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INFORMATION TECHNOLOGIES IN KNOWLEDGE ECONOMY

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Abstract:

This paper analyses the importance of information and communication technologies in knowledge management and the impact on the increase of competitive advantage of organizations of their independent neighbouring countries. Comparative analysis has been conducted for the Republic of Serbia, Croatia and Bosnia and Herzegovina. The data of the World Economic Forum concerning the use of information technologies served as the baseline for this study. Moreover, the data from job advertisements announced by employers in these three countries during the period March-May 2013 have been experimentally analyzed. The results show that the application of information technologies is almost the same in all three countries, amounting to approximately 65%.

Key words:

information technologies,
knowledge economy,
skills.

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INTRODUCTION

From their very beginnings, the industries that underwent a period of expansion in the second half of the twentieth century, such as pharmaceutical or information industry, very often were not organized as national units but as international systems in which individual tasks, either those related to research, projecting, engineering, development or testing, were organized at the transnational level (Draker, 2006). That has set great challenges to education system which needs to adequately prepare workers for the jobs that will be performed in the

international labour market. Accordingly, it was necessary to determine which knowledge and skills were needed without distinction in the jobs of future knowledge economy. One of the first answers to this question were information technologies and computer skills, as being well conversant with them is nowadays one of the main requirements for almost all positions in almost any organization.

Over the past ten years, the progress and development of global information society have affected all segments of economy in such a way that no one can imagine any business process which does not rely on the use of information technologies.

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In the European Union, information and communication technologies (ICT) have been recognized as the major factor affecting the economic growth and innovativeness (European Union, 2007), and seven leading initiatives of the economic strategy Europe 2020 include “Digital Agenda for Europe”, which indicates the importance of ICT in modern economic growth and development. Such a trend has also been observed in Serbia. According to the results of the Statistical Office of the Republic of Serbia, 55.2% of households in Serbia had computers at the end of 2012 (Republički zavod za statistiku, 2013). These results support the fact that the share of information technologies in gross domestic product is small, and therefore, it is necessary to conduct serious education system reforms, which primarily needs to allow knowledge sharing in the field of information and communication technologies so that national economy could properly respond to the demands of knowledge economy and that employees could make their contribution to enhancing competitive advantage of their respective organizations.

EDUCATION SYSTEM AND SKILLS FOR XXI CENTURY

With development of information technologies, the labour market in knowledge economy has been determined by division into hard skills and soft skills. Hard skills include all those skills, knowledge, techniques and procedures that indicate which knowledge needs to be applied for a certain job, whereas soft skills indicate the manner in which hard skills and knowledge are used in interaction with other people (Vukašinić, 2013). The structure of basic business literacy has changed, so today an individual is considered to be literate in terms of business if he/she possesses three types of knowledge: not only functional linguistic literacy, but also basic numerical and computer skills. However, apart from these basic hard skills, an individual needs to possess basic soft skills in order to get the desired employment and prosper in the modern labour market. The basic soft skills include a whole range of social and emotional skills, communication and self-management skills. In traditional sense, literacy meant just the subject matter knowledge, such as basic analytical skills or linguistic skills. However, in knowledge economy, it is equally necessary to have procedural knowledge defined by personal business skills, which gives us the answer to the question regarding how individuals learn and whether they are able and motivated to continue learning (Draker, 2005).

According to the previously stated and unlike traditional literacy which implies the basic numeric and linguistic skills, the modern literacy implies basic computer skills, which challenged education by requiring it to introduce, even in primary schools, the subjects related to basic computer skills, which would enable an individual to develop “computer fluency” in the course of his/her future education, which is a prerequisite for personal development as well as the development of an organization and society as a whole. The report of the American National Research Council (NRC) published in 1999 first provided the basis for the development of programs that should contribute to “computer fluency” specifying that “computer fluency” requires three types of knowledge:

- ♦ ability to use available information and communication applications,
- ♦ knowledge of fundamental principles on which information technologies are based,
- ♦ intellectual abilities for the use of information technologies for an organization, problem-solving, understanding (Hoffman and Blake, 2003).

