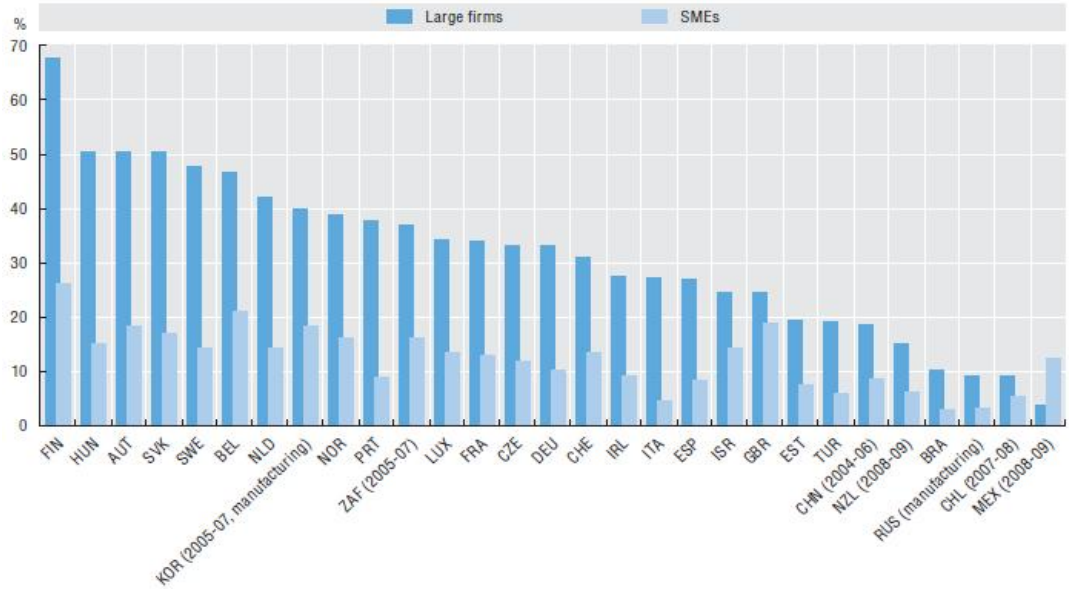


Fig. 1. Participation of innovative companies cooperating with universities and research institutes (by business size)
Source: OECD , based on Eurostat (CIS-2008) data and international data sources, June 2011

Analysis of the above figure shows that among OECD countries, the number of patents registered to patent offices in the EU, the United States and Japan is dominated by Switzerland, Germany, Sweden, and Finland. Luxembourg, Iceland and France lead in the number of registered trademarks.

An important indicator of the level of interest in socio-economic development and innovation-based competitiveness is the level of enterprise spending, incurred for private business budgets for research and development (R&D). This indicator covers expenditures on internal R&D and that carried out by research institutes and the higher education sector, but only those that aim to create innovative products, technologies and techniques for the development of new or improved goods and services introduced to the market. Finland is the leader among the members of the European Union who saw the earliest development opportunities in science and economy cooperation.

