

# INFORMATION TECHNOLOGIES IN THE CONTEXT OF VIRTUAL ORGANIZATIONS DEVELOPMENT

Received 10<sup>th</sup> July 2007; accepted 30<sup>th</sup> September 2007.

Bożena Kalinowska

## Abstract:

The aim of this paper is to present the influence of information technologies (IT) on the organization structure, particularly in the context of virtual organizations' (VO) development. The work describes examples and new models of virtual organizations. Subject connected with this type of organization is comparatively young and has appeared in the Internet era. Thanks to the development of communication technology enterprises can function in more elastic and competitive way: in innovative virtual forms. This new type of organizations will enlarge their market share. There are possibilities to reduce costs and be more competitive in the same time. Electronic and computer systems make the fundamentals of the virtual organization management. Main activities of such organization are: information flow control, planning, production, service, distribution of products, and promotion. In the global economy virtual projects can be perceived as an optimal model of the organization activity. The new organizations are aiming to reinforce their competitive position, as well as to increase the profitability; they have also to take care of the smallest project details, the exact control of costs and optimisation of schedules. Virtual projects and organizations are still not well recognized. New researches should be taken up in this field.

**Keywords:** competitiveness economy, virtual enterprise, management, control systems, knowledge economy.

## 1. The essential features of information technologies in the context of new knowledge-based economy

Information technologies have more and more influence on economy. The development of technologies leads to development of information services, as well as to formation of the new kinds of data banks – which have an influence on production activity of enterprises. An example of activity, using the features of information technologies is merging several elements and formation of electronically integrated organization.

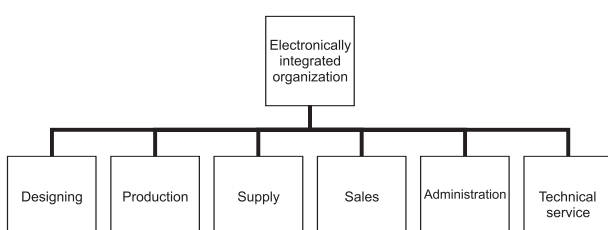


Fig. 1. Electronically integrated organization [1].

Information technologies can be characterised as the ability to improve quality of technological processes, goods, as well as services. Implementation of electronic production quality control enables introduction of improvements, which saves capital or energy, as well as decreases the number of defective goods. Information technologies manifest themselves through ability to join different networks – like suppliers, wholesalers and producers, where use of communication technologies enables to generate savings in stock on different stages of production. Use of information technologies increases flexibility in designing and production of new types of goods. The fact is that nowadays one can observe transformation from mass production era to short series production era; short series production is more profitable. Such behaviours, especially in small and medium enterprises (SME), make new possibilities to grow of competitiveness amongst enterprises.

Information and knowledge are components determining the development of the economy based on knowledge; this economy operates with the term “knowledge management”. This type of management aims at an effective management of the knowledge, which has an effect on improvement of innovativeness and growth of competitiveness. Knowledge management is usually defined as a scientific discipline, system or process. A significant role in this system play: technology (i.e. Internet, intranet), knowledge measurement's tools (i.e. Balanced Scorecard) and people oriented to organizing culture, which favours forming of knowledge generating unofficial groups [1].

An unavoidable globalisation progress forces the companies to a watchful observation of the competitors' behaviour and to fast reaction to the changes. That rapidity of the reactions is enabled due to i.e. development of the information technologies. The value of the information resources in a given enterprise increases the possibility of the successful innovation's implementations.

### 1.1. Towards information society – changes in societies

In today's world economies communication barriers and custom limitations have been abolished. Instead of it the trans-border facilities concerning the flow of goods and services have been implemented. Along with these processes the society is also under the transformation and becomes an information society, where information management and the pace of its flow are the basic factors of competitiveness in industry and services. Growth of the information society enables to emerge virtual organizations. It is assumed that Martin Bangenmann, a former

EU commissioner responsible for development of telecommunication and information technologies, originated building of the European information society. In 1994 he published the document called "Europe and the Global Information Society. Recommendations to the European Council". The report included recommendations concerning changes in the infrastructure in the wide implied information domain; and it also presented the opinion on changes occurring under the influence of novel teleinformation technologies, as well as the chances and risks connected with it. According to the report, communication systems and advanced information technologies are the key to information [2].