Based on the Strategy for the Development of Information Society in the Republic of Serbia until 2020, the development of information society needs to be followed by inclusion of all categories of society and development of knowledge and skills related to information and communication technologies and strengthening of the role of information and communication technologies in the education system (Vlada Republike Srbije, 2010).

The changes brought by the information society concerning new manners of using information technologies for the most various purposes, such as social networks, You Tube, blogs, mobile phones, iPad, Google and other services available and used on a daily basis through the Internet which primarily reflect the necessity to change the way of learning and education that needs to comply with such technologies. For that reason, the theories of knowledge, learning and lectures are undergoing the process of transition. Learning is today much more than simply memorising and repeating the facts. It is an active, meaningful process that requires engagement of full potentials of an individual in order to find meaning, connection and deeper understanding of what is being learned. On the other hand, lecturing is nowadays much more than delivering the facts and it implies full engagement of a lecturer who needs to motivate a student to undergo com-



plete learning experience. Information technologies are, on the other hand, more than a tool. They are the basis for the development of knowledge which needs to be supported by commitment to studying, connecting different sources and areas, and creating and participating in social networks for knowledge exchange. The above-stated indicates the gap between the lecturers who have spent their entire careers on developing skills needed for modern education and the necessity to make change in education system in accordance with the new understanding of the terms such as knowledge, learning, teaching and information technologies (Jacobsen, 2010).

COMPUTER FLUENCY AND KNOWLEDGE ECONOMY

According to the report of the European Centre for the Development of Vocational Training, the growing demand for professions based on knowledge and intensive business skills is evident in the European Union. Based on the results of the research published in their report *Skills supply and demand in Europe*, the occupations that will be more in demand include highly professional and not manual occupations, such as management and specialized occupations, which are projected to have more than 8.5 million job openings between 2010 and 2020. According to the same report, professions that will prevail in the total number of newly formed jobs are from the area of technical and natural sciences such as physicists, engineers, life sciences professionals and professionals in the field of medicine and education management (European Centre for the Development of Vocational Training, 2010). Those are exactly the jobs that require computer fluency, and accordingly, this study once again points out to the necessity to use information and communication technologies in the modern knowledge-based economy.

If the precondition for survival and advancement in knowledge economy is spreading and sharing of knowledge, its improvement, organization of the existing and collection of new knowledge, then technology certainly plays an important role in the given processes. Some authors consider that having the right technology infrastructure and creating a detailed project plan when implementing new technology is a key strategy to driving business. The significance and usefulness of technology is particularly stressed in the analysis of the basic elements of the knowledge-management concept which should provide individuals, organizations and society as a whole with the real knowledge in the right place

and at the right time, thus creating the environment that will take advantage of any knowledge in an innovative and creative way, better and faster than the existing competition. The above-stated indicates that technology is one of the basic elements of the knowledge-management concept along with people and processes. However, by overemphasizing its importance in knowledge management, the social and human nature of knowledge is sometimes neglected.

Undoubtedly, we hold the opinion that it is impossible to neglect the fact that knowledge comes only from someone able to create by connecting information, using experience, new ideas, concepts, intuition and linking it with other knowledge, providing judgements and opinions, and taking necessary knowledge-based actions. Of course, technology is regarded as a necessary and indispensable tool in managing knowledge defined in such a way. IT tools have improved the KM process by increasing the speed, accuracy, cost-effectiveness, better control and operational efficiency and made the implementation of KM practices much easier (Chadha and Saini, 2014).

Therefore, by defining the fundamental elements of knowledge management and calling it DNA of knowledge management, Michael Stankosky mentions the so-called four pillars of this concept: leadership (management), organization, learning and technology. By explaining the use of technology, the author particularly emphasises the importance of technologies aimed at supporting and facilitating knowledge management strategy and activities, mainly those that support cooperation and codification of knowledge management strategies and functions (Stankosky, 2005). According to Thomas Davenport and Laurence Prusak, knowledge management requires much more than technology, but that technology or „techknowledge”, as they call it, is an important part of this process. The basic task of technology applied in the knowledge flow management is to make the knowledge in the mind of individuals or documents widely available to everybody in the organization. Given the value added by a man (context, experience, interpretation), which transforms data and information into knowledge, the ability of technology to adopt and sum up those human contributions makes this technology particularly suitable for business.

The authors point out that the role of people in the use of technologies focused on knowledge management is of crucial importance for their success (Davenport and Prusak, 2010). According to



Heejun Park, creation, storage and sharing of knowledge within and among different knowledge societies require coordinated management and exchange of tacit and explicit knowledge. He also claims that technology enables the flow of explicit and tacit knowledge through four models of conversation – socialization, externalisation, combination and internalisation. Technology surely has to be applied through incorporation of other critical elements (business strategy and leadership, organizational structure and learning) (Park, 2005). By expressing his view on the importance of information technologies but giving the priority to the man in the process of knowledge creation, Karl Erik Sveiby (2012) is of the opinion that people have begun to realize that they are just people and not information systems, the core of the value creation. More and more people are becoming aware of the fact that efficiency through information technologies is not enough. The real value for campaigns and society is created only by establishing the environment that would enable people to create and share knowledge.

Observed at the level of knowledge-based organization, the prerequisites for successful application of information technologies are certainly the following (Giraldo, 2005):

- a) the application of information technologies must necessarily be linked to corporate strategy;
- b) the application of information technology needs to be supported by the leader in the organization;
- c) organization has to pay attention to employee training regarding the use of the given technology;
- d) organization has to motivate its employees to use the technology.

It is well-known that the use of Internet / Intranet / Extranet technology has a profound impact on the ability of people to share knowledge and act efficiently on the basis of that knowledge. Of course, people play the crucial role in achieving the stated importance of technology – if not used, technology will not serve the purpose (O'Dell *et al.*, 2000). For the purpose of this study, we shall focus on the importance of being conversant with the above-mentioned techknowledge and development of skills that would enable the use of full potentials of such defined technology in the economy and society based on knowledge. In order to manage the challenges imposed by knowledge economy and continuous technological and information revolution, it is primarily necessary to possess the follow-

ing technology and knowledge-based skills, as well as the knowledge needed for the use of the following methods (Đorđević Boljanović, 2009):

- ♦ Skills of using ontology and taxonomy. Knowledge comes in different forms: structured, semi-structured or unstructured. In order to organize this knowledge, it is necessary to collect, group and categorize it. It is also possible to create schemes of conceptual lexicon of terms and expressions and relationships among them, which is called “knowledge map” or “ontology”. In order to avoid situations in which everyone organizes knowledge in a special way according to his/her own views and perspectives, ontology has been developed indicating the certain level of organization of information and understating. In the context of knowledge management, ontology can be defined as a formal, explicit specification of a shared conceptualization (Bhat, 2013). Taxonomy of knowledge includes hierarchical classification of terms set out to clearly point out at mutual relationships among the terms.
- ♦ Search engines skills. A large amount of information that can be obtained via the Internet has to be available in the fastest possible way. Therefore, the search on the Internet is done more by searching for index and not for the whole text, as it would significantly slow down the process of obtaining necessary information. “Search engines” are based on “crawler – indexer architecture” which sends the request to web server asking for new or updated pages. The search engine processes the index through a large number of algorithms and ranges the received results.
- ♦ Agent technology skills. Agents are computer systems capable of acting independently in the given environment in order to perform the assigned task. These systems may act without interventions of a man. Basically, these systems divide huge complex problems into those smaller, simpler and more convenient for solving. Any data input from a user is treated by this system as a new lecture. The system can predict the behaviour of a user after some time based on the fed form.
- ♦ Personalisation skills. The main goal of all technologies based on the personalisation is to predict with great precision the needs and desires of each user. In terms of information, technologies based on personalisation can be



used to reduce the time necessary for searching for specific information. This technology may purify the search for certain information by precisely defined key words used in the requested document.

- ◆ Knowledge of Case-based reasoning (CBR). CBR offers the technique for collecting and storing past problems, their solutions and logic that preceded the solution. The user inputs the description of the existing problem and checks whether the solution to some similar problem from the past can be applied to the current problem. If the past experience can help, the current problem with its estimation and solutions are added to the existing problem for similar situations in the future.
- ◆ The use of Online analytical processing (OLAP). OLAP technique is used when analysing a large amount of data from different perspectives, e.g. in case of an organization which has thirty products in five regions, it is necessary to analyse all these factors in relation to the factor of sale, costs and profit.
- ◆ Data mining skills The term “data mining” imitates observing, searching and discovering new things about the man and implies the treatment of observed data, their analysis and interpretation and integration of results. Tools and resources used in discovery of knowledge in databases are simple, concise and easy to use. They may be expert systems, decision trees, rules of induction, generic algorithm and generic programming, neural networks, associative memories and clustering technique.
- ◆ Data warehouse is a database which contains a large amount of information originating from a wide range of sources. The idea is that data storage serves as the “warehouse” of data that can be used for different analyses.
- ◆ Knowledge of Groupware tools encourages cooperation among people for the purpose of increasing knowledge sharing among them. As a concept, it tends to be applied to information technology which supports cooperation, communication and coordination of activities through space and time, as the information itself is transferred.
- ◆ The use of Expertise yellow pages. In order to enable knowledge sharing within an organization, it is often necessary to find individuals or groups from one part of the organization who possess knowledge and skills required by another part of the organization. In that sense, “yellow pages” contain the list of all employees in the organization, with the overview of their knowledge and skills. All employees have the access to these data, with a code for intranet system.
- ◆ Intranet portals are usually the websites connecting a large number of sources of information on one web page. The portals should be the entrance to already stated large number of sources of information. The portal does not keep a large amount of information, but connects it. The key feature of the portals is the possibility of their customization and adjustability (Leistner, 2010).
- ◆ E-learning is the generic name used to describe on-line learning, computer-based and web-based trainings. E-learning is the application of the Internet technology with the aim to support spreading of learning, skills and knowledge. E-learning need not necessarily depend on the Internet, but there is a tendency to use different learning technologies such as mentoring, chat rooms, expert discussions, web seminars, online meetings and virtual classrooms.
- ◆ The use of SAP- SAP (German: Systeme, Anwendungen und Produkte, English: Systems, Applications and Products in Data Processing). It is the leading company in production of software for electronic business management. The main SAP product is MySAP ERP, the program that provides a complete set of functionalities for business analytics, finances, human resources management, logistics and corporate services. SAP is taking steps to help to minimize the types of problems imposed by more traditional enterprise software. A growing number of modern organizations are turning to the use of SAP, which enables maximum sharing of knowledge within the organization and extremely high data availability. SAP can now cover all that happens in the business of an organization, thereby respecting the characteristics of different economic branches.
- ◆ A growing number of organizations use the so-called “wikis” as a tool for knowledge sharing. Wikis are on-line databases, which can be supplemented and changed in the



simplest way using any Web browser. The most famous “wiki” today is surely on-line encyclopaedia Wikipedia. However, a large number of organizations, from Microsoft to FBI, use “wikis” to collect knowledge about their employees and thus create an environment in which they can meet each other and cooperate in relation to various issues, from planning the meetings, documenting the best practices, to brainstorming new products and processes. Wikis used in organizations can be divided in three types: single – contributor wikis, group or project wikis and company – widewikis (Poole and Grudin, 2010). Single contributor wikis are those that have only one contributor and are used for personal information management or as easily edited web pages. Group or project wikis, are used as a team or project collaboration tool. Company – widewikis are used as company encyclopedias (Opačić and Veinović, 2012). The concept of “semantic wiki” has recently emerged, integrating the advantages of the wiki with semantic web technologies (Zaidan and Bax, 2011).

Having considered the above-mentioned, we can conclude that knowledge economy requires the application of the most advanced information technologies and average knowledge workers should be familiar with most of these technologies (Opačić and Veinović, 2014). Such IT tools facilitate knowledge sharing in different ways, but they all support interactivity (Davison *et al.*, 2013). However, the very application of technology without paying enough attention to the nature, character and specificity of knowledge as a human, social category, inevitably leads to the lack of use of its full potentials. Therefore, in order to achieve the goals imposed by knowledge-based economy and information technologies designed for that purpose, it is necessary to start exactly from a man and his skills to use technology in combination with his ability of innovative knowledge creation.

RESEARCH

According to the research conducted by the World Economic Forum (WEF) on the use of information technologies in 2012, Serbia is ranked 85th out of 142 countries, Croatia 45th while Bosnia and Herzegovina is on the 84th place on the list. This research indicates that the position of Serbia is not to such extent the result of the level of infrastructure development or

training of the population to use ICT, but it is primarily the consequence of insufficient use of ICT in business community and state administration. If we start from the basic postulate of knowledge-based economy, and that is, that one organization knows as much as its employees know, *i.e.* that it is worth as much as its individuals can contribute to creation of added value, then the use of information technologies in business community can be observed only through the use of information technologies by individuals employed in those respective organizations.

Having in mind the results of the above-mentioned research, the purpose of this study is to explore the demand for computer skills in these three countries, in order to analyse the use of information technologies, which can provide us with more detailed information regarding the use of information technologies in business community in general. This research should show whether the figures related to the needs of employers for computer fluency of their employees correspond to the data published by the World Economic Forum which shows that the Republic of Croatia is twice better rated regarding the use of information technologies than Bosnia and Herzegovina and the Republic of Serbia. For that purpose, we have analysed the advertisements announced by the employers in these three countries for the period March - May 2013, or more precisely, 586 job advertisements from the Republic of Serbia, 450 from the Republic of Croatia and 200 from Bosnia and Herzegovina, by exploring how many employers, out of the total number of employers, expect from their employees to possess computer fluency for such positions. According to these results, out of the total number of employers in the Republic of Serbia, 69% require computer fluency while 31% do not consider it relevant. The graphical overview is given in Figure 1.

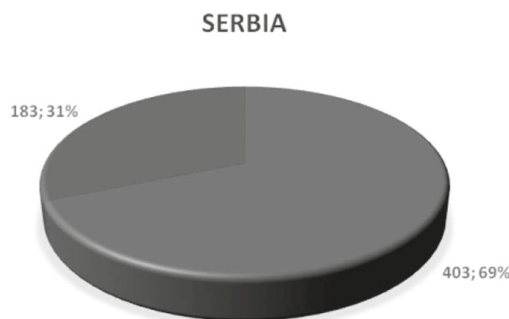


Figure 1: Needs of employers for computer fluency of employees in Serbia



Based on the same criteria, out of the total number of employers in the Republic of Croatia, 66% require computer fluency from their employees while 34% do not. The graphical overview is given in Figure 2:

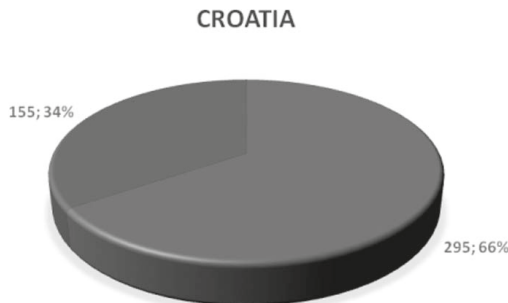


Figure 2: Needs of employers for computer fluency of employees in Croatia

Our research has showed that the results in Bosnia and Herzegovina are very similar to the results in the other two countries. Namely, out of the total number of employers, 65% require computer fluency while 35% do not. The graphical overview is given in Figure 3.

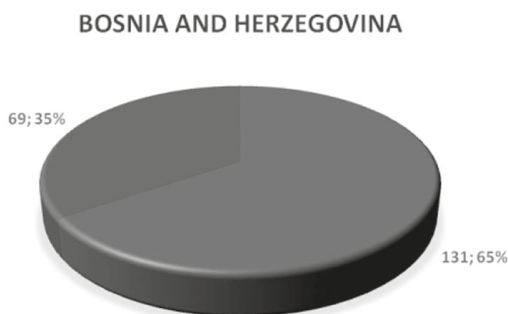


Figure 3: Needs of employers for computer fluency of employees in Bosnia and Herzegovina

Based on our research, we can conclude that the relationship regarding the need for computer fluency in these three countries is almost the same. Accordingly, we can see that the business community in all three countries has the same awareness of the importance of information technologies for their operations. Therefore, the assumption is that the use of information technologies in these three countries is almost the same, which questions the results published by the World Economic Forum.

CONCLUSIONS

As ICT technologies have become an integral part of our daily lives, they are also increasingly becoming an integral part of all human activities. The exponential growth in the development of these technologies and their application with the participation of people from all countries in the world, have a significant bearing on the culture and economy at a global level. This impact is such that it cannot be ignored and therefore, the organizations need to adapt and adopt new business strategies. New information technologies significantly simplify and reduce the costs of marketing activities of knowledge management. Communication barriers between the organizations, their clients and partners are disappearing and therefore, they can now participate in the creation of new products and services. The organizations which adapt to the new manner of operation have a far greater chance to succeed than the competition operating in the traditional way.

Information and communication technologies, as a global phenomenon, have completely changed the world over the past few decades. The use of ICT is the subject of periodical studies of the Statistical Office of the Republic of Serbia, which annually publishes the latest indicators in this area. Based on the current statistics, 47.5% of households have Internet access, which indicates that permanent Internet access in Serbia is widely spread. As for the companies, the results are even better. Namely, about 99% of the companies use computers and the Internet, while about 74% of them have their official websites. Therefore, it can be concluded that the Internet has also become an integral part of business life in Serbia.

According to the research of the World Economic Forum on the use of information technologies in 2012, Serbia is ranked 85th out of 142 countries, Croatia 45th and Bosnia and Herzegovina is on the 84th place. This paper includes comparative analysis of data for the above-stated neighbouring countries. The starting point for the study was the data of the World Economic Forum. The data from job advertisements announced by employers from these three countries during the period March-May 2013 have been experimentally analysed. The obtained results indicate that the application in all three countries is almost the same, amounting to approximately 65%. Therefore, it can be noticed that the received data drastically differ from the data provided by the World Economic Forum. The fact is that the results



of the development of infrastructure or training of population to use ICT are very similar for these three countries, particularly in relation to education or school equipment. Greater differences are mostly the result of insufficient use of ICT in the business community and state administration.

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INFORMACIONE TEHNOLOGIJE U EKONOMIJI ZNANJA

Rezime:

Cilj ovog rada jeste da ispita značaj informaciono-komunikacionih tehnologija u menadžmentu znanja kao i uticaj na nacionalne ekonomije tri nezavisne susedne zemlje. Komparativnom analizom obuhvaćene su Republika Srbija, Hrvatska i Bosna i Hercegovina. Kao polazna osnova za ovu studiju korišćeni su podaci Svetskog ekonomskog foruma o upotrebi informacionih tehnologija. Eksperimentalno su analizirani podaci iz oglasa za posao koje su poslodavci u ove tri zemlje oglasili u periodu od marta do maja 2013. godine. Dobijeni rezultati ukazuju na to da je primena informacionih tehnologija u sve tri zemlje približno ista i da iznosi oko 65%.

Ključne reči:

informacione tehnologije,
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