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Future Belongs to Innovative and ICT Skilled Nations – Is Serbia Ready?

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Abstract: *We are witnesses of intensive transformations of society where innovations are everyday business of each company striving to stay on the market. This paper aims to bring the most interesting facts about the characteristics of nowadays business, innovativeness, education in order to clear the connections between business success, innovation and ICT skills of citizens of different countries. It is obvious that growth still belongs to those countries who had the best innovation models implemented in the whole society and with strong economy support. Serbia has potentials, but should reorganize itself.*

Keywords: *innovations, ICT skills, economy growth*

1. INTRODUCTION

We live in a time of intensive transformation of industrial society into new design- informational society. Activities, that are typical for an industrial society, give way to new activities connected with producing information and due to that, the value system and institutions are changing. This is most evident in highly developed countries. But, these changes are happening much faster than during industrial transformation even in developing economies.

The core of this new economy is made of the global network where investors, using ICT, trade with actions and use informational technology for improving productivity. The new technologies for processing information enable business globalization, and production of information is needed to improve activities and this is followed with directly or indirectly increasing employability of people dealing with information [16].

Rapid changes in doing business were introduced during 1992-2000 because the development of ICT during that period had reached the level that allowed them to have the power to transform all aspects of economy life (as did the steam engine and electricity) [15].

Manuel Castells [1] highlights the difference between *information society* and *informational society.* He notes that the first term highlights the role of information in society and that the second one means specific form of social organization in which production, processing and transmission of information become the fundamental source of productivity and power.

From a different definitions *of informational society* it can be concluded that [11]:

- Information becomes the main strategic resource in industrial and economic development,
- Rapid computerization of economy enables closer connections between regional, national and international economies,
- Globalization depends on informational networks,
- The limits of space are decreasing.

The innovations are recognized as the core for developing economies of all countries. Digital technologies, according to Cortada [3], represent a great possibility for innovations, through upgrading operation efficiency, development and sales of new products and services, through digital means. This can lead to the destruction of some existing industries – it can happen that whole industries, companies or their parts are not needed any more on the market, due to the implementation of ICT innovations. Also, it can happen that new technologies could be implemented in different areas of life with different speeds and that can provide a gap.

Cortada [4] notes that the speed of informatization of a society will depend on investments in infrastructure and interest/capability of wide of users to use potential and benefits from a informational technology. It is evident that Internet development is going to be crucial in future design.

In his work, Daniel Pink [9] predicts that the next phase in social development is the conceptual phase, in which people are going to deal with creative, artwork jobs, and that a lot of attention is going to be focused on:

- Design,
- Stories,

- Symphonies,
- Empathy,
- Gaming and
- Thinking.

Also, Daniel Pink presented his view of civilization development with a picture of a man changing through time from a monkey, as a farmer, skilled engineer in a suit to a casually dressed painter with a spade and a pallet [10].

If we take in consideration that we are living in a time when knowledge has an exponential growth rate and when even food production is supported with ICT (even Serbia has its first digital farm), maybe that new type of society, conceptual society is not so far.

2. ROLE OF INTERNET IN DEVELOPING SOCIETY

Since 1775, when Samuel Johanson noted that there are two types of knowledge: knowledge about some theme and knowledge where that information can be found [5], it was clear that information is very important for each segment of life. Finding information about something today, in an era of Internet, seems to be easy. But, on the other hand, people from so many different sides and with different intentions are charging the Internet with data, and still there are no strict rules for creating and connecting data bases.

So, today's education for using new ICT offers, not only knowledge how to use computers and Internet, but also learning a wide range of technologies dealing with multi-functionality, multimedia, multi communication, using data bases, and especially the knowledge about how to use Internet data searching machines [14]. The users of the Internet are *forced to* find their own way how to use the Internet possibilities and to deal with phenomena that endanger their security, habits, market position etc. But, missing ICT skills for the 21st century is a lack that can be allowed by the side of each person striving to survive.

