EMI, Vol. 6, Issue 1, 2014
ISSN: 1804-1299 (Print), 1805-353X (Online) Article

SUPPORT OF INNOVATION POTENTIAL IN BUSINESS ENVIRONMENT WITH KNOWLEDGE INTENSIVE SERVICES

PODPORA INOVAČNÍHO POTENCIÁLU V PODNIKATELSKÉM PROSTŘEDÍ ZNALOSTNE INTENZIVNÍMI SLUŽBAMI

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Abstract:
This article focuses on analysis how can influence knowledge intensive services to increase innovation activities of economy. The analysis aims to highlight that outsourced engineering services are becoming more important within the innovation process of enterprises. The introductory part of this paper describes the degree of innovation intensity in Slovakia. The next part characterizes the role of knowledge intensive services in innovation performance to maintain the level of competitiveness and the description of key KIS based on engineering.

Key words:
Innovation potential, knowledge intensive services, support of innovation activities, engineering.

Abstrakt:
Příspěvek je zaměřen na analýzu možných vplyvů znalostně intenzivních služeb na zvyšování inovační aktivity v podnikatelském prostředí. Cílem je zdůraznit fakt, že externě zabezpečované inženýrské služby se stávají při realizaci inovačních procesů pro mnoho podniků stále důležitějšími. Úvodní část článku specifikuje východisko problematiky - hodnocení nízké inovační úrovně Slovenska a přechází do charakteristiky znalostně intenzivních služeb z hlediska jejich aplikací při přípravě inovací. Zejména posílení inženýrských kompetencí prostřednictvím outsourcingu služeb této kategorie je významným impulzem pro zvyšování inovační výkonnosti malých a středních podniků.

Klíčová slova:
Inovační potenciál, znalostně intenzivní služby, podpora inovačních aktivit, inženýring.

JEL: L80, O30

1 Introduction

The Slovak Republic has improved the quality performance of its science, innovation and technology base, and has slightly changed the structure of its economy towards a higher knowledge intensity and greater weight of high- tech and medium- high- tech products in the trade balance. The main challenge for the country in the future consists in raising the knowledge intensity in firms and innovation performance growth. Knowledge-intensive services (KIS) contribute significantly to the improvement and acceleration of product, process and organizational innovation processes and the transfer of experience, best practices and solutions. Growth in the KIS sector could drive innovation throughout an economy. So the size of the KIS sector should be positively associated with the rate of growth in innovation performance. Innovation involves the application of knowledge in creative activities and knowledge is a key output of innovation. Knowledge- intensive engineering services providers support innovation performance in business environment and thanks to their creative activities, skills and abilities it is possible to generate new innovative ideas that will help organisations to achieve a competitive advantages.

Submitted paper deals with the challenges of knowledge intensive services, based on engineering outsourcing, that offers to enterprises a number of advantages, e.g. cost reductions, increased flexibility and access to complementary competencies. Subject of this article covered the tendencies, possibilities and impulses to future developing the knowledge, information and innovative economy. The scope of the article begins with more general issues of innovation intensity and performance in Slovakia. At the introductory part of this paper is formulated the reflection that the innovation intensity in the Slovak Republic is one of the lowest within the EU. After that the focus is turned to a more specific analyze of knowledge- intensive services. In this study the aim is at recognizing those engineering services that are important for innovations. Some KIS related with product design and process modernization can be considered as accelerators that support growth of innovation performance. A model of innovation process and related activities to generate innovations with knowledge services is presented. There are other important outsourced engineering activities for knowledge creation in innovation processes that should be analyzed and understood in order to support innovative business. These themes have been studied in order to deepen the understanding of the connection the innovation potential with the knowledge intensive services.

To prepare this article it was necessary to analyse relevant documents that were publish from reputable institutions, mainly carried in online version. Our interpretations of information presented in this article are based on the combined data set of many published papers in global scale.

Primary data were obtained through mapping of different reports and analysis of studies, based on using the methods of collection, comparison, induction, deduction and synthesis of knowledge.

2 The scope of innovation potential in Slovakia

Over the last decade, in the Slovak Republic, R&D intensity has steadily declined from a peak of 3.88 % in 1989 to 0.68 % in 2011, one of the lowest within the EU. [6] The rise of a dual economy limited the indigenous R&D capacity: on the one hand a predominance of foreign multinational companies with high productivity and on the other, 60 000 domestic SMEs and a few large companies typically with low productivity levels.

