

# **The Changes of Information Technology Structure in Condition of Adaptation the Enterprises' Management System to the Knowledge-Based Economy Requirements**

*Joanna Kałkowska*

*Faculty of Engineering Management  
Poznan University of Technology  
Poznan, Poland*

## **ABSTRACT**

The accepted conception of the knowledge-based economy development supported by capital achieved from the European Union is a great background for enterprises' development. The direct and indirect opportunities which are created by the knowledge development economy is a sign for adaptation the enterprises' development strategy to the new economy conditions as well as to proper selection and development of information technologies which are one of the basis of adaptation to the new reality. According to this, it seems to be observed a kind of growing trend of ICT importance in Poland. Also, the global or European development of ICT affects the use of ICT in Poland what directly influence on the Polish enterprises competitiveness. According to this, also the importance of different e-services as well as IT outsourcing will be increasing. The paper is focused on selected research results concerning the changes in usage of ICT technologies in selected Polish enterprises in a process of adopting into knowledge-based economy requirements. Presented researches of ICT technologies are a part of broaden research concerning adaptation the enterprises management systems into knowledge based economy requirements which are carried out since 2010 at the Faculty of Engineering Management, Poznan University of Technology.

**Keywords:** Information and communication technologies (ICT), Knowledge-based economy

## **INTRODUCTION**

The goal of this paper is to present some research results concerning the changes in usage of ICT technologies in selected Polish enterprises in a process of adopting into knowledge-based economy requirements. The research was carried out under the project: "Adaptation the enterprises' management systems into knowledge-based economy requirements"<sup>1</sup>. The research concerning information and communication technologies (ICT) on the one hand results from ICT importance in knowledge-based economy and on the other hand results from the activities undertaken by the enterprises aiming to the use of opportunities creating by the knowledge-based economy. The research was aiming to point out the direct dependencies between the environment changes resulting from the knowledge-based economy assumption and adapting activities of organization' potentials. The presented results concern the importance of ICT in the enterprises focusing on presenting some changes while adaptation to the knowledge-based economy.

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<sup>1</sup> The project was carried out by the team of researchers from the Faculty of Engineering Management, Poznan University of Technology (J. Kałkowska, E. Pawłowski, S. Trzcielinski, H. Włodarkiewicz-Klimek)

## **KNOWLEDGE-BASED ECONOMY FUNDAMENTALS**

At present, one of the most important factor of socio-economy development as well as improvement of competitiveness became an enterprise's transformation into requirements of the knowledge-based economy. The enterprises are searching for competitive advantage concerning quality of products, manufacturing costs, time of launching products and application of modern information technologies. To achieve this, first of all enterprises need to possess the ability of the knowledge potential proper usage because widely understood enterprise's development is connected both with the permanent wining, transformation and usage of knowledge and information. To fulfill that opinion, the European countries in 2000 accepted the common concept of the knowledge-based economy. The development's postulate concerning the potential knowledge usage were presented in Lisbon Strategy which resolutions are still binding. The Lisbon Strategy focuses on four fundamental potentials, among which it can be distinguished following ones:

- human resources, i.e. society of knowledge (which the part of knowledge is gathered in),
- innovation system (with the entrepreneurship, more concentrated for operations of companies, but also on the cooperation with science), it creates new knowledge in result of discoveries and innovations,
- information technologies facilitating the exchange of knowledge, also with foreign countries,
- institutional and legal environment, which creates conditions for development of presented domains; it constitutes from various institutions and regulation, etc. (Kałkowska and Włodarkiewicz-Klimek, 2009).

The classic definition presented in 1996 by the OECD shows the knowledge-based economy as an economy which directly is based on the production, distribution and using the knowledge and the information (OECD, 1996). World Bank is presenting another view point at the idea of knowledge based economy claiming that the economy is becoming a „knowledge-based economy”, when using and creating knowledge maintain permanently the center of its processes of the economic development. The knowledge-based economy is an economy which uses knowledge as a motor of economic growth (World Bank, 2006). Knowledge is treated here as a fundamental driving force of the economy, as a factor stimulating to progress.