Due to this fact, almost all educational systems in the world are changing in a manner to educate students to think, to solve problems based on using data, to be creative. The skill for learning facts is in that way put behind – because on the Internet you can find facts just on time when you need them (Einstein noted that he did not want to remember some data that can be found in each practicum). In this way the interactive learning is changing the face of teachers and students together [15]- new technologies are becoming the integral part of the classroom and they are putting students in the center of the education process. Besides this, new forms of education, such as lifelong learning is spread among countries. The most interesting changes that are noted are:

- learning is a much more nonlinear process (example: less reading books from beginning to end and more and more nonlinear processing information from Internet, TV),
- transition from giving instructions to processes of research and design researches for information,
- students are in the center of the education process, not teaches,
- more teaching about how to learn and how to synthesis everything learned,
- learning is a lifelong, continuous process etc.

It is evident that finding new ways of producing, processing and presenting data using less time is going to be one of the main challenges that we will be facing with in the future. The Internet will here conduct one of the crucial roles as a place where data about everything and everybody can be found.

Some predictions say that in 2050 in the USA 60% of employees will be working in the *info-industry*, 15% in industry and 20% of employees in other services [13].

This leads to the opinion that new ways of organizing companies are going to be more and more network organizations, like Internet is and more similar to marine than spider network. Exchange of knowledge is therefore, going to be faster and faster, so the realization of companies goals are going to be measured in less days, months. Internet will help in choosing right goals: information from the net will provide knowledge about similar situations in closer history and mistakes will be easier to prevent.

3. ROLE OF INNOVATION IN NEW SOCIETY

The world is changing very fast and innovations are pronounced for the main *culprit*. It is said that there have been more innovations in the last 50 years that during the whole last known history of civilization. On the global level, competitiveness of economies, regions, industries becomes very important. Somehow the connection between countries development and level of innovation is established. Also, it is assumed that there is a strong relationship between innovativeness and ICT skills of nations and development of the economies. That is why a lot of analysis are conducted every year about the level of national economies innovativeness, citizen ICT skills and competitiveness.

On Fig 1 the ranging countries according to their competitiveness for 2017 is given. On Fig 2 the Innovation Scoreboard ranking of countries for 2017 is shown. Together, figures show that countries that are good in innovations are also good ranked in the table of competitiveness.

Serbia is, on list shown on Fig 1, in 78th place.

GCI **Global Competitiveness Index**

Rank/137	Country / Economy	Score	Trend	Distance from best
1	Switzerland	5.9		
2	United States	5.9		
3	Singapore	5.7		
4	Netherlands	5.7		
5	Germany	5.7		
6	Hong Kong SAR	5.5		
7	Sweden	5.5		
8	United Kingdom	5.5		
9	Japan	5.5		
10	Finland	5.5		
11	Norway	5.4		
12	Denmark	5.4		
13	New Zealand	5.4		
14	Canada	5.3		
15	Taiwan, China	5.3		
16	Israel	5.3		
17	United Arab Emirates	5.3		
18	Austria	5.2		
19	Luxembourg	5.2		
20	Belgium	5.2		
21	Australia	5.2		
22	France	5.2		
23	Malaysia	5.2		
24	Ireland	5.2		
25	Qatar	5.1		
26	Korea, Rep.	5.1		
27	China	5.0		
28	Iceland	5.0		
29	Estonia	4.8		
30	Saudi Arabia	4.8		
31	Czech Republic	4.8		
32	Thailand	4.7		
33	Chile	4.7		
34	Spain	4.7		
35	Azerbaijan	4.7		
36	Indonesia	4.7		
37	Malta	4.6		
38	Russian Federation	4.6		

Fig.1 Global Competitiveness Index for 2017, [18]

The European Commission follows the data for each year in order to do the fine tuning of its *Strategy for Sustainable, Smart and Inclusive Growth 2020*. Countries are divided into 4 categories, according to innovativeness level: modest innovators, moderate innovators, strong innovators and innovative leaders. For 2017, results show that Sweden remains the innovation leader, while Lithuania, Malta, the Netherlands, Austria and the UK are the fastest growing economies. In global perspective, the EU is catching up with Canada and the US, but South Korea and Japan are pulling ahead. China shows the fastest progress among international competitors. In the EU, Sweden is followed by Denmark, Finland, the Netherlands, the UK (first time become an innovation leader) and Germany. In selected areas of innovations, the EU leaders are: Denmark – human resources and innovation-friendly environment, Luxemburg- attractive research systems and intellectual assets, Finland – finance and support, Germany- firm investments, Ireland – innovation in SMEs and employment impact, Belgium – innovation linkages and collaboration, UK- sales effects.

