

DEVELOPING A KNOWLEDGE-BASED ECONOMY AS A FACTOR TO RAISE THE COMPETITIVENESS OF THE SERBIAN ECONOMY

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Abstract: The most developed and most competitive countries today (including the leading countries of the European Union) are so-called “knowledge-based economies”, where knowledge, information and highly sophisticated skills play an important role in the development of the business and public sector. Knowledge and technology are becoming ever more complex, participation in knowledge-based economic activities is significantly increased (high-tech production and knowledge-based services), and connecting companies in these areas with private and public institutions facilitates development and the successful application of new innovations, thus raising the level of competitiveness of companies, industries and the country as a whole. In the last few years, rapid growth in the international trade of high-tech products and knowledge-based services has significantly changed a large number of countries’ international competitiveness. These trends show that creating, implementing and commercializing new technology and knowledge facilitates the development of high-tech products and knowledge-based services, which have become an important source of increasing productivity and manufacturing and export competitiveness. Thus high-tech sectors have become an important source of high added value and well-paid jobs, plus sustainable economic growth and global competitiveness. According to the World Economic Forum’s competitiveness rankings, Serbia is 95th out of 144 countries and is in the group of the 33 countries whose competitiveness is efficiency-driven. The achieved level of competitiveness of the domestic economy and the

achieved level of economic development (Serbia is 75th in the world for GDP per capita in dollars) points to low productivity in the use of available (human, capital, financial, etc.) resources accompanied by high current spending, which is not a situation that is sustainable in the long-term. The research starts from the assumption that the development of high-tech and knowledge-based activities plays a significant role in strengthening the competitiveness of the economy. A comparative analysis examines the link between the lagging Serbian economy in terms of competitiveness and the slower development of a knowledge-based economy, compared to the most highly developed European countries and selected countries in the region. A structural analysis and comparison of the most important business indicators (employment, productivity and added value) of high technology and knowledge-based companies shows the development and basic characteristics of the knowledge-based economy in Serbia and the macro-competitive position of Serbia compared to the leading and neighboring European Union countries. The paper also identifies the most important factors of developing a knowledge-based economy in Serbia, which needs to be improved to facilitate significant development of high-tech and knowledge-based activities as the basis for the future competitiveness of the domestic economy. The final objective of the paper is to point out the need for more substantial and faster development of a knowledge-based economy as a prerequisite for achieving long-term international competitiveness and sustainable development of the Serbian economy.

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1. Developing a knowledge-based economy

Knowledge and new knowledge-based technologies are the primary drivers of the development of the world economy. Economic history shows that the most adaptive and innovative countries are the most successful, that is, those countries which adapt to changes with new innovations quickly and in the best manner are the countries that develop more rapidly. The development of knowledge and knowledge-based innovation enabled the rapid industrial development that began with the discovery of the steam engine and went in the direction of continuous improvement of machines and the production process all the way to full automation. The development of modern computers, information and communications technology and the Internet brought about a new information age. New knowledge built into modern information technologies allows data to be collected, processed and analysed and decisions to be made based on a massive amount of information. Thus, information is becoming the most important development resource, gaining primacy over

natural resources (a characteristic of the first industrial revolution) or wealth with physical capital and accumulation (a characteristic of the second industrial revolution). That is why the modern development of economies based on the use of ICT and the creation of knowledge-based economies are often referred to in literature as the “third technological revolution”.

The growing role of knowledge in the conduct of economic activities has substantially changed the importance of knowledge and information in the economy and society and has enabled the transition from the traditional economy to “knowledge-based economies” or „knowledge-driven economies“.¹ The OECD defines knowledge-based economies as economies which are directly based on the production, distribution and use of knowledge and information.² This new knowledge-based economy is not only about the qualitative pushing of the boundaries of existing knowledge, but also about numerous qualitative changes which entail more efficient utilisation of existing and the development of new knowledge in all areas of business activity as well as a greater degree of networking and cooperation between different actors (companies, private and public research organisation, different institutions, agencies, etc.) in order to exchange more effectively existing information and creating better conditions for new knowledge creation. The increasing application of knowledge and development of new knowledge-based activities and products has influenced the decline of the manufacturing industry’s share in GDP (a phenomenon known as deindustrialisation) in the most developed economies. However, when you include qualitative indicators beside quantitative indicators in the observation, you see that this is a much more complex phenomenon, i.e. the fundamental restructuring of these economies. Low-accumulative, non-innovative and technologically obsolete activities (for example, the textile industry, the wood processing industry, consumer goods manufacturing, etc.) are relocating to less developed countries and regions with a cheaper workforce, while the most innovative, high-technology and knowledge-based activities develop quickly in the most developed economies. That is why instead of deindustrialisation, we can speak of the structural transformation of the economy in the most developed, knowledge-based economies, i.e. of reindustrialisation based on ICT and the knowledge-based economy.

Although the concept “knowledge-based economies” has existed for more than a decade, many theorists still see it as a metaphor and not as a clear concept with a precise meaning. However, most authors proceed from the fact that knowledge is qualitatively more important as an input today than it has ever been before. So, for example, one of the most well-known management theorists, Peter Drucker suggests that knowledge is now becoming one factor of

¹ The concept “knowledge-based economies” is used to further underscore the importance of knowledge as a carrier of development of the modern economy.

² OECD (1996), p. 7.

production, sidelining both capital and labour.³ There are also a great number of other views on the role and importance of knowledge in the modern economy. Some authors believe that knowledge is more important as a product, while others underscore the importance of codified⁴ knowledge and the relevant databases based on it, and then there are also the authors who underscore the importance of developing information and communications technologies and the Internet because they allowed physical restrictions to disappear and they drastically reduced the costs of collecting and distributing information and thus facilitated and accelerated the creation and exchange of new knowledge. Common to all approaches is that economic development is increasingly less based on physical capital investment and increasingly more so on knowledge which is created as result of investment in new knowledge.

The knowledge-based economy is a complex concept. Besides knowledge, which is at the core of this concept, the knowledge-based economy is characterised by the market globalisation process, the emergence of global competition, the change in the way companies compete, the development of multinational and transnational companies, the emergence of new forms of networking and cooperation between companies, the development of new management methods and management, the emergence of new forms of company organisation, the development of completely new products (e.g. digital applications), the formation of new economic branches (IT industry), the shortening of the product life cycle, the change in the needs, habits and wishes of consumers, the change in the role of the government, economic deregulation, changed rules of doing business, etc. Although this is a complex phenomenon that arose out of the simultaneous action of a large number of factors, the successful development of a knowledge-based economy to a great extent depends on the ability of companies to apply existing and create new knowledge and develop creativity and innovation. Knowledge in knowledge-based economies has ceased to be simply valuable information. Knowledge is intellectual capital and new ideas, that is, it is the basis for and the source of the development of new business ventures, new systems and production models, and new products and services.