2.1 The indicators of innovation performance

With the development of knowledge economy, technology and market changes rapidly, knowledge, innovation and speed of service businesses gain a competitive advantage to become the key. The indicators in the table 1 present the synthesis of research, innovation and competitiveness in Slovakia. They relate knowledge investment and input to performance or economic output throughout the innovation cycle. They show thematic strengths in key technologies and also the high - tech and medium - tech (HT + MT) contribution to the trade balance. The table includes a new index

on excellence in science and technology (S&T) that takes into consideration the quality of scientific production as well as technological development. The indicator on knowledge - intensity of the economy is an index on structural change that focuses on the sectorial composition and specialisation of the economy and shows the evolution of the weight of knowledge - intensive sectors, products and services. [6]

Table 1: Characteristics of the innovation intensity in Slovakia

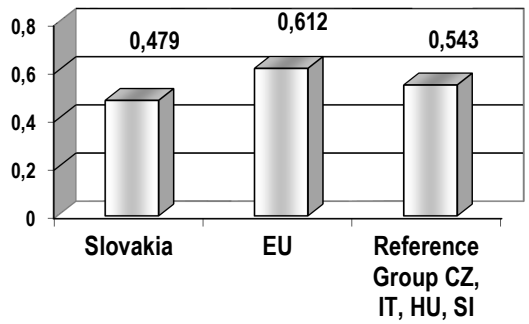
Area	Investment and input	Performance/ economic output
Research	***R&D intensity*** 2011: **0,68%** (EU: 2,03%; US: 2,75%)	***Excellence in S&T*** 2010: **17,73** (EU: 47,86; US: 56,68)
Innovation and structural change	***Index of economic impact of innovation*** 2010 – 2011: **0,47** (EU: 0,61)	***Knowledge – intensity of the economy*** 2010: **31,64** (EU: 48,75%; US: 56,25%)
Competitiveness	***Hot- spots in key technologies*** Foot and agriculture, Energy, ICT, Materials	***HT + MT contribution to the trade balance*** 2011: **4,35 %** (EU: 4,2%; US: 1,93%)

Source: European Commission study [6]

The research and innovation system in the Slovak Republic is characterised by a very low R&D intensity (one of the lowest in Europe and also low compared to the reference group countries CZ, IT, HU, SI) in both the public and private sectors (in 2011, the Slovak R&D intensity was 0.68 % of GDP, where public sector R&D intensity amounted to 0.36 % and business R&D intensity 0.27 %). [10] In the private sector, domestic firms, including a great number of SMEs and a few large companies, are characterised by low R&D expenditure and productivity levels. As a result, the production system is dominated by technology imports. Therefore, a major challenge for Slovakia remains to be raising the R&D intensity in Slovak firms and the country shows particular strengths in the automotive sector. [6]

The index below (see chart 1) is a summary index of the economic impact of innovation composed of five of the Innovation Union Scoreboard's indicators. [6]

Chart 1: Summary index of the economic impact of innovation



Source: European Commission study [6]

According to this index, the Slovak Republic underperforms compared to its reference group and is clearly below the EU average. The country ranks 18th due in particular to its poor performance in factors "patent applications per GDP", "share of the employment in knowledge - intensive activities" and "share of knowledge - intensive services in total export of services". [6]

Investment in knowledge, technology - intensive clusters, innovation and the upgrading of the manufacturing sector and knowledge – intensive services are determinants for a country's competitiveness in global scale into the future.

3 Reflection of knowledge intensive services to support innovation activities

Knowledge Intensive Services hold a pivotal role in "new" knowledge-based economies. [10] KIS are firms that provide knowledge-intensive goods and services for other business firms. Knowledge is the main production factor and the good they offer. KIS firms themselves are frequently also engaged in innovation activities. Activities of KIS aimed at innovation and overall development of higher added value consists in collecting, concentrating and diffusion of expert knowledge. KIS can affect the innovation processes in different ways: some services (such as R&D and strategic management) aim at firm renewal; other, more routine services (such as accounting) help maintain and improve existing systems and activities within organizations. [4]

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2 3.1 The role of knowledge intensive services to innovation

KIS can be defined as [5] economic activities conducted by private sector organizations that combine technology, knowledge (such as R&D) and highly skilled employees to provide a service to the market. KIS are generally characterized by their knowledge intensity (knowledge intensity reflects the integration with a generic or service-specific science and technology base), relative capital intensity and high degree of specialization.