Today's society lives in a period of unprecedented technological change while technologies are known as ICT (Information and Communication Technology). Organization for Economic Co-operation and Development (OECD) proposes standards for measuring the information society widely connected with ICT. In statistical terms, the conceptual model as below can show framework of the information society: [3]

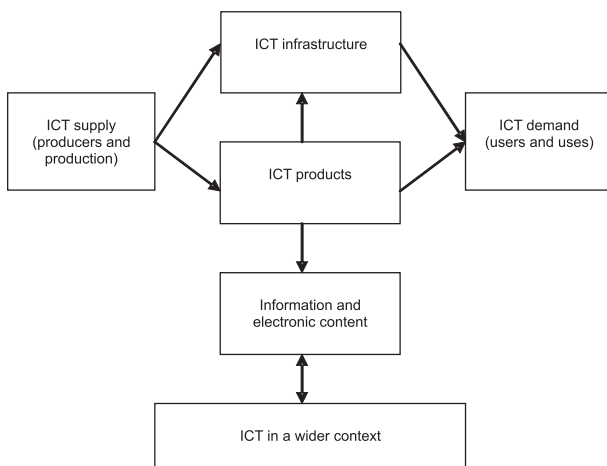


Fig. 2. Information society statistics conceptual model [3].

In the above-mentioned model particular items shall be described as:

- ICT infrastructure - Investment and services on which the IS relies.
- ICT products - Definitions and classifications Imports and exports Price and quality.
- Information and electronic content - Definitions and classifications Producers and products Users and uses.
- ICT supply (producers and production).

## 2. Implementation of innovation in enterprises

The emerging new technological possibilities and variable and increasing requirements of the market constrain the creation of innovation. An enterprise, which does not implement innovation, is ageing. For world economies the innovation development is a priority. Innovativeness of economy manifests itself through i.e.: entrepreneurs' capability to constant search and implementation of results of the research and development works or new ideas [4]. Implementation of innovation is commonly connected with changes concerning organization, technology, equipment or human resources.

By innovative activity one understands number of works connected with preparation and implementation of new or improved goods, appliances, services or processes, intended for introduction into the market. One can speak about success of the innovative action when the proportion of the income is increasing relating to expenses. In Poland the level of innovativeness of industrial enterprises is measured with a percentage index of the share of innovative enterprises in the whole population of examined enterprises [5].

According to EUROSTAT, European countries can be divided into four groups, depending on their innovation performance:

- 1<sup>st</sup> group – "leading countries": Switzerland, Finland, Sweden, Denmark, Germany;
- 2<sup>nd</sup> second group – "average performance": France, Luxembourg, Ireland, United Kingdom, Netherlands, Belgium, Austria, Norway, Italy, Iceland;
- 3<sup>rd</sup> third group – "catching up": Slovenia, Hungary, Portugal, Czech Republic, Lithuania, Latvia, Greece, Cyprus, Malta;
- 4<sup>th</sup> group – "losing ground": Estonia, Spain, Bulgaria, Poland, Slovakia, Romania, Turkey.

It is assumed that some countries could reach the "old" EU-25 average within 20 years, but for many other it might take longer [6].

Globally in years 2003-2005 there was an innovation gap between the 'new EU' countries (EU-25) and the USA, Japan and the 'old EU' countries (EU-15). The innovation gap to Japan was increasing but the gap to the USA was constant [6].

The motivating factors for enterprises to take up innovation activities are i.e.:

- interesting offer of projects emerging in R&D units,
- possibilities of purchase of license,
- beneficial terms concerning the trade of goods with foreign countries,
- adequate solutions in economy connected with properly functioning credit or finance system [7].

## 3. Correlation between virtualisation and competitiveness in organization

Subject connected with virtual organizations emerged in the 90`s - in the Internet revolution era. Virtual organization is one of the newest and most important forms of enterprise. Owing to development of communication and information technologies (Internet) enterprises have a possibility to run a flexible business, increasing their market share and reducing the costs at the same time. Enterprises are looking for chances to improve effectiveness and increase competitiveness by turning into the forms of virtual organizations. It can be achieved by investing in immaterial resources. Ability to learn faster than competitors is very often the only advantage that the given enterprise can have [8]. Virtual organization, by functioning within the global market, is a dynamic tool of management, simplifying gain of the competitive advantage. It is based mainly on networking solutions and the Internet. Enterprises implement changes in the management so that they can achieve a synergic effect of merging the two elements:

- technology;
- new forms of organizing the work.

Merging two above-mentioned items contributes to emergence of the virtual forms of organizations. Enterprise that aims to be competitive has to generate an income from the productivity. This kind of effect can be achieved by implementing and merging innovation in technology, management and organization of work connected with support of virtualisation, as shown in the figure below:

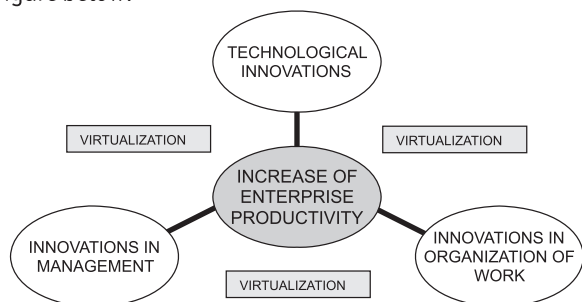


Fig. 3. Process of increasing enterprise productivity.