The knowledge-based economy did not emerge quickly and out of the blue, rather it was a gradual process that took place over many years. Currently, however, four influences can be identified as increasing the speed of change:

1. Extraordinary progress of Information and Communication Technologies (ICT);
2. Increased speed of scientific and technological advance;

³ Drucker (1998), p.15.

⁴ Codified knowledge is recorded, systemised knowledge that can be stored, read and transferred, i.e. exchanged.

3. Increased global competition, facilitated in part by reduced communication costs;
4. Changing demand associated with rising incomes, and the changes in tastes and attitudes to leisure that come with greater prosperity.⁵

In addition to knowledge, innovation⁶ has an important place in the knowledge-based economy as creating and exchanging knowledge is not the goal in itself, rather it is the basis for and the source for new innovations, whether technological, production and marketing or innovations in organisation and methods and models of doing business, etc. The approach to innovation and the innovation process itself has changed significantly in the knowledge-based economy. The approach where innovation is based on technological research and the exchange of technology between companies (the so-called closed innovation system) has been replaced in favour of encouraging innovation that takes place within a broad network of innovative cooperation (joint development, exchange of knowledge and ideas, sharing of results, etc) between different companies and other interest parties (institutes, laboratories, public and private development centres, etc.) where knowledge plays the most important role in encouraging the development of innovation. The majority of innovations is made by combining existing knowledge. To turn knowledge into innovation, it needs to be accessible, that is, there needs to be quick, easy and inexpensive access to a large and broad spectrum of knowledge. Besides availability, to transform knowledge into innovation, there need to be experts who are able to apply available knowledge and create new knowledge.

Knowledge-based economies, in general, are characterised by a pronounced accent on innovation – especially technological, but also organisational innovation. Successful innovation depends on different kinds of knowledge – organisational, social, economic, marketing and alike. Although not all innovations arise as a result of knowledge derived from research and development activities, knowledge continues to be the most important factor in developing innovation.

New knowledge allows new innovations to be developed (new products, services, processes, organisational models, etc.) At the same time, successful innovation, as the most important source of change, has facilitated the development of the knowledge-based economy. Knowledge-based activities stimulate new types of innovation and allow innovation processes to adapt to new circumstances. The relationship between knowledge, innovation and the knowledge-based economy is complex because knowledge is the primary source of innovation, innovations change society and build a knowledge-based society, and the very nature of innovation itself changes in the knowledge-based economy.

⁵ European Commission (2004), p. 21-22.

⁶ Innovation is a process of seeking market opportunities through identifying the value potential in existing operations and adapting them to generate new business or enhance existing business.

2. Competitiveness of Serbia in developing a knowledge-based economy

The competitiveness of the economy is a reflection of the overall development of individual parts (economic branches) and of society as a whole. An economy in which a large number of successful companies operate, which has full employment and which provides the population with a sustainable high standard is a competitive one. At the core of competitiveness are the institutional conditions and microeconomic policies which create the business environment in which companies operate (ease of starting new companies and stimulating conditions in which existing companies operate), as well as macroeconomic policy that provides security and stability of the business environment and guides the direction of development of the economy (e.g. facilitates the development of a knowledge-based economy). Growth in competitiveness implies acceleration of productivity. Growth in productivity enables sustainable growth per capita to be achieved, which, consequently, leads to growth in disposable income, purchasing power and the standard of living.

In a knowledge based economy, competitiveness of firms is in large extent based on their capability to innovate (introduce new or improved products or processes), produce qualitative changes and new products, to utilise ICT and marketing activities, to introduce new technologies and organisations. In a changing world the competitive advantage of firms is also determined by firm's specific "dynamic capabilities".⁷

Developing a knowledge-based economy is the attempt of individual countries to achieve long-term competitiveness the conditions of the global market and competition with other countries. Knowledge-based economies base their competitiveness by creating efficient scientific and technological databases, encouraging the creation of new and exchange of existing knowledge, exchanging business and technological research and development results, creating favourable conditions for encouraging innovation and improving the quality of available human resources through formal and informal education and different forms of lifelong learning, as well as by increasing their mobility. To survive in a knowledge-based economy, companies constantly review the competitiveness of their products, services, processes, organisation models, marketing approaches and all other activities on which their market position and success depend.

The competitiveness of countries and their economies can be measure and compared in a large number of ways depending on which aspect of competitiveness is being examined. Numerous complex indicators comprised of a larger number of individual indicators have been developed to obtain a more complete picture of competitiveness. The primary goal of measuring

⁷ European Commission (1999), p. 55.

competitiveness is to compare the achieved level of competitiveness between countries in order to see which areas are lagging behind and to propose measures for improving current competitiveness.

The different competitiveness indicators classify Serbia into the group of less competitiveness countries. According to the Global Competitiveness Index (GCI)⁸, which is one of the most commonly used international indicators of national competitiveness, of the 144 countries covered,⁹ Serbia comes in the 95th position and with a GDP per capita of USD 6,081 finds itself at the bottom of the group of 33 countries (Phase 2 Efficiency-driven economies) which are trying to achieve economic growth and improve their overall competitiveness position by increasing efficiency. Almost all of the countries in the region are in the second development phase, apart from Hungary (60) and Croatia (81), which are transitioning towards the most economically strong group of countries, in which Slovenia (56) is already present with a GDP per capita of USD 24,533. According to this index, in 2012 Serbia remains one of the most uncompetitive countries on the European continent – only Greece has a lower position, and Bosnia and Herzegovina has caught up with Serbia and is currently in the 88th position (a jump of 12 places from last year's report). Because of the large decline in the values of the innovation factors, Serbia has significantly weakened its competitiveness in the past few years.