KIS are both sources and carriers of knowledge, which influence and improve the performance of individual organizations, value chains and industry clusters across all sectors of the economy. KIS activities play several important roles in innovation processes; they serve as [7]:

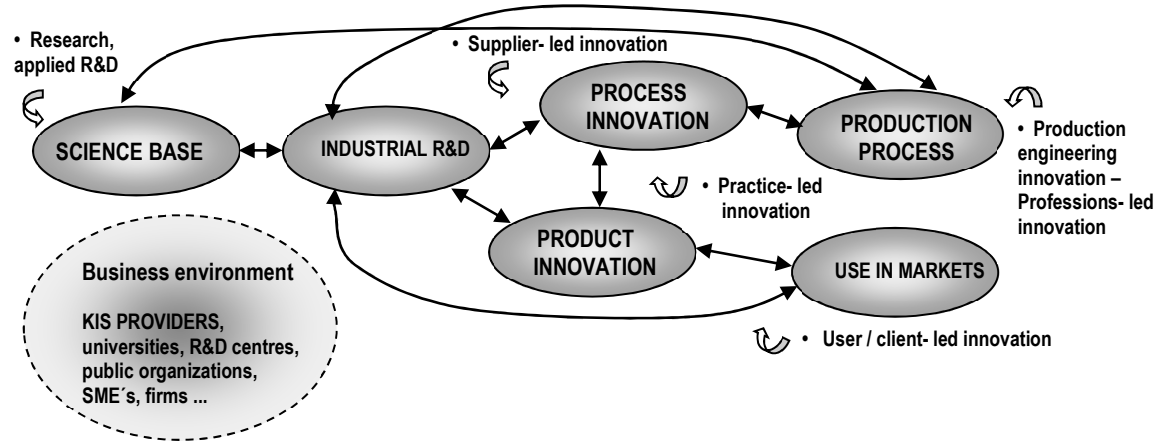
- *sources of innovation* - when they play a role in initiating and developing innovation activities in client organizations;

- *facilitators of innovation* - when they support an organization in the innovation process;
- *carriers of innovation* - when they aid in transferring existing knowledge among or within organizations, industries or networks so that it can be applied in a new context.

Reflecting their different roles, KIS are used to different degrees at different points in the innovation process, e.g. services related to R&D are important in early stages of innovation, while those related to intellectual property rights, commercialisation, marketing and production processes tend to be more important during later stages of the innovation life cycle. [11] KIS activities influence innovation via collective or collaborative problem-solving processes in which organisations work together to meet a market need or opportunity.

There are many relevant characteristics that are important to measure the innovation performance of company - one of the aspects of the company's innovation potential is degree of collaboration in partnership networks. The importance of KIS due to the fact, that, for example, small and medium enterprises have very often limited resources to implement their innovative activities. This is one of the main reasons for the development of knowledge-intensive services. [5] The model of KIS provider networking shows figure 1. Companies involve external partners in innovation processes and these are not only KIS firms. The basic types of infrastructure applicable to growth KIS sector with R&D and innovative capacities are e.g. science and technology park, university center (working places and laboratories at universities), centre of excellence, technological development center, research institutions, engineering services center (centres focused on engineering, construction, designing services from early phase to virtual manufacturing phase, development services and prototyping), testing center, innovation center (centres focused on new innovative solutions of products, production processes, systems, designing of testing laboratories, plant layouts, creating analytical documents, innovation intelligence) etc..

Figure 1: The KIS players in the field of generated innovation



Source: Autor´s adaptation according to [2]

There are two major types of effects that KIS carry out in innovation [4]:

- *The direct effects* refer to the development of own innovations (product, process or organizational).
- The specific effects of KIS are the *indirect*, divided into four types: knowledge transfer, integration of different stocks of knowledge and competence, adaptation of existing knowledge to the specific needs of their clients and production of new knowledge.

KIS providers develop the product via application of new knowledge and support of IT tools, adaptation of existing knowledge from different sectors of the economy, create unique solutions and

integrate the outputs of innovation intelligence into the business processes. KIS supporting the innovation performance of enterprises combine multidisciplinary expertise. It leads to mutual combination of knowledge bases, mutual learning process and creation of new knowledge, up to the merge and implementation of experience, which was for the enterprises previously not available (or the enterprises were not available to effectively use it without the necessary consulting support). The providers of KIS up-and-coming open up the new strategic possibilities for innovative business development. It is realized through the accumulation of new scientific information from other branches or through the transfer of specific knowledge between sectors towards the comprehensive sophisticated product and technological innovations. [7]

4 Enhanced of innovation potential with KIS based on outsourced engineering

There are different reasons for wider use of knowledge engineering services in the form of external outsourcing and supporting such design innovations. Among them, the most significant regards are: the individualization of customer demands, reducing the product life cycles, sophistication and increasing complexity of products, dynamics, variation and flexibility in the technical, economic and social sphere, the potential of high-tech electronics and effort to reduce the costs particularly through outsourcing. [1]

The specific challenges for the growth of the outsourcing services are following [1]:

- Development, manufacturing and logistics need to be better integrated, while product life cycles are reduced and time-to-market is minimized.
- Market and product requirements are changing continuously – process complexity and cost pressure is rising all the time.
- Strong and rapidly occurring sales fluctuations require increased flexibility in production.
- Heterogeneous IT environments and high maintenance costs for legacy systems are causing unnecessary and increasing IT costs.
- The requirement for global networking is growing continually.
- The holistic planning, implementation, control and on-going improvement of major manufacturing processes and resources require the methodical implementation of a ‘digital factory’, including IT-based tools for well founded management decision-making.

  Integration of KIS into the business processes in the context of product development and production design and planning enhances the quality of business processes in various dimensions.

3 4.1 Innovation supported by engineering services

Important engineering services, requiring intensively generating the knowledge and constant updating, are the services for product innovation - design and prototype development. Providing of these services in the field of research and product development is so called high-tech knowledge intensive services. These are services with high added value. Most frequent outsourced knowledge services in manufacturing industry based on engineering are e.g.: product idea and concept design, product design, product engineering and testing, product development and set up of manufacturing process, product sales and distribution support. [3] The main areas of engineering - KIS utilization within the frame of product lifecycle can be described as follows [8]:

1. *Product design and technology development*: these services range from concept development, to analysis and design, for virtual design, modelling, animation, digitizing, simulation, prototyping and production, testing and product lifecycle management solutions.

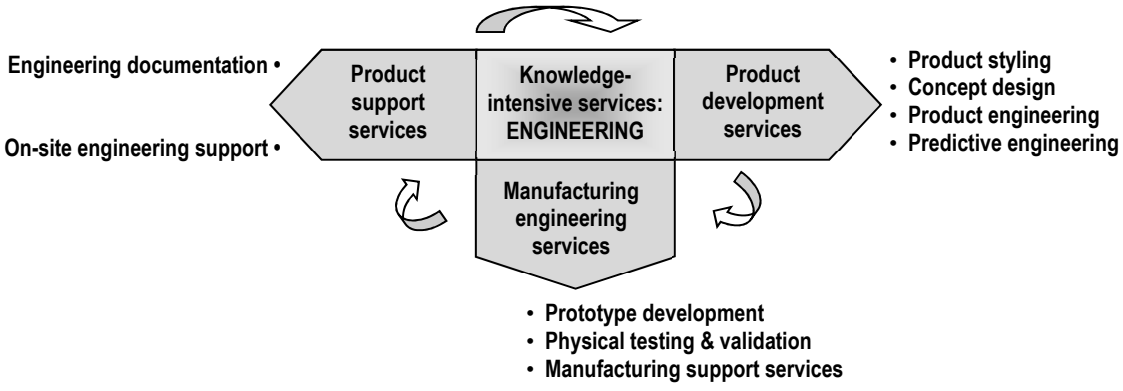
2. *Process engineering*: these include the use of various tools and techniques to achieve efficiency through optimization of plant (production-delivery facility) set-up and operational costs, optimization of material and information flows.
3. *Plant design and automation*: starting from plant layout and design for the optimized production or delivery process, these services extend through development of automation systems for monitoring and managing production activities and also to facilitate organizations make faster decisions. These can be expert services and innovative solutions for investment projects, project management.
4. *Plant operations and maintenance*: these services include monitoring, managing and maintenance of plant, equipment and the associated automation systems. Comprehensive services optimizing manufacturing operations in order to gain the quality systems, safety and environmental certificates.
5. *Process assessment and re-engineering*: these are techniques to reduce operational inefficiencies through continuous performance assessment of the process and re-engineering them.

Figure 2 presents selected KIS to support engineering processing in companies during the innovation projects working out. Knowledge services for manufacturing sector focuses on engineering represented solutions: from product design through all engineering disciplines, from e.g. digital planning to final production. [9]

In the global market of engineering services, there is a lot of room for intermediaries who deliberately seek the new knowledge and transfer it to their clients in the form of innovation consulting. Such a service solutions are provided in two main forms [4]:

- *Consulting*: identification of innovation potential in the product lifecycle; development of product design, harmonization and optimization of manufacturing processes or selected sub-processes, followed by foresight – roadmap for further steps.
- *Implementation*: in the fields of collaborative product development, product data management supported IT service, production and visualization that are specifically tailored to the requirements of the industry.

Figure 2: Engineering activities as part of provided knowledge intensive services



Source: Autor´s adaptation according to [9]

Offering KIS-type services are based on professional experience and accumulated knowledge that are applied to provision of services to partners, and these services are focused on adoption and implementation, as well as the joint development of innovative solutions.

There are specified main benefits of engineering services outsourcing [3]:

- Flexibility: it provides companies with access to a large pool of engineering resources and enables them to quickly build up, reduce or refocus their resources.
- Cost reductions: engineering services provider enables clients to reduce their own R&D workforce as some – typically less complex – tasks are completed by external engineers who usually work for lower salaries.
- Access to additional competencies.

And on the contrary, the possible disadvantages are [3]:

- Potential loss of know-how and intellectual property is the most prevalent; as industrial companies begin to bring into their R&D organizations external engineers who will leave once a project is finished, the accompanying know-how will also leave the organization if no preventive measures are taken.
- The day-to-day cooperation between internal and external engineers can create additional "hidden costs" (e.g. for travelling, IT systems, communication) that further diminish the achievable cost reductions.

Significant impact on the improvement and support of engineering has computer science and computer technology. Continuous progress in this area shows in advanced CAx systems, whose implementation in product development and production systems is becoming a prerequisite for competitiveness and innovation ability of enterprises. This area also heavily involves the specialized knowledge service providers. [9]

5 Conclusion

Presented article discusses the importance of the activities of the knowledge- intensive services in the area of innovation potential in business environment. It is focused on the characteristic of the selected knowledge- intensive services based on the engineering capacity.

One of the conclusions of the article is that outsourced KIS are very significant to engineering support in the innovation performance to the firms since these represent not only important input, but also output to the transformation process. The business cooperation can be an important route for the transmission of the knowledge and experience into innovation in high-tech area.

Knowledge intensive services firms perform the screening of new knowledge and systematically seek the information that could be commercially evaluated and thereby stimulate the innovation activities in enterprises. KIS contribute significantly to the improvement and acceleration of product, process and organizational innovation processes and the transfer of experience, best practices and solutions. A functional system of transfer of innovation based on knowledge-intensive services is characterized by the mutual interaction of subjects in business environment, involved into commercialized research and development (universities, research organizations, technology transfer agencies, consultants, educational institutions, SMEs, etc.).

Product design, engineering analyses and manufacturing support through the KIS means that across most industries, engineering capabilities become increasingly critical to driving growth through innovation and new product development. Summing up, engineering services outsourced to enterprises mean lower development costs, quicker time-to-market, more efficient global collaboration, improved compliance with laws and directives, reduced IT complexity and hence also significantly higher customer retention.

In context of the innovation potential support through knowledge-intensive services, it can be concluded that innovation in connection to knowledge intensive services sectors have a major impact on technology transfer and increasing competitiveness. As the pressure to innovate increases and the

means of doing so become more complex, there is a growing tendency to outsource knowledge input for innovation. Firms are increasingly outsourcing KIS including to foreign providers. This practice has contributed to economy-wide productivity growth and helped accelerate and deepen the innovation process.

With respect to future research in the field of innovation performance, it seems clear from this paper that one of the main challenges is to sort out more systematically the relationship between the key dimensions investigated, in particular the roles and functions of KIS in creating and diffusing knowledge and fostering regions as innovation systems.

Based on the analysis listed above in the article, it is possible to summarize the following conclusions:

- The success key to gain of competitive advantage in terms of development of knowledge economy, technology and market changes is knowledge, innovation and speed of service.
- Customers become an important source of innovation in business environment, so high degree of innovation with knowledge-intensive service oriented customers.
- The prominent role of knowledge intensive services in the innovations process is becoming evident.
- The knowledge-intensive services play an important role as carriers, shapers and creators of innovations.
- KIS can play a critical role as intermediaries and agents of innovation.
- Certain engineering services are taking the lead role in the innovation process.
- The suppliers of knowledge-intensive services are taking a more central role in innovation within national and international innovation systems.
- Due to increased outsourcing and networking, service firms are increasingly becoming partners to manufacturing firms in innovation.

KIS provide knowledge, self-knowledge must first be carried out continuously innovate and absorb new technical knowledge, develop new information processing and analysis methods, the creation of appropriate technology and production requirements of the development of new knowledge and application of models; must also, together with their clients from the manufacturing field to innovate, provide solutions to a variety of new problems of knowledge service products.

[1] **Acknowledgements**

[2] This contribution is the result of the project "*VEGA 1/0879/13: Agile, to market adaptable business systems with highly flexible structure in enterprise*" - supported by the scientific grant agency of the Ministry of Education of the Slovak Republic (ME SR) and of Slovak Academy of Sciences (SAS).

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