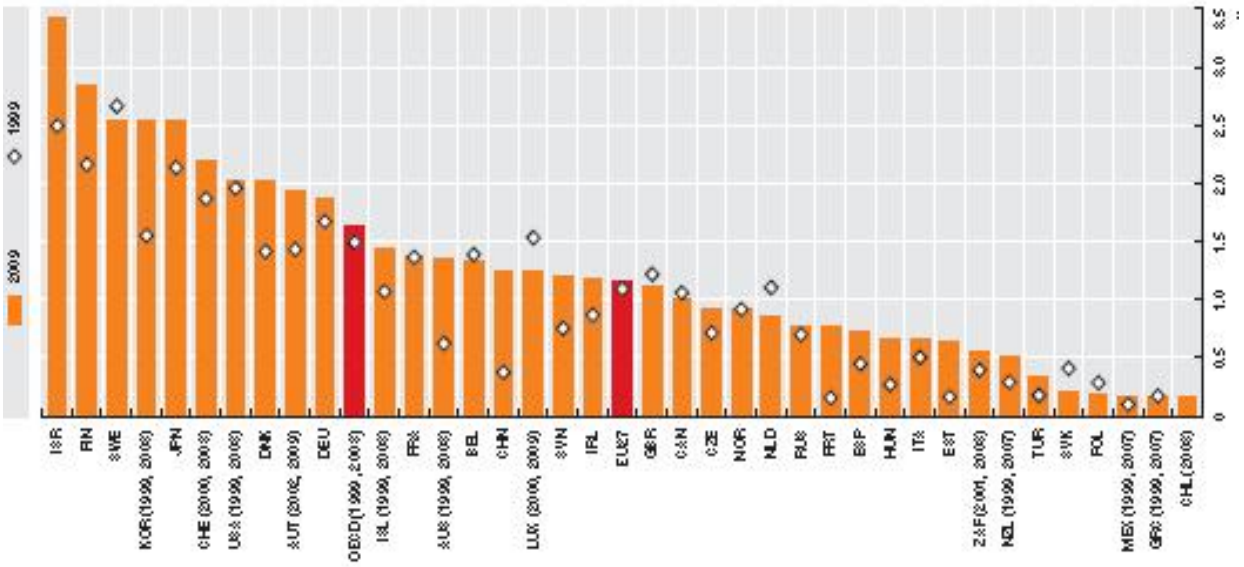
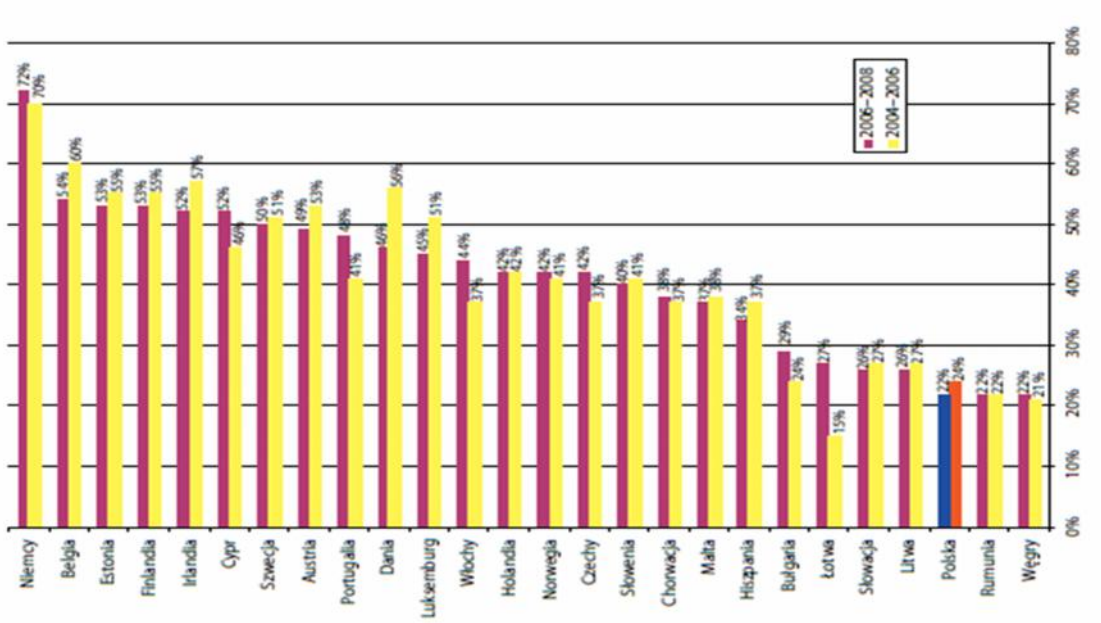


Fig. 2. Expenditure of R&D enterprises in 1999 and 2009 as a percentage of GDP
Source: OECD, Main Science and Technology Indicators Database, 2011



ys.3. Percentage of companies conducting innovative activity in the scope of products and processes in industry in selected countries in the years 2004-2006 and 2006-2008
Source: Innovation Report 2010, based on Eurostat Statistics Database