Serbia is in a very unfavourable position in terms of competition, because according to the majority of the indicators, it is below the average of the countries in the second development phase, and this means it is far from the average of the countries of the European Union. Without modernising manufacturing capacities and constantly investing in education and improving workers' expertise, Serbia can neither improve efficiency in other economic spheres nor can achieve a higher level of development. In the long-term, human capital and technology are the two key factors that determine sustainable economic growth and the sustainable position of the open market economy. Threats to the current (un)competitive international position of Serbia are the absence of healthy competition in the domestic market and inefficient anti-monopoly policy with the slow restructuring of public companies, the problem of property rights and issuing construction permits, poor employer-employee relations and so on. Serbia is distinguished by its low level of state investment in advanced technologies as well as little support given to the development of

⁸ The Global Competitiveness Index (GCI) is a complex (composite) indicator in which competitiveness is viewed as a group of institutions, policies and factors that define a country's level of productivity (expressed as GDP per capita in USD) and shows the level of development that may be achieved. When comparing countries according to GCI, all countries are classified into three groups depending on the achieved level of GDP per capita, whereby the countries where primary products have a 70% share in exports (five-year average) are classified into the first group, regardless of the level of productivity.

⁹ According to World Economic Forum (2012).

innovative and high-tech capacities, meaning overall investment in research and development needs to be increased substantially in order for the country to achieve a higher level of development and join the countries of the EU. Besides this, it is necessary to remove the great many limitations that exist: inadequate number of researchers, outflow of highly-educated people from country, obsolete structure of the R&D sector alongside the public sector being dominant over the business sector, weak or inexistent cooperation between the academic and business sectors and the inadequate and unplanned use of all available national resources and available EU funds. Furthermore, the large difference in Serbia's ranking in terms of the level of competitiveness (95th according to the World Economic Forum) and GDP per capita in dollars (75) indicates that use of available resources (human, capital, financial) is unproductive, and current spending is too high.

The World Economic Forum, besides the 2012 Competitiveness Report,¹⁰ is preparing another report titled The Europe 2020 Competitiveness Report, which will assess Europe's competitive progress based on the Europe 2020 Strategy every two years until 2020. The Europe 2020 Competitiveness Index is organised into three sub-indices that monitor the EU's efforts to become an intelligent, inclusive and sustainable economy. The primary finding of this year's report is that there are large differences in competitiveness between member states within the EU itself. An analysis of the Report shows that Europe is currently being pulled ahead by the advanced Nordic countries in the creation of intelligent, highly-productive economies, and that Serbia comes last out of all the 32 countries observed (28 member countries and 4 candidate countries). Compared with other advanced economies, the EU as a whole is making progress in building an inclusive and sustainable society, but significantly lags behind in the critical area of intelligent growth, which brings into questions its innovation capacities, ability to increase competition and the potential to sustain a high and rising standard of living. The report also shows that countries with a relatively high level of economic prosperity are lagging behind in the building of knowledge-based economies – highly-productive economies suffered the greatest losses in terms of employment or wages or in both in times of crisis.

According to the latest EBRD Report,¹¹ 2012 is generally characterized by reform stagnation (or slow reform) and not a reversal of reform processes. No significant progress has been made in Serbia – the average progress in transition score of 3.17 is unchanged and when compared with the countries in the region is only greater than the score gained by Bosnia and Herzegovina (3.00).

¹⁰ According to European Commission (2012)

¹¹ The European Bank for Reconstruction and Development in its Transition Report monitors economic development and reform progress in European countries in transition, which provides a comparative view of the degree and quality of reforms undertaken, for more see: EBRD (2012).

According to the EBRD indicators, Serbia lags behind most countries in the region in the privatisation of large systems, company management and restructuring and implementation of competition policy.

In the latest Doing Business 2013,¹² Serbia came 86th in the ranking of 185 countries (95th in 2011). Of the European countries, Serbia only has a better position than Ukraine (137), Bosnia and Herzegovina (126), Russia (112) and Malta (102). A comparative analysis of the dynamic and tempo of improving business indicators with countries in the region indicates reform speed and economic competitiveness. While no reform progress was made in 2011, in 2012 Serbia once again found itself among 10 countries that had most improved the business environment compared with the previous year and had implemented reforms in at least 3 of the 10 key areas on which the World Bank bases its research. The leader in implementing reform is Poland (which jumped from the 74th to 55th position), and out of the countries in the region, Serbia made the largest leap, having improved its ranking by 9 positions and having improved the conditions for doing business in terms of starting a business, enforcing contracts and resolving insolvency. Serbia's ranking improved most substantial in terms of starting a business by abolishing the minimum paid-in capital requirement, thus improving its ranking by 49 positions, which contributed to the country finding itself above the Western Balkan average as well as the European Union average. The mostly unchanged values of the other business indicators alongside the worsening of their positions compared with the previous year, shows that there has been no significant improvement in the business environment in Serbia, and that certain countries have managed to improve their business environments and mitigate the consequences of the global economic crisis by carrying out structural reforms.

The competitiveness of the Serbian economy measured according to the different criteria is at the level of the less developed countries in the region, and in some aspects it is even lower. Low competitiveness directly affects possibilities for economic growth, the amount of income and the level of prosperity. For this reason, all observed weaknesses and limitations need to be removed and a business environment created which facilitates the development of companies that will be competitive and successful in the global market. Globally, the main carriers of competitiveness and sustainable economic development are companies in the high-technology sectors.

¹² The World Bank has for more than 10 years been analysing the conditions of doing business through company development from starting a business, respect for legal requirements and regulatory measures and possibilities for getting credit to protecting investors and closing a business. The data pertains to the achieved solutions that will apply the next year. The World Bank's report and ranking of countries according to ease of doing business contains business environment indicators that may facilitate or may be an obstacle to doing business, for more see: World Bank (2012).

3. Level of development of high-technology sectors in Serbia and their importance for building long-term competitiveness

The knowledge-based economy is characterised by the rapid development of companies that base their business on knowledge and new technologies, no matter whether they conduct manufacturing or service activities. Although the knowledge-based economy cannot be equated with the high-technology sectors,¹³ the high-technology sectors are the most important part and the driver of developing a modern knowledge-based economy. In the knowledge-based economy, technology and knowledge become increasingly complex, the importance of and possibilities for connecting companies with other companies and research organisations grow, whereby new opportunities for gaining new knowledge and development and applying and spreading innovation are created, which leads to further development and strengthening of the competitiveness of the high-technology sectors and of the economy as a whole.