The last used methodology for evaluating innovativeness better captures: investments in skills, digital readiness, entrepreneurship, and public-private partnerships.

The parameters that are used to evaluate innovativeness are:

- *category 1* – new doctorate graduates per 1000 people aged 25-34; percentage of population among 25-34 that has finished tertiary education; percentage of population among 25-64 that is participating in lifelong learning; international scientific co-publications per million people, scientific publications among 10% of most cited publications in comparison to the total number of published papers; foreign doctorate students as a percentage of all doctorate students; broadband penetration; opportunity driven entrepreneurship,
- *category 2* – R&D expenditure in a public sector as a percentage of GDP; venture capital investment as a percentage of GDP, R&D expenditure in the business sector as a percentage of GDP; non –R&D innovations expenditure as a percentage of total turnover; enterprises provide training to upgrade ICT skills of workers,

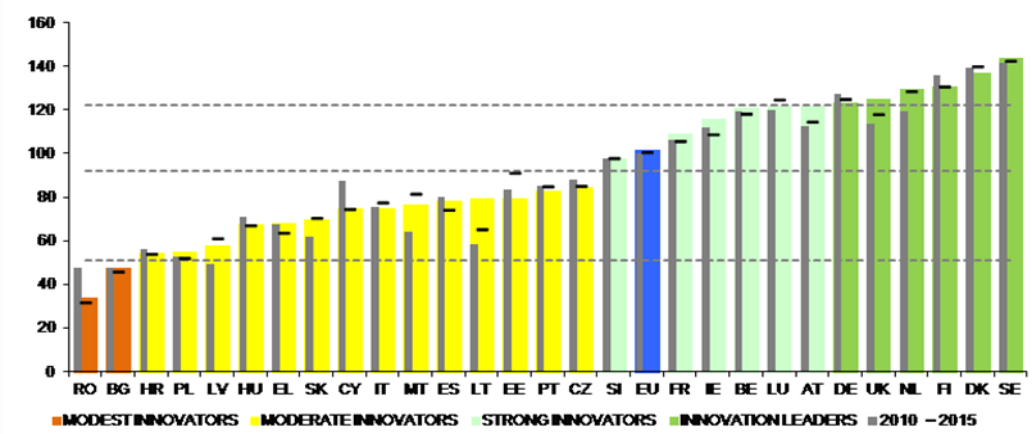

Figure2 : Innovation Scoreboard for 2017 country ranking, [19]

- *category 3* - SMEs introducing product or process innovations; SMEs introducing marketing or organizational innovations; SMEs innovating in-house; innovative SMEs co-operating with others; public-private scientific co-publishing cooperation per million people; private co-funding of public R&D expenditure; PCT patent applications per billion GDP; trademark applications per billion GDP; design applications per billion GDP,
- *category 4*- sales of new-to-market and new-to-firm innovations employment in knowledge-intensive activities as a percentage of total employment; employment in fast growing enterprises; export of medium and high technology products; knowledge intensive services export. [13]

Interesting to note is that there is a correlation between percentage of population that has finished tertiary education and innovation possibilities. It is also interesting to note that about 11% of the EU population has participated during 2017 in lifelong learning activities. In Switzerland, Sweden, Denmark, Finland and Iceland higher than 25% of population among 25-64 has participated in those trainings.

Switzerland and Ireland have the highest percentage of scientific co-publications (more than 2.500 per million citizens), while the lowest level (less than 250) had Ukraine, Turkey, Former Yugoslav Republic of Macedonia, Romania and Bulgaria. The best score in citations have Switzerland, UK and the Netherlands.

In second category, where there is debating about R&D expenditure, the best score have Denmark, Sweden and Finland. They are investing 1% and more in R&D. Investments in business sector is higher than 2% of GDP only in Israel, Sweden, Austria and Switzerland.