An example of the initiative (1996-1999, 2000-2003), which promotes the formation of networking organizations, is the Finnish project called „The Finnish Workplace Development Programme”. It was the first Finnish programme for the organization of work development. Main objectives of the project included i.a.: establishing the teams and groups of cooperation, creating the external networks of cooperation, research on the projects of networks supporting creation and testing of innovation organizations which have a potential significance for creation of new working places. Projects executed within the project framework were focused on i.a. promotion of the project teams and building a network between the enterprises. Both the management and employees were participating in the planning and conducting of the projects [9].

The fact is functioning in that way and developing of virtual organizations is possible thanks to the Internet. In different countries the number of people with access to worldwide network rapidly increases (see chart below) [10].

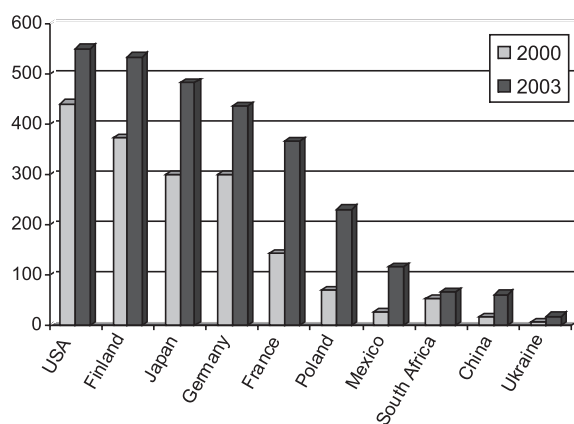


Fig. 4. Number of Internet users per 1000 population in different countries comparison between years 2000 and 2003 [10].

### 3.1. Main features of virtual organizations

Let's remind the definition of virtual organization by Professor Jerzy Kisielnicki: *We presume that virtual organization is created on a voluntary basis by organizations of different types. These organizations start to cooperate with one another using methods of Information Technology. The aim of the cooperation is to bring benefit for all participants. These benefits should outstrip the traditional way of operation of the organizations engaged in cooperation* [11]. The concept of the virtual enterprise is based on the ability to cooperate in teams, which usually after finalizing the given task are dissolved and new ones are created, which have a new assignment of tasks. Personnel of the enterprise, which usually stays unchanged, are most of all coordinators, who have to i.e.: coordinate the works, create the teams or keeping contact with the clients. Cooperation is usually based on e-communication, sometimes also on personal meetings. Currently, the basic value of goods is included in services and information, to which access is through these goods. The result of this situation is a change of production type of given enterprise towards the information technology. From the merge of information, services and products some consequences can result: information becomes a product; changes on the market have a tendency to head towards the domains, where knowledge, human resources, creativity and innovativeness are important. In virtual organization and innovation are both intensity and level of cooperation, which can be represented by following forms: consortia, partnership, new enterprises, cooperation and contractor-supplier. Due to the functioning of virtual organization the duration of time between production and introduction into the market is reduced. That way the enterprise can be expanded very fast. Speed of various activities is a basic advantage of virtual organizations functioning. In this kind of organization there is a possibility of instant acquisition of access to new markets and moving from sale of goods to sale of solutions, services – as e.g. technical advisory. Therefore smaller enterprises functioning in the traditional way have the chance to grow, due to implementation of virtual forms into their activity.

The most important features of virtual organization are i.e.:

- the main foundation of its operation is confidence;
- it's customer's needs orientated;
- it reacts fast to the market changes, without unnecessary administrative operations;
- the objectives are unequivocal, accepted by all participants, who are aiming to their realization;
- communication is frequent [12].

In virtual group one can achieve a lot of benefits with small expenditure. On the market various models of virtual organizations emerge, which are constantly subjected to construction and improvement processes. In the infrastructure of virtual organization few factors play a key role:

- network - based on the information exchange;
- database - available for the participants;
- the corporate portal - can be used as information and discussion forum;

- interim inclusion of external experts to the work and constant possibility to use moderator's support [13].

Table 1. Virtual organization creation – SWOT analysis.