Creating, exploiting and commercialising new technologies has become essential in the global race for competitiveness. High-technology sectors are key drivers of economic growth, productivity and welfare, and are generally a source of high value added and well-paid employment.¹⁴ Technology-intensive enterprises are commonly referred to as high-technology (or 'high-tech') companies. They are vital to the competitive position of a country because:

- They are associated with innovation and, hence, tend to gain larger market shares, create new markets for products and services and use resources more efficiently. Environmental aspects are playing an increasingly important role in this context.
- They are linked to high value-added production and success in foreign markets, which help to yield higher returns on the workers they employ.
- The industrial R&D they perform has spill-over effects which benefit other lines of business by generating new products and processes, often leading to productivity gains and business expansion and creating highly paid jobs.¹⁵

The achieved level of development of the high-technology sectors is a good indicator of the extent to which an economy has become a knowledge-based economy. The most developed economies today are the economies in which high-technology sectors play a significant role and are a basis of new growth,

¹³ High-technology (high-tech) sectors includes: High-technology manufacturing (Manufacture of basic pharmaceutical products and pharmaceutical preparations and Manufacture of computer, electronic and optical products) and High-tech knowledge-intensive services (Motion picture, video and television programme production, sound recording and music publishing activities, Programming and broadcasting activities, Telecommunications, Computer programming, consultancy and related activities, Information service activities, Scientific research and development)

¹⁴ European Commission (2009), p. 151

¹⁵ European Commission (2010), p. 219

employment and competitiveness. Accordingly, the achieved level of development of the high-technology sectors in Serbia will be examined below and compared with the average of the European Union and individual countries, especially with countries in the region which are members of the European Union.

In 2010, 8,067 companies operated in the high-technology sectors (2.8% of the total number of companies).¹⁶ The high-technology sectors in Serbia are smaller compared to the EU 27 average (863,921- 4.8%) and most EU members (the share of high-technology sectors is only greater in Serbia when compared with Bulgaria – 2.7%, Spain – 2.2%, Lithuania – 2.0% and Portugal – 2.0%). Of the countries in the region,¹⁷ the share of the high-technology sectors is only greater when compared with Bulgaria, and significantly less when compared with the rest of the countries (Hungary – 7.5%, Romania – 4.2%, Slovenia – 7.1%, and Croatia – 3.4%). The structure of the high-technology sectors in Serbia and the EU is also different. The share of high-technology manufacturing (23.1% - 1,860 companies) in the high-technology sectors is significantly larger in Serbia compared with the EU (5.6% - 48,100 companies). High-technology knowledge-intensive services have a share of 76.9% (6,207 companies) in the high-technology sectors in Serbia, while in the EU they account for 94.4% (815,821 companies).

The smaller presence of the high-technology sectors compared with most EU countries and countries in the region indicates that Serbia lags behind in building a modern knowledge-based economy compared with the countries of the European Union and most countries in the region. The difference in the structure of the high-technology sectors themselves indicates an insufficient number of high-technology knowledge-intensive services companies, which is significantly reflected in the size of the sector itself.

In 2010, 8.1 million of the 183.4 million workers in the European Union were employed in the high-technology sectors (4.4%). Of the 1.0 million employees in Serbia, 51,000 or 5.1% are employed in the high-technology sectors. Domestic companies have a greater share of employment in the high-technology sectors compared with the EU average and with most EU countries (Serbia only has a lower share than Belgium, Czech Republic, Denmark, Ireland, Malta, Finland and Sweden). Compared with the countries in the region, Serbia has a lower share of employment in the high-technology sectors only when compared with Hungary (5.9%) and Slovenia (6.1%), and a larger share than Bulgaria (3.4%), Romania (3.0%) and Croatia (3.7%). The larger share of employment in the high-technology sectors compared with the EU

¹⁶ Sectors not included in the analysis (A, B, D, E and F): Agriculture, forestry and fishing; Mining and quarrying, Electricity, gas, steam and air conditioning supply; Water supply and Construction

¹⁷ Data only available for countries in the region that are EU members– Bulgaria, Hungary, Romania, Slovenia and Croatia.

average and most EU countries does not mean that domestic companies in the high-technology sectors employ more workers on average than other countries, but that domestic companies in other sectors of the economy employ on average significantly fewer workers than most EU countries (see table 3). Within the high-technology sectors, 16.4 thousand workers (32.4%) are employed in high-technology manufacturing, while 34.4 thousand workers (67.6%) are employed in high-technology knowledge-intensive services. Viewed according to the employment structure in the high-technology sectors, there are no large differences between companies in Serbia and in the EU. The size of employment in the high-technology sectors is important for every economy because there are more employees with a higher (university) education and wages, as a rule, are on average higher than in other sectors of the economy.

Table 1 Size and Structure of the Economy and Employment in the EU and Serbia According to Technological Intensity in 2010

	Sectors	Number of enterprises				Employment			
		European union 27		Serbia		European union 27		Serbia	
		Number	% of total	Number	% of total	Number (in 1000's)	% of total	Number in 1000's)	% of total
1	Total (3+8) *	18,130,333	100.0	284,155	100.0	183,366	100.0	1,002	100.0
2	High-technology sectors (4+11)	863,921	4.8	8,067	2.8	8,052	4.4	51	5.1
3	Manufacturing industries (4-9)	2,129,488	11.7	54,385	19.1	34,392	18.8	374	37.5
4	High-technology	48,100	0.3	1,860	0.7	2,332	1.3	16	1.6
5	Medium-high-technology	213,495	1.2	3,632	1.3	9,715	5.3	69	6.9
6	Medium-low-technology	744,298	4.1	14,356	5.1	9,579	5.2	96	9.7
7	Low-technology	1,123,595	6.2	34,537	12.2	12,766	7.0	192	19.3
8	Knowledge based services (9+14)	16,000,845	88.3	229,770	80.9	148,974	81.2	627	62.5
9	Knowledge-intensive services (10-13)	4,540,101	25.0	52,651	18.5	83,239	45.4	158	15.4
10	Knowledge-intensive market services	3,724,280	20.5	33,811	11.9	12,665	6.9	80	7.6
11	High-tech knowledge-intensive services	815,821	4.5	6,207	2.2	5,720	3.1	34	3.4
12	Knowledge-intensive financial services	-	-	2,244	0.8	6,485	3.5	7	0.7
13	Other knowledge-intensive services	-	-	10,389	3.7	58,369	31.8	37	3.7
14	Less knowledge-intensive services	11,460,744	63.2	177,119	62.3	65,735	35.8	469	47.0