When providing trainings among employees for developing ICT skills, in Norway, Austria, Finland and Belgium this share is 34% of all established companies is less than 5%. Over 50% of companies in Switzerland, Luxemburg and Ireland had innovations in the area of marketing and organization, while, for example, Romanian companies have not innovated at all.

When innovations in-house are discussed, once again Switzerland is leader, with 38%, while Romania had 0% of in-house innovations. Best cooperation among the public and private sectors in publishing scientific papers has Switzerland (18%), than Island (17%) and Denmark (13%), with more than 100 co-publications per million of citizens, while 11 countries have less than 5 papers on the same population.

The capacity of companies to develop new products strongly influences their competitiveness. One of indicators is the number of new products among number of patents. Israel, Sweden, Finland and Switzerland have the best scores (8 and more new products per billion GDP).

Knowledge-intensive activities provide services directly to customers, such as telecommunications and they provide inputs for conducting innovative activities in other firms. Leaders in this area are: Israel, Luxemburg, Switzerland, Iceland and Ireland (from 20 to 27% of employment).

Interesting indicator is technological competitiveness – the ability to commercialize the results of research and development (R&D) and innovation in international markets. Export of medium and high technology products is higher than 60% in four countries (Hungary, Germany, Slovakia, Czech Republic). The exports of knowledge-intensive services are the highest in Ireland, Luxemburg, the UK, the Netherlands, Norway and Sweden (more than 75%). Also, interesting data is the sales of new-to-firm and new-to-the-market innovations. The best scores have the UK, Switzerland, Slovakia, while Ukraine, Malta, Cyprus, Bulgaria and Croatia have less than 5%.

Using broadband connectivity is one of the criteria for evaluating the level of digitalization and digital skills of citizens. In [7,8] the author dealt with the comparisons among EU and Serbia in the area of using ICT, ICT skills and digitalization and it is shown that ICT skilled workforce can provide faster acceptance of changes and innovations in firms.

If we compare list of GCI and this analysis, it is obvious that innovations influence competitiveness.

4. SERBIA IN NUMBERS

The Republic of Serbia (RS) is in 62nd place on the Global Innovation Index list (GII) for 2017 among 127 countries. The most innovative countries, according to that list are: Switzerland, Sweden, the Netherlands and the USA. Before the RS on that list is Slovenia (32), Bulgaria (36), Hungary (39), Croatia (41), Romania (42), Montenegro(48), Macedonia (61).

This system of evaluating innovativeness of a society takes into account lot of parameters: institutions (political stability, low legislation, business climate), human capital and research, infrastructure, market sophistication, creativity and technological output, quality of education.

Per criteria, the RS has the next score:

- on the institution level (50/127),
- infrastructure – 52/127,
- human capital and research – 54/127,

- output of technology and knowledge – 53/127
- economy and business- 99/127,
- economical sophistication – 79/127.

The criteria, by which Serbia is evaluated good, is the export of ICT services as a percentage of whole export (23/127), online g-services (24/127), number of researchers per million (35/127), number of graduated in scientific, technological and engineer areas in a relation to a hole number of graduates (22/127).[17]

Looking at the EU Innovation Scoreboard, according to the criteria that had provided the results, Serbia is somewhere among 10 countries with worst results. For example, Serbia did not provide results for lifelong learning, but is very bad (third worst result) according to broadband penetration. If we take into account that the best export results in Serbia for 2017 has export of software solutions, improving this parameter can bring interesting benefits for whole society. The good score is received in returns from equipment investments (4th place – category 2- 2.2.2).

Potentials for reaching better scores can be found in strengthening those indicators that the EU support (they are used to foster smart and sustainable growth through innovation). The following data is taken from [6].One of indicators is the number of new doctorate graduates per 1000 people aged 25-34. On that list, Serbia is among the first half of countries with the lowest level of indicator value (1,2 versus max 3,6). When indicator *completed tertiary education* is discussed, Serbia did not provide results to the EU Commission, so that data could not be compared but potential for improvement can be found here. This situation is also related to the following indicators: percentage of population aged 24-64 that are involved in lifelong learning, PCT patent applications per billion of GDP, employment in fast-growing enterprises.