The accepted conception of the knowledge-based economy development supported by capital achieved from European Union is a great background for enterprises' development. The direct and indirect opportunities which are created by the knowledge development economy is a sign for adaptation the enterprises development strategy to the new economy conditions as well as to proper selection and development of information technologies which are one of the stimuli of the adaptation to the new reality. Taking into consideration the Lisbon Strategy it can be state that the enterprises which applied Information Technologies become a part of this strategy.

## **THE CONTEXT OF CHANGES OF THE INFORMATION TECHNOLOGIES IN THE KNOWLEDGE-BASED ECONOMY**

Information technologies are a critical factor for the effective operation and prosperity of modern organizations, however, management and dissemination of information is central for the enterprise (Morgan, Colebourne, Brychan, 2006). Also other result of IT application in enterprise is depart from hierarchical organizational structure which very often lead to communication barriers, mistakes in information flow as well as wasting human knowledge. Moreover, IT are considered as a one of the most important factors of modern enterprises development and competitiveness. IT usage influence also on a number of indicators allowing for competitiveness estimation. These indicators are following: costs reduction, quality improvement, increasing production flexibility, products and technology innovativeness, extending products assortment and productivity, introducing into international markets. Moreover, thanks to the information infrastructure and proper software it is possible a quite fast coordination of all tasks carried out in enterprise. Also e-business based on IT technology became an intensive dominant area. Besides, one of a key factors of enterprise's management system in a context of the knowledge-based economy is including information technologies into widely understood management processes. In that meaning, this technologies are

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treated as a one of determinants of enterprises' transformation into knowledge based economy, enabling not only for increasing but also for crating of new organizational knowledge. Furthermore, information technologies may dramatically enhance the coordination and control capacity of the enterprise, so that way can stimulate increase use of management system. IT removes distance and time constrains in accessing required information flows and hence improves the coordination of activities within organizational boundaries. IT affects planning systems by improving organizational communication as well as by enhancing organizational flexibility (Spanos, Prastacos, Poulymenakou, 2002), however, the application of advanced IT corresponds to an incremental process of organizational capability and strategic impact (Spanos, Prastacos, Poulymenakou, 2002). Information and communications technology (ICT) are defined as the convergence of telecommunications and computing (Gibbs, Tanner, 1997); simply they are called information technologies ( IT).

According to the Lisbon Strategy, the motor of the knowledge-based economy are all activities aiming to the competitiveness' growth also through the intensive use of ICT. The ICT are the one of the basis factors fastening the globalization process and technology progress both while creating the knowledge-based economy as well as in a context of enterprises' development. That, the ICT are the one of the most important conditions fulfilling the concept of the knowledge management in the enterprise and their usage is one of the stimuli of permanent adaptation of enterprises' to the changes appearing in the environment.

In general ICT can be a basis of further deliberation from which it can be observed that the knowledge-based economy is very often described by ICT technologies development as well as technology progress and innovations. According to this, the influence of ICT development on changes in the knowledge-based economy can be analyzed in macro (independent variables) and microeconomic dimensions (dependent variables) (figure 1).