*Manufacturing industries and knowledge based services (sectors A, B, D, E and F not covered)

Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013

Table 2 Size and Structure of Turnover and Value Added in the EU and Serbia According to Technological Intensity in 2010

	Sectors	Turnover				Value added			
		European union 27		Serbia		European union 27		Serbia	
		Value (EUR million)	% of total	Value (EUR million)	% of total	Value (EUR million)	% of total	Value (EUR million)	% of total
1	Total (3+8) *	19,335,185	100.0	56,561	100.0	4,715,377	100.0	10,648	100.0
2	High-technology sectors (4+11)	1,495,051	7.7	3,362	5.9	600,324	12.7	1,317	12.4
3	Manufacturing industries (4-9)	6,410,413	33.2	17,197	30.4	1,587,298	33.7	3,647	34.3
4	High-technology	521,191	2.7	1,178	2.1	163,551	3.5	270	2.5
5	Medium-high-technology	2,218,980	11.5	2,855	5.0	555,911	11.8	481	4.5
6	Medium-low-technology	1,896,296	9.8	4,621	8.2	428,291	9.1	974	9.1
7	Low-technology	1,773,946	9.2	8,544	15.1	439,545	9.3	1,922	18.0
8	Knowledge based services (9+14)	12,924,772	66.8	39,364	69.6	3,128,079	66.3	7,001	65.7
9	Knowledge-intensive services (10-13)	2,486,355	12.9	6,304	11.1	1,080,376	22.9	2,254	21.2
10	Knowledge-intensive market services	1,512,495	7.8	2,732	4.8	643,603	13.6	849	8.0
11	High-tech knowledge-intensive services	973,860	5.0	2,184	3.9	436,773	9.3	1,046	9.8
12	Knowledge-intensive financial services		0.0	581	1.0		0.0	92	0.9
13	Other knowledge-intensive services		0.0	806	1.4		0.0	267	2.5
14	Less knowledge-intensive services	10,438,417	54.0	33,060	58.5	2,047,703	43.4	4,747	44.6

*Manufacturing industries and knowledge based services (sectors A, B, D, E and F not covered)

Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013

Domestic companies in the high-technology sectors in 2010 had a turnover of EUR3.4 billion, which accounts for 5.9% of total turnover. Companies in the high-technology sectors in the EU had a turnover of EUR19,335.2 billion, which is 7.7% of total turnover. Compared with certain EU countries,¹⁸ Serbian companies in the high-technology sectors only had a higher share of turnover in total turnover than Lithuania (3.7%), Austria (5.0%) and Portugal (5.5%). Companies in countries in the region (Hungary – 14.5%, Romania – 6.6% and Slovenia – 7.6%) also have a higher share of high-technology sector turnover compared with companies in Serbia. The lower share of turnover of the high-technology sectors in Serbia compared with the observed countries indicates that companies in the high-technology sectors in Serbia have less business activity compared with other sectors of the economy. Within the high-

¹⁸ Data not available for 10 countries: Belgium, Bulgaria, Ireland, Greece, Cyprus, Latvia, Luxembourg, Malta, Sweden and Croatia.

technology sectors, 35% of turnover was created in high-technology manufacturing and 65% in high-technology knowledge-intensive services, which is almost identical to companies in the EU.

Companies in Serbia that operate in the high-technology sectors created EUR10.6 billion in added value in 2010, which is 12.4% of total created added value in the economy. A slightly larger share in total added value (12.7%) was created by companies in the EU that operate in the high-technology sectors (EUR4,715.4 billion). Of the 18 EU countries for which data are available,¹⁹ only three countries have a larger share in the added value of companies in the high-technology sectors compared with companies in Serbia: Denmark (15.1%), Hungary (16.3%) and Finland (30.6%) which indicates that the high-technology sectors had the greater importance in creating new value in conditions of the economic crisis in Serbia compared with the observed countries. Within the high-technology sectors, 79.5% of the added value was created in high-technology knowledge-intensive services and 20.5% in high-technology manufacturing, which differs from the EU average, where 27.2% of the added value was created in high-technology manufacturing and 72.8% by high-technology knowledge-intensive services. Although high-technology knowledge-intensive services have a lower share in the total number of companies in the high-technology sectors, they have a larger share in creating added value (79.5%) than is the case in the EU (72.8%). The reason for this is almost twice lower productivity of domestic companies operating in high-technology manufacturing compared to high-technology knowledge-intensive services companies.

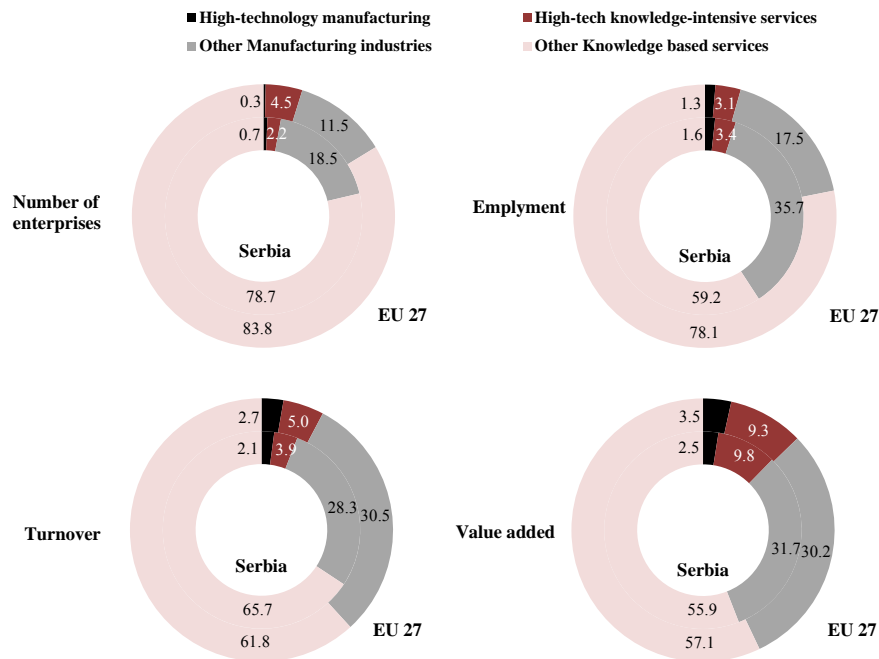
The previous comparative analysis of the basic business indicators shows the level of development of high-technology sectors in Serbia compared with the EU average and individual EU countries, with special emphasis placed on countries in the region. The importance, contribution and competitiveness of domestic companies in the high-technology sectors can be seen by analysing the presented business indicators. To this end, the average size of companies, business activity and productivity of domestic companies in the high-technology sectors compared with the rest of the economy, the EU average and individual EU countries are comparatively analysed below.