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• flexibility of activities,</li> <li>• speed of transaction,</li> <li>• cost reduction.</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• access to network and database required,</li> <li>• confidence within the group of VO,</li> <li>• lack of good models of functioning.</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• fast reaction to market changes (niche),</li> <li>• possibility of application of modern management techniques,</li> <li>• lack of borders in information connections.</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• lack of law regulations concerning functioning,</li> <li>• data transmission problems.</li> </ul>

#### 4. Virtual management of production

In virtualised forms of organization activities like designing, production, sale or administration, function in one electronic environment; where is the capability of merging into networks of subcontractors representing one or more branches. The benefits can be achieved due to electronic control of production quality - savings of the capital and effort emerge, the quality and efficiency increase. An example of production virtual enterprise is Nike company, which having its headquarters in the USA decided to move its production lines to Asian countries in order to reduce costs. Designs are made in the USA but production is taking place in Korea or Indonesia. Complex process of making the product is coordinated by IT systems. Well-developed infrastructure enables supply of the components in time, as well as management of goods supplies to the global markets. These systems are flexible and allow managing a constant product innovation process. Innovation processes enable introduction of several hundred of new product designs into the market [14].

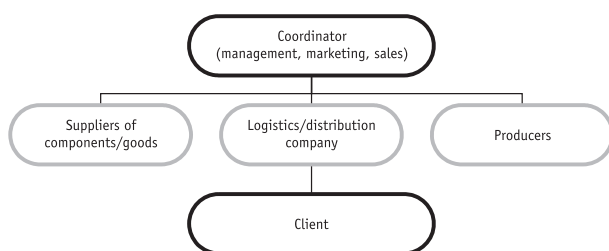


Fig. 6. An example model of virtual enterprise functioning.

#### 5. Summary

In this paper changes in economy towards virtualisation of the enterprises were summarized - this process is possible due to development of information technologies. The author described correlation between information technologies, virtualisation and competitiveness. Currently a predominant solution conducive to increase of the competitiveness is transition to flexible virtual forms. Enterprises should search for changes, react to them and take as an opportunity to economical implementation or

social innovation. Due to development of IT technologies time, geographical or cost limits, which usually limit development of enterprises, disappear, which as a result enables to emerge virtual organizations.

#### AUTHOR

**Bożena Kalinowska** - Industrial Research Institute for Automation & Measurements - PIAP, Al. Jerozolimskie 202, Warsaw, 02-486, Poland, tel. +48 22 874 0140, e-mail: bozena\_kalinowska@wp.pl

#### References

- [1] W. M. Grudzewski, I. K. Hejduk, *Przedsiębiorstwo wirtualne* (A virtual company), Difin, Warsaw 2002, (in Polish), pp. 13-48.
- [2] M. Bangemann, *Europe and the global information society, Bangemann report recommendations to the European Council*, European Council 1994 (<http://ec.europa.eu/idabc/servlets/Doc?id=18174>).
- [3] OECD, *Guide to Measuring the Information Society*, 2005, p. 9. (<http://www.oecd.org/dataoecd/41/12/36177203.pdf>).
- [4] E. Stawasz, *Przegląd podstawowych pojęć: innowacje, transfer technologii, krajowy i regionalny system innowacji, polityka innowacyjna* (Basic concepts' review: innovations, technology transfer...), in: *Instrumenty transferu technologii i pobudzania innowacji* (Instruments of technology transfer and innovation), ed. T. Markowski, E. Stawasz, R. Zembaczyński, Przedświt Publ., Warsaw 1997, (in Polish), p. 17.
- [5] Główny Urząd Statystyczny (Central Statistical Office), *Nauka i Technika w 2005 r.* (Science and technology in 2005, Warsaw 2005, (in Polish), pp. 156, 562.
- [6] *Science, technology and innovation in Europe*, Eurostat, Luksemburg 2007, pp. 73-76.
- [7] A. H. Jasiński, *Innowacje techniczne a działalność marketingowa* (Technical innovations and marketing activity), WSPZ, 1998 Warsaw, (in Polish), p. 27.
- [8] Arie de Geus: [www.peoplepartnering.com.pl](http://www.peoplepartnering.com.pl)
- [9] <http://www.mol.fi/tyke/00-03/en/index.html>
- [10] *Concise statistical yearbook of Poland*, Główny Urząd Statystyczny (Central Statistical Office), Warsaw 2006, p. 562
- [11] J. Kisielnicki, *Problemy etyczne w organizacjach wirtualnych* (Ethical issues in e-commerce), (in Polish). Available at: <http://www2.wz.uw.edu.pl/ksiz/download/Wirtualna-Etyka2005.pdf>
- [12] W. M. Grudzewski, I. K. Hejduk, *op. cit.*, pp. 35-36, 44-45, 48.
- [13] <http://www.virtual-organization.net>.
- [14] M. Christopher, *Logistyka i zarządzanie łańcuchem dostaw* (Logistics and delivery management), Polskie Centrum Doradztwa Logistycznego, Warsaw 2000, (in Polish), p. 118.