Niemcy – Germany; Belgia – Belgium; Estonia – Estonia; Finlandia – Finlandia; Irlandia – Ireland; Cypr – Cyprus; Szwecja – Sweden; Austria – Austria; Portugalia – Portugal; Dania – Denmark; Luksemburg – Luxembourg; Włochy – Italy; Holandia – The Netherlands; Czechy – Czech Republic; Słowenia – Slovenia; Chorwacja – Croatia; Malta – Malta; Hiszpania – Spain; Bułgaria – Bulgaria; Łotwa – Latvia; Słowacja – Slovakia; Litwa – Lithuania; Polska – Poland; Rumunia – Romania; Węgry - Hungary

As the above figures show, 68% of large and 25% of small and medium innovative Finnish companies cooperate with universities and external research institutes, while in Germany these ratios are 32% and 10%, respectively, and in Poland they oscillate around a few percent. Only 7% of Polish companies run their own R&D studies, and only 3% of companies do it on an ongoing basis.

Fig. 4. Number of patents and trademarks per capita in 2007-2009 [1]
Source: OECD, based on Patent Database data, May 2011, US Patent and Trademark Office (2011), JPO Annual Reports 2008-2010

As can be seen in Figure 3, the Finnish, Swedish and Danish companies spent the most on research and development among the European Union's member states from 1999 to 2009. German companies were also above the OECD average. It is noteworthy that in 1999 Sweden was the world leader in R&D expenditures. Although it currently ranks third in the ranking above, it is still a country with impressive achievements in pro-innovation areas.

The key to building a competitive economy at the national and regional level are new technologies that are increasingly emerging through close links between businesses and science and its latest developments. The most rapidly developing innovative economies are based less on natural resources and material resources as they were in the 20th century, and more on high quality social capital, information and telecommunications technologies, and international cooperation. Most importantly, the introduction of innovative products and services into the economic practice resulting from the work of research institutes, universities and development centers.

One measure of innovation is the number of patents and registered trademarks per capita. As the above chart shows, the number of patents filed to the patent offices of the EU, the United States and Japan is dominated by Switzerland, Germany, Sweden, and Finland. Luxembourg, Iceland and France are the leaders in registered trademarks. Poland, however, has a long way to go. Innovation in Polish companies, measured by the number of patent applications and registered trademarks, significantly deviates from the levels recorded in most EU countries. From the PARP Innovation Report 2010, it follows that this concerns not only product and process innovations but also organizational and marketing innovations, whose relevance is constantly growing. Polish companies ranked among the last places in terms of average expenditures on innovative activity, the percentage of companies implementing innovations, and the average value of output sold of new or significantly improved products. In addition, for many years they have maintained a low position in terms of outlays and the number of companies doing so in the field of research and development. Since the Republic of Poland became a member of the European Union in 2004, there has been growing awareness of the need to move away from the traditional, extensive industries in favor of building a knowledge-based economy.

[1] Triadic patent means a series of patents registered simultaneously with the European Patent Office (EPO), the USPTO and the Japanese Patent Office (JPO) for the same invention by the same applicant or inventor, creating a special type of patents family.

Clusters: A source of innovation and synergy of benefit

Increasingly, innovation is the result of the cooperation of many organizations in a network, including companies, institutions of the R&D sector, and supporting institutions. In the technology transfer and commercialization process, the role of intermediaries between bidders and the recipients of innovation is increasing. These institutions include innovation and technology transfer centers, academic business incubators, technology incubators, science and technology parks. Most importantly, they also include collaborative networks and links between companies, research institutes, universities, business environment institutions, and local administration. At present, EU policy is focused on the development of companies operating in networks or clusters. Different types of clusters can be distinguished, inter alia knowledge-based clusters for which the added value is to support the development of innovative enterprises that benefit from the research output and achievements of affiliated R&D institutions or academic centers.

Effective and expansive local innovation systems remain open, which is a key element of their success. Innovative clusters are not exclusively high technology clusters, but also low- and middle-tech clusters, such as clusters for the development of renewable energy.

There are many bioenergetic clusters in the global and European economies that are internationally successful, thanks to high-tech process innovations and a multi-faceted, integrated approach to solving problems. Examples are the Polish Bioenergy Cluster for the Region and the German deENet network.