In 2010, the average company in Serbia employed 3.5 workers, which is substantially lower than in the EU, where the average company employed 10.1 workers. In the European Union, the average company in the high-technology sectors employs 9.3 workers, which is below the average of the overall economy (10.1) and the manufacturing industries (16.2), at the level knowledge-based services companies (9.3), and higher than the less knowledge-

¹⁹ Data not available for 10 countries: Belgium, Bulgaria, Ireland, Greece, Cyprus, Latvia, Luxembourg, Malta, Sweden and Croatia.

intensive services companies (5.7). The situation is different in Serbia. The average company in the high-technology sectors employs 6.3 workers, which is above the average of the overall economy (3.5), the knowledge-based services companies (2.7) and the less knowledge-intensive services companies (2.6), but below the average of the manufacturing industries (6.9). Although companies in the EU on average have more employed workers than companies in Serbia in all sectors, this difference is most pronounced in companies in high-technology manufacturing. Domestic companies in high-technology manufacturing on average employ 8.8 employees, and companies in the EU employ 5.5 times as many (48.5 employees). This can indicate that the companies operating in high-technology manufacturing in the EU are much larger than domestic companies.

Figure 1. Share High-Technology Sectors - High-Technology Manufacturing and High-Tech Knowledge-Intensive Services – in Economy in 2010



Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013

The average company in the European Union in 2010 had a turnover of EUR105.4 thousand per employee which is more than double the turnover of the average company in Serbia (EUR56.5 per employee). The disparity in the business activity of companies is even more pronounced in companies in the high-technology sectors because the average company in this sector in the EU has a turnover of EUR185.7 thousand per employee, while in Serbia this is three

times lower (EUR66.3 thousand per employee). The business activity of companies in Serbia in the high-technology sectors is also lower compared with all other individual EU countries, except Lithuania where companies in this sector on average has a turnover of EUR63.5 thousand per employee. Countries in the region (Romania – EUR68.4 thousand per employee, Slovenia – 99.8, and Hungary – 158.9) also have a large turnover per employee. Within the domestic economy, companies in the high-technology sectors have a larger turnover per employee compared with the average of the overall economy (56.5), as well as compared with the average of the manufacturing industries (45.9) and knowledge-intensive services (39.9), but smaller than the less knowledge-intensive services average (70.5). Within the high-technology sectors, high-technology manufacturing companies had a larger turnover per employee than high-technology knowledge-intensive services companies, but smaller than knowledge-intensive financial services companies.

Table 3 Economic Statistics on High-Technology Sectors, 2010

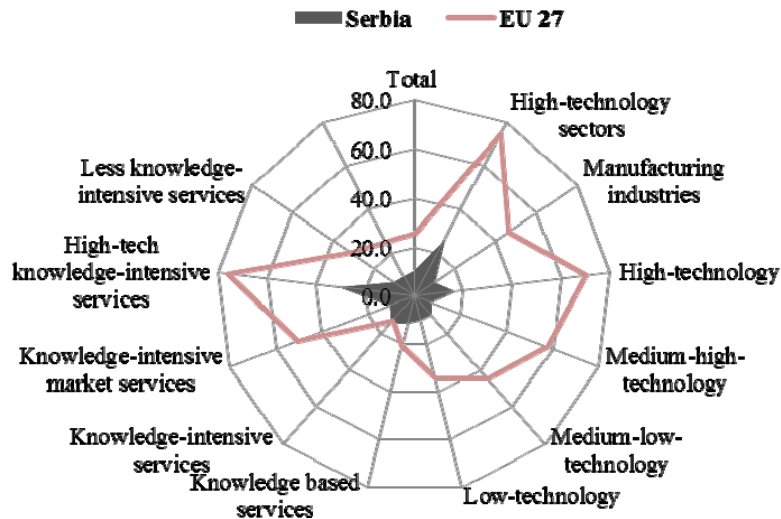
		Employment per enterprise		Turnover per enterprise		Productivity	
		EU 27	Serbia	EU 27	Serbia	EU 27	Serbia
1	Total	10,1	3,5	105,4	56,5	25,7	10,6
2	High-technology sectors	9,3	6,3	185,7	66,3	74,6	25,9
3	Manufacturing industries	16,2	6,9	186,4	45,9	46,2	9,7
4	High-technology	48,5	8,8	223,5	71,7	70,1	16,5
5	Medium-high-technology	45,5	19,0	228,4	41,3	57,2	7,0
6	Medium-low-technology	12,9	6,7	198,0	47,9	44,7	10,1
7	Low-technology	11,4	5,6	139,0	44,4	34,4	10,0
8	Knowledge based services	9,3	2,7	86,8	62,8	21,0	11,2
9	Knowledge-intensive services	18,3	3,0	29,9	39,9	13,0	14,3
10	Knowledge-intensive market services	3,4	2,3	119,4	34,1	50,8	10,6
11	High-tech knowledge-intensive services	7,0	5,5	170,3	63,6	76,4	30,5
12	Knowledge-intensive financial services	-	2,9	-	89,2	-	14,1
13	Other knowledge-intensive services	-	3,6	-	21,7	-	7,2
14	Less knowledge-intensive services	5,7	2,6	158,8	70,5	31,2	10,1

*Manufacturing industries and knowledge based services (sectors A, B, D, E and F not covered)

Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013

The average company in the European Union in 2010 created EUR25.5 thousand in added value per employee, which is 2.5 higher than the average company in Serbia (EUR10.6 thousand per employee). Companies in Serbia in the high-technology sectors when compared with EU countries are more productive than companies in Lithuania and Romania, which created EUR25.2 thousand and EUR25.4 thousand per employee respectively. Companies from Hungary (EUR33.7 thousand of added value per employee) and Slovenia (EUR39.5 thousand per employee) are more productive than Serbian companies in the high-technology sectors.