One interesting indicator of the potential for growth and increasing innovativeness is *international scientific co-publications per million people.* According to this indicator Serbia is in 8th place of 36 countries, with 300 papers per million population. If we take the average EU score – 500, but also that Denmark has about 750, Switzerland 2800, this indicator by itself does not mean a lot.

Indicator *Broadband penetration* is interesting in the context of using full e-potential that is being offered on a world bases. Only 3,5% (best score is 32% in Sweden) of companies that have access to broadband internet are using it for electronic commerce. This is a huge potential for fostering business and innovativeness on firm level.

An interesting indicator is the opportunity-driven entrepreneurship. Serbia, above all, chose security of maintaining their income, than to be driven by opportunity to risk, be independent and earn more. Only 1% of citizens among 25-64 chose entrepreneurship as a chance (EU average score is 3%, Norway is a leader with 13%).

Research and Development (R&D) expenditure in the public sector (as a percentage of GDP) is, for example, in Serbia on the level of 0,60%, while the EU average is 0,7%. This expenditure is very important due to the fact that the public sector provides some services for all industry development. Another indicator – *R&D expenditure in business sector*- captures the formal creation of new knowledge within firms. This is important in the science-based sectors (pharmaceuticals, chemicals, some areas of electronics). Serbia, with 0,3% has much lower score than EU -1,3%. This is one of the very important factors because it is directly connected with developing innovations which can provide products/services that will bring funding for further innovations.

Serbia is, with 1,7% of investments (which come from total turnover) in equipment and machinery, acquisition of patents and licenses, among 4 countries that are best scored. Taking into account that the Serbian GDP is still low, using licenses can be a way to lower unemployment and raise average GDP. This method was used in Serbia after the Second World War and nowadays Turkey is an example how this is applicable.

In almost all criteria that are connected with trainings of staff (*ICT skills, innovation trainings dealing with all areas of business in companies- new products, services, marketing*), Serbia comes out in the middle of the list. Also, when it comes to *cooperation with other organizations in order to provide innovations*, Serbia is in the middle of the list. Better governmental strategy can provide faster flow of knowledge and services among higher education institutions and economy partners (production companies firstly) in the future.

Two interesting indicators, connected with Serbia export structure are – *knowledge –intensive services export as percentage of total services* and *sales of new-to-market and new-to-firm innovations as a percentage of turnovers.* As a country with huge export of ICT services, investments in infrastructure, retraining and education in ICT skilled workers, Serbia can provide a good base for GDP growth and deliver more knowledge-based services and a higher number of new-to-market and new-to-firm innovations.

5. CONCLUSION

Through this work it is shown that there is strong relationship among innovations and economy development of countries and that the level of ICT

skills of citizens can influence GDP growth. A research made under the OECD countries during 2010 whose results were published by Vincenzo Spiezia, [12] concluded that development of ICT skills do not influence an employee capability to innovate, but ICT skills influence capability to adopt innovations in firms. This can be used in Serbia, to foster innovation acceptance on a daily bases. Also, Serbia should force itself to foster education of production staff into using ICT skills in order to foster innovation. These can be reached through improving cooperation among innovation centers and companies, additional education employed staff through lifelong learning trainings or through education in teamwork among companies staff.

Looking on examples from developed countries, who mostly innovate and knowing that innovations in ICT foster innovations in other areas, it is obviously that Serbia should firstly be focused in the area of food production, tourism, chemical industry and software production because Serbia is in those areas well quoted in the world. Missing infrastructure must be the priority of Serbian Government. Focus in sales should be mostly done in developing high technology products and services and some efforts should be done in patents implementations in the field. Money should be invested only in patents that Serbian industry can support at this moment.

Potential lies in using opportunities under the institutions: The Innovation Fund, Development Agency of Serbia, Chamber of Commerce and Industry of Serbia. For example, Chamber of Commerce and Industry of Serbia organizes meetings with important EU companies where it can be found what projects they are running and where Serbian knowledge-based companies can be involved.

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