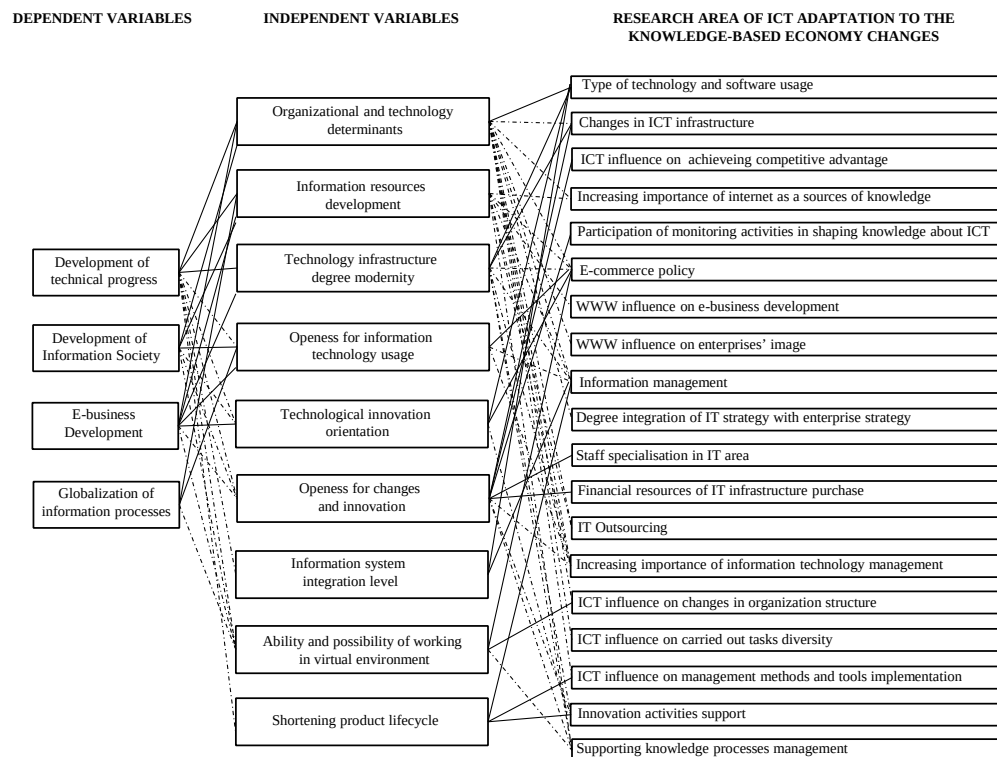


Figure 1. The research areas of adaptation the ICT technologies to the knowledge-based economy requirements (own study)

The macroeconomic dimension is related to the general condition of the economic system determining the enterprise development into the knowledge-based economy with particular reference to the actual technology trends. Within

that scope, the most adequate changes in the ICT area are described by the following independent variables: technology progress development, information society development, e-business development and globalization of information processes.

The microeconomic dimension is related directly to the enterprises, where ICT technologies on the one hand are the integral part of the information system assuring information and knowledge management and on the other hand enable the delivery of management process through the prism of information technologies.

In such a view, the information system is understood as a system of connected elements, decision making processes, methods and tools enabling to obtain planned goals which distinguishes temporarily and spatially to reach set goals (Unold, 2005, Łobejko, 2005). From the view point of management through information technologies, the information system will be connected with aspects which are related to its technical structure (computers, software, networks, servers, etc.), whereas the management through information technologies is oriented to the enterprises' accomplishment of goals by improving business processes, creating new developing possibilities, perceiving information technologies as a factor of competitive advantage growth as well as orientation towards accomplishment of the IT strategy (Brzozowski, Kopczyński, 2009).

## **THE CHARACTERISTIC AND RESEARCH RESULTS CONCERNING THE CHANGES IN IT IN A PROCESS OF ORGANIZATIONS' ADAPTATION TO THE KNOWLEDGE-BASED ECONOMY REQUIREMENTS**

### **The Research Concept**

The research concerning the ICT changes in knowledge-based economy was carried out under the research project: "Adaptation the enterprises' management systems into knowledge-based economy requirements". The project was carried out by the team of researchers from the Faculty of Engineering Management at Poznan University of Technology. The issue of initiated whole research was to point out whether there is a dependency and what type of dependency between changes that can be observed in the enterprises' according to the concept of the Europe development strategy in the scope, in which it tends to create the knowledge-based economy and changes taking place in enterprises, appearing in a process of building the organizations based on the knowledge. The research is also focused on presenting the relation between changes in the environment constituting the knowledge-based economy (independent variables) and changes in enterprises aiming to create a knowledge-based organization (dependent variables). One of the detailed research area is concerned on the research of the ICT technologies adaptation level to the knowledge-based economy requirements under the frame of the commonly conducted research of the project defined above.