Figure 2 Productivity of the Sector in the EU and Serbia in 2010



Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013

In the European Union, companies in the high-technology sectors with productivity of EUR74.6 thousand of added value per employee are the most productive and most competitive part of the European economy. The situation is also similar in Serbia despite domestic companies in the high-technology sectors being almost three times less productive than the average EU company operating in the high-technology sectors. With EUR25.9 thousand of added value per employee, the high-technology sectors are the most productive segment of the Serbian economy, and compared with the manufacturing industries, the knowledge-intensive services and less knowledge-intensive services high-technology sectors are more than twice as productive, which also makes them the most competitive part of the Serbian economy.

Within the high-technology sectors in Serbia there is a great difference in productivity between high-technology manufacturing and high-technology

knowledge-intensive services, which is not the case in the European Union. Companies in high-technology knowledge-intensive services in Serbia (EUR30.5 thousand of added value per employee) are almost twice more productive than high-technology manufacturing companies (EUR16.5 thousand of added value per employee) and are by far the most productive part of the Serbian economy.

The large difference in competitiveness in favour of the high-technology sectors within the Serbian economy and the large lagging behind compared with the EU average and individual EU members, points to the need to change economic policy in the direction of creating conditions in which the high-technology sectors can be consolidated more powerfully and developed more dynamically. Economic development policy should take into account the development possibilities of the individual parts of the economy, their contribution to employment, to creating income, new value and the potential for long-term competitiveness. Accordingly, there is a need to define new systemic measures and activities aimed at assisting (improving financing and credit conditions, facilitating networking, a stimulating tax policy, employee training assistance, etc.) companies in the high-technology sectors so they can be in the condition to catch up with the productivity and competitiveness of companies in the high-technology sectors in the EU and form the basis for developing a knowledge-based economy, new employment and the sustainable competitiveness of the Serbian economy.

4. Conclusion

The growing role of knowledge in the conduct of economic activities had led to the transition from the traditional economy to knowledge-based economies, which is increasingly less based on physical capital investment and more on knowledge and innovation. Besides knowledge, which is at the core of this concept, the knowledge-based economy is also characterised by many other phenomena such as market globalisation, global competition, the development of multinational and transnational companies, new forms of connecting and cooperation between companies, the development of new management methods and systems, the development of completely new products and the emergence of new economic branches and alike. The knowledge-based economy is a complex phenomenon which arose from the simultaneous action of a large number of factors, and its successful development to a great extent depends on the ability of companies to apply existing and create new knowledge and develop creativity and innovation. Knowledge-based economies are characterised by a pronounced accent on innovation, and although not all innovation is the result of knowledge, knowledge is the most important factor in the development of innovation. The relationship between knowledge, innovation and the knowledge-based economy is

complex and interdependent because it facilitates the development of new innovations, and innovations change society and build a knowledge-based society.

The competitiveness of the economy is a complex phenomenon because it is the totality of the development of the individual parts (economic branches) and society as a whole. An economy is competitive if there is a large number of successful companies operating in it, if there is no mass unemployment and if it allows a sustainable high standard of living. Growth in productivity is at the core of growth in competitiveness because it enables sustainable growth per capita to be achieved, which, consequently, leads to growth in disposable income, purchasing power and the standard of living of the population. Knowledge-based economies base competitiveness on creating new and exchanging existing knowledge, exchanging business and technological research and development results, new innovations, education, employee training, etc. In the knowledge-based economy, companies must continually review the competitiveness of their products, services, processes, organisation, marketing and other activities that define their position and success in the global market.

With a view to monitoring national competitiveness, a large number of international and national organisations and institutions have developed a large number of indicators and different approaches to measuring competitiveness. These are most frequently complex indicators composed of a larger number of individual indicators with a view to encompassing and measuring the competitiveness of a country as faithfully and fully as possible. According to the latest competitiveness measurement results, Serbia is at the bottom of the European rankings alongside the least developed countries in the region. According to the latest Global Competitiveness Index by the World Economic Forum, out of the 144 covered countries, Serbia is 95th and at the bottom of a group of 33 countries (Phase 2 efficiency-driven economies) which are trying to achieve economic growth and improve their overall competitiveness position by increasing efficiency. According to this report, Serbia is in a very unfavourable position in terms of competitiveness, because the majority of the indicators show that it is below the average of countries in the second development phase, and this means that it is far from the average of the member countries of the European Union. According to another report by the World Economic Forum titled *The Europe 2020 Competitiveness Report*, which monitors the progress of competitiveness based on the Europe 2020 Strategy, Serbia is last of the 32 observed European countries (28 member countries and 4 candidate countries). The latest EBRD Report shows that Serbia has not made significant progress in reform processes and that Serbia is lagging behind most countries in the region in this regard, especially in the privatisation of large systems, company management and restructuring and implementation of a competition policy. In the latest *Doing Business 2013*, Serbia comes 86th in the ranking of 185 countries. In this report, Serbia again found itself in 2012 among the 10

countries which had improved the business environment the most compared with the previous year and had implemented reforms in at least 3 of the 10 key areas. Serbia improved its ranking most in the starting a business indicator, by removing the minimum paid-in capital requirement. Besides progress in these areas, the other business indicators in other fields remain largely unchanged alongside the worsening of their positions compared with the previous year, which all together indicate that there has been no substantial improvement of the business environment in Serbia and that Serbia has not implemented significant structural reforms in order to improve its global competitiveness.

In the knowledge-based economy, technology and knowledge are becoming increasingly more complex, the importance of and possibilities for connecting companies is rising, whereby new opportunities for acquiring new knowledge, developing new innovations and strengthening competitiveness are created. The primary characteristic of the knowledge-based economy is rapid development of production and service companies that base their business on knowledge and new technologies. Although they cannot be equated solely with these companies, the high-technology sectors are the most important part and driver of the overall development of the knowledge-based economy.

The most developed economies are the economies in which the high-technology sectors play a significant role, so that the achieved level of development of the high-technology sectors is a good indicator of the development of the knowledge-based economy. The high-technology sectors in Serbia are smaller compared with the EU average and most EU members and, of the countries in the region, are only larger than Bulgaria (smaller than Hungary, Romania, Slovenia and Croatia). The structure of the high-technology sectors in Serbia and the EU is also different because, compared with the EU, the share of high-technology manufacturing is substantially larger than high-technology knowledge-intensive services, which indicates an insufficient number of high-technology knowledge-intensive services companies. Overall, the smaller presence of high-technology sectors compared with most EU countries and countries in the region indicates Serbia is lagging behind in building a modern knowledge-based economy compared with the countries of the European Union and most countries in the region.