Cluster Bioenergy for the Region

Cluster Bioenergy for the Region is an open-ended cooperative initiative, bringing together more than forty companies, research institutes, local government units and business environment institutions operating in the field of renewable energy resources. The aim of the Cluster is to contribute to the sustainable development of bioenergy of the Lodz Region in the context of the European Commission's Integrated Action Package on Energy and Climate Change to reduce emissions in the 21st century. Its mission is realized through the following features:

- Comprehensive solution to issues related to regulating the market of renewable energy sources in the Lodz region, especially in the scope of methods of obtaining, processing and using biomass as RES;
- Integration of the activities of Cluster Members such as companies, research units and local authorities to increase the share of biomass, geothermal and solar and wind energy in the region's energy balance;
- Educational and information activities promoting the use of renewable energy sources and energy efficiency in Łódź.

Since the development of renewable energy is a global challenge, going beyond a single region or a country, the Bioenergy for the Region cluster appreciates the importance of international cooperation. The cluster within the framework of internationalization is oriented towards the following objectives:

- First, improving the image of Poland as an attractive economic partner in the field of renewable energy, a place to establish valuable business contacts, investing and operating environmentally friendly businesses;
- Second, fostering the international flow of knowledge and experience in developing renewable energy;
- Third, promoting the international partnership of members of the Bioenergy Cooperation for the Region.

Bioenergy for the Region is the official partner of the European Commission as part of the campaign "Sustainable Energy for Europe", run by the Directorate-General for Energy and Transport. Bioenergy for the Region is an active member of the Swedish-Polish Sustainable Energy Platform and participates in the work of the "Cluster-Dialogue Germany-Poland" network, which works to develop economic cooperation between the members of the renewable energy cluster in Poland and Germany.

The Distributed Energy Competence Network (deENet) was established in 2003 as a joint initiative of entrepreneurs, the Agency for Regional Development and the University of Kassel. Since then, through numerous research and pilot studies, deENet has established a strong brand recognition both nationally and internationally. Today, the network is comprised of more than 120 members representing various actors involved in R&D, planning, production, service and further education. These issues are illustrated in the figure below.

Fig. 4. Different areas of activity of individual members of deENet network
Source: deENet network

Twenty of the network members are engineers, architects, associations and agencies, as well as private individuals. The rest are manufacturers providing solutions in the field of distributed energy, people from consulting companies in the construction and energy sectors, as well as manufacturers of electric cars. There are numerous companies focusing on photovoltaics and bioenergy among the network members.

However, in a general perspective, the economic profiles of partners are related to all aspects of distributed energy. Similar variation occurs in the context of the size of the companies that are part of the network, including micro, small, medium and large enterprises with headquarters or agents located in the region. At present, the main activities are carried out by staff in Kassel, who are responsible for overseeing joint research projects and helping to exchange information between members.

The deENet network is a unique composition of universities, institutions and innovative companies. It is important that they form a coherent whole of the supply chain, from the research process through planning, design, production to implementation and further education. Network members are active and aware of the role that renewable energy plays in the economic development of the Hesse region. Consequently, they focus on areas such as solar and wind energy, bio-energy, hydroelectric power, geothermal energy, energy efficiency for residential and industrial buildings, and cogeneration. One of the priority issues today is the creation of regional added value through the creation of decentralized energy systems and the development of strategic documents for municipalities to implement an integrated environmental system. In response to these needs, the deENen Network, in collaboration with scientists and public administrations, implements many projects designed to develop joint strategies and feasibility studies for the reduction of carbon emissions. These projects are regional and national in nature, and international initiatives complement them. Internalization aims to exchange experiences and take advantage of the best practices abroad, which is expected to translate into sustainable economic growth of the entire network and the individual participants.

Conclusion

In conclusion, both the deENet network and the Bioenergy Cluster for the Region are excellent examples of success achieved through open innovation. By creating multi-sectoral capitals, they bring together businesses, organizations, and research units pursuing the common goal of creating and developing innovative products.

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