### **The Research Characteristic**

The presented research was carried out in 150 random selected enterprises located in Poland. It embraces the time period from 2007 to 2012. The research was carried out by the paper and pencil interview (PAPI). The accepted research tool was the questionnaire involving 107 questions. The questionnaire was divided into four parts and enabled the evaluating changes in the strategy of enterprises, human capital, ICT technologies and organizational structure. Presented research results in this paper are only related to the ICT technologies and characterizes selected research area of the ICT adaptation to the knowledge-based economy requirements presented in figure 1. The analysis between dependent and independent variables in relation to the research area of ICT adaptation to the knowledge based-economy changes will be a subject of further research in another publications. The research results included in this paper are presented as an aggregated analysis areas by interpreting answers for particular groups of

questions. The research areas of ICT technologies adaptation to the knowledge-based economy requirements are presented in figure 1. The research results concerning ICT area in enterprises are the following:

#### **Type of technologies and software**

Concerning the use of technology by the enterprise the most popular is the wire network (80%), then the wireless network is used by 65% of enterprises. The mobile internet access is used by 51%. An email account registered with an enterprise domain have about 64% of enterprises. Moreover, the research results shows, that more and more enterprises use diverse software. A lot of enterprises use operation systems – 73%. Then, the most exploited systems are record-transaction systems (63%), Business Intelligence systems are applied at 5% - 7% researched enterprises. The enterprises used also authors' software (studied by enterprises' workers – 26%), as well as free software obtained from trade journals and internet (49%).

#### **The changes in infrastructure and software**

The changes analysis of infrastructure point out that in comparison with 2007, 69% enterprises have increased the amount of computers and laptops, in 29% of enterprises the amount of computers hasn't changed, while 1% of enterprises observed that the amount of computers has reduced. Concerning the changes in software that is already being used, the situation looks as follows: about 61% of researched enterprises report an increasing use of specialist software, dedicated software and systems. In 37% the number of exploited software has not changed, while 1% of enterprises observed that the diversity of applied software has reduced.

#### **The influence of ICT technologies on gaining the competitive advantage**

The research shows that in comparison with 2007, about 34% enterprises have increased their territorial area through exploitation of advanced information technologies and systems influencing at the same time their competitive advantage.

#### **The increasing importance of the internet as source of knowledge as well as environment monitoring in order to obtain a knowledge about new ICT technologies**

At present, internet is treated as a comprehensive knowledge source. It is also reflected in carried out research. Among the enterprises, which carry out the monitoring in order to obtain knowledge about new available technologies ICT; most of them do this using the Internet - 86%. Other way of that process is to following the trade journals – 83%, analysis of potential suppliers – 72%, participation in trade fairs and conferences – 69% as well as permanent market analysis paying special attention to available new technologies – 66%. Monitoring of environment concerning ICT technologies and obtaining knowledge about them is carried out in every fifth enterprise.

#### **The e-commerce policy**

The enterprises interest in e-commerce development have increased. The internet sales are delivered by the 16% of researched enterprises and another 6% is going to run electronic distribution channel in the near future. At present, about 54% of researched enterprises carrying out all services or sales of whole assortment through internet.

#### **The importance of www for the e-business development**

A lot of enterprises attribute their success in e-commerce to the very high interactivity and functionality of internet webpage. Most of researched enterprises think that a properly designed webpage has a positive influence on an enterprise's image. About 49% of researched enterprise think that the information included on their webpages has an influence on obtaining new customers.

#### **Information management**

In the age of dynamic technical progress development, the research enterprises attribute the most important meaning to the information management as well as they notice the need of information management because the amount and diversity of information which has to be transformed is increasing. The respondents also said that the aiming to effective information management it is required to apply advanced information technologies enabling for effective communication and supporting management and design.

### **The increasing importance of management through information technology**

The importance of the information technology management process demonstrates a tendency towards growth compared with 2007 it has increased in 32% enterprises, has not changed in 61% enterprises and none of enterprises has noticed a decrease in the tendency of problem discussed.

### **Staff specialization in IT area**

In 2007, about 21% of research enterprises had the position of an IT Manager. The research period shows relatively stable situation in that matter. The amount of IT specialist share in enterprise structure is rather stable. It results from the enterprise size and profile and place of IT area in organizational structure.

### **The sources of financing the purchase of IT infrastructure**

The researched enterprises have not displayed the activities concerning IT infrastructure development. Most enterprises do not invest in the purchasing of new technologies. Moreover, about 88% of enterprises did not apply for financial support for purchasing technologies at all. Some of enterprises applied for financial support from structural funds and national public resources. Depending on funds for financial support applied to about 6% to 9% of researched enterprises. Some of enterprises applied for more than one support. Finally, about 5% to 7% of enterprises have received financial support from one of external resources mentioned.

### **IT outsourcing**

There is evidently an increasing interest amongst enterprises in IT outsourcing services. The main premises of IT outsourcing are the following: cost reduction, data safety, development of information services or lack of well-educated staff. Concerning IT outsourcing, enterprises most often use external services to maintain the software and infrastructure (87%), a fewer enterprises use the network administration and antivirus software (61%), less than half of enterprises use data backup (48%) and specialist software installed on external servers (44%).

### **Supporting the processes of knowledge management**

The analysis point out, that in the research period, all tools of knowledge management have developed. The highest growth dynamic of usage concerned organizational processes management (19%). The most used tools of knowledge management were the following: electronic documents management, customer relationship management and electronic work management. In evaluating the process of knowledge management in organizations the possibility of knowledge management tools development was also researched. The development of tools actually used was reported by about 25% of respondents, 46% do not undertake any activities aiming to develop these tools. About 20% use applied tools at a very low level. The selected enterprises which declare knowledge management tools development concentrate on improving the electronic documents management processes, work processes as well as relations with customers. Moreover, the enterprises are working on creating knowledge bases and improving the best practices program.

## **CLOSING REMARKS**

The carried out research confirmed that the information technology is still increasingly important for the enterprises while adapting to the knowledge-based economy. Application and development of the different tools of IT helps the accumulation and innovation of knowledge capital. Effective information technology helps improve the transmission and proliferation of the accumulated explicit knowledge contributing to the knowledge-based economy development, decrease the transmission cost and improve the transmission effectiveness. Furthermore, the digital convergence of information technology helps the developing countries decrease the technology gap (Chen, 2008).

The research of particular ICT areas present that in comparison with 2007, it was observed a positive change in some cases. The evident changes, indirectly connected with the ICT development were observed in the areas, where the type of used technology is the most important. First of all it concerned the increasing importance of the world wide page in enterprises' activity (particularly for the e-business development), the interest in IT outsourcing, supporting of innovation and supporting the knowledge management processes. The relatively stability is observed concerning IT staff specialization. The research analysis also point out that applied technologies enable the enterprises to relatively fast adaptation to the knowledge-based economy requirements. It seems that in this process,



the key role is the enterprises ability to proper understating the information management process particularly while data gathering and transforming.

The presented research results initially confirmed the research assumption in which it was pointed out the direct dependency between the changes in environment resulting from the knowledge-based economy and the adapting activities of organizations' potentials. The ability of ICT usage also significantly influence on the new ideas generation, to even out the knowledge level amongst the workers and creating the new organizational knowledge especially in codified area. The detailed analysis of research results (with the use of statistical analysis) will enable the evaluation of the ICT area adaptation level to the knowledge-based economy requirements. This will be the subject of further consideration in the nearest future.

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