Of the total number of employees in the European Union, 4.4% are employed in high-technology sectors, while in Serbia this is higher, at 5.1%. Furthermore, Serbia has a larger share of employees in the high-technology sectors than most EU countries (only a smaller number when compared with Belgium, Czech Republic, Denmark, Ireland, Malta, Finland and Sweden). Compared with the countries in the region, Serbia has a lower share of employment in high-technology sectors only when compared with Hungary and Slovenia, and a larger share when compared with Bulgaria, Romania and Croatia. The larger share of employees in the high-technology sectors does not mean a greater degree of

development of the high-technology sectors in Serbia; rather this is the consequence of lower employment in other sectors of the economy. The size of employment in the high-technology sectors is important for each country because there are more employees with a higher (university) education in the employment structure who earn higher wages compared with the rest of the economy.

High-technology sectors in Serbia account for 5.9% of total turnover, which is lower than the EU, where this stands at 7.7%. Compared with individual EU countries, the share is only larger when compared with Lithuania, Austria and Portugal, and smaller when compared with countries in the region (Hungary, Romania and Slovenia). The smaller share of turnover of high-technology sectors in Serbia indicates companies in high-technology sectors in Serbia have less business activity compared with other economic sectors.

With high-technology sectors accounting for 12.4% of total created added value, Serbia does not differ much from the EU average (12.7%). Of the 18 EU countries, Denmark, Hungary and Finland only had a larger share than Serbia, which indicates the great importance high-technology sectors have in creating new value in Serbia. Within the high-technology sectors, 20.5% of added value was created in high-technology manufacturing and 79.5% in high-technology knowledge-intensive services, which differs from companies in the EU. Although high-technology knowledge-intensive services have a smaller share in the number of companies in the high-technology sectors, they have a larger share in the creation of added value in Serbia (79.5%) which is not the case in the EU (72.8%) due to the domestic companies that operate in high-technology manufacturing being twice less productive than the companies in high-technology knowledge-intensive services.

In 2010, the average company in Serbia employed 3.5 workers, which is significantly lower than in the EU (10.1 workers). In the European Union, the average company in the high-technology sectors employs 9.3 workers, and in Serbia this is 6.3 workers. In Serbia, the average level of employment in the high-technology sectors is above the average of the overall economy and the knowledge-based services and less knowledge-intensive services averages, but below the average of the manufacturing industries. The difference in the average number of employees in Serbia compared with the EU is most pronounced in companies in high-technology manufacturing, where domestic companies employ 8.8 workers on average while companies in the EU employ 48.5 workers. This difference in the average number of employees can indicate the difference in the size of domestic companies and companies in the EU.

The average company in the European Union had more than the double of the turnover of the average company in Serbia. The disparity in the business activity of companies is even more pronounced in companies in the high-technology sectors, as the average company in the EU has a turnover that is

three times that of a company in Serbia. The business activity of a company in Serbia in the high-technology sectors is also lower compared with all individual EU countries (except Lithuania), as well as the countries in the region (Romania, Slovenia and Hungary). In Serbia, companies in the high-technology sectors have a larger turnover per employee compared with the average of the overall economy as well as compared with the average of the manufacturing industries and knowledge-intensive services, but smaller than the less knowledge-intensive services average. Within the high-technology sectors, high-technology manufacturing companies had a larger turnover per employee from companies in the high-tech knowledge-intensive services, but less than companies in knowledge-intensive financial services.

In the European Union, the average company created 2.5 times more added value per employee than the average company in Serbia. Compared with individual EU members, domestic companies in the high-technology sectors are only more productive than companies in Lithuania and Romania, and are less productive than companies in the countries in the region (Hungary and Slovenia).

Although the high-technology sectors in Serbia are three times less productive than the EU, they, like in the EU, are the most productive part of the economy. And despite being more than more than double less productive than the other sectors of the economy, they are the most competitive part of the Serbian economy. Within the high-technology sectors themselves, there is a large difference in productivity (which is not the case in the EU). Companies in high-technology knowledge-intensive services are twice as productive as high-technology manufacturing companies. It can be concluded that high-tech knowledge-intensive services are the most competitive part of the Serbian economy. The large difference in competitiveness in favour of the high-technology sectors (especially high-tech knowledge-intensive services) in the Serbian economy and the large lagging behind compared with the EU average and individual EU members points to the need to change economic policy and to assist the development of high-technology sectors more strongly and to a greater extent. That is why an entire range of new measures needs to be devised and implemented (e.g. in the fields of financing and credit, networking, tax policy, education, etc.) which will allow domestic companies in the high-technology sectors to develop quickly and strengthen their competitiveness in the global market. More rapid development of high-technology sectors will increase their contribution to employment and the creation of income and new value, and will substantially improve the overall competitiveness of the Serbian economy and the development of the knowledge-based economy.

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RAZVOJ PRIVREDE ZASNOVANE NA ZNANJU KAO FAKTOR POVEĆANJA KONKURENTNOSTI PRIVREDE SRBIJE

Apstrakt: Najrazvijenije i najkonkurentnije zemlje danas (uključujući i vodeće zemlje Evropske unije) su takozvane „privrede zasnovane na znanju“, u kojima znanje, informacije i visoko sofisticirane veštine igraju važnu ulogu u razvoju poslovnog i javnog sektora. Znanje i tehnologija postaju sve složeniji, učešće aktivnosti koje se zasnivaju na znanju (visokotehnološka proizvodnja i usluge zasnovane na znanju) se značajno povećava, a povezivanje preduzeća u ovim oblastima sa privatnim i javnim ustanovama olakšava razvoj i uspešnu primenu inovacija, čime se podiže nivo konkurentnosti preduzeća, privrede i zemlje u celini. U poslednjih nekoliko godina, brz rast međunarodne razmene visokotehnoloških proizvoda i usluga zasnovanih na znanju značajno je promenio veliki broj međunarodnu konkurentnosti velikog broja zemalja. Ova kretanja pokazuju da stvaranje, primena i komercijalizacija novih tehnologija i znanja omogućava razvoj visokotehnoloških proizvoda i usluga zasnovanih na znanju, koji postaju važan izvor povećanja produktivnosti i proizvodne i izvozne konkurentnosti. Sektori visoke tehnologije postali su važan izvor visoke dodate vrednosti i dobro plaćenih poslova, kao i održivog ekonomskog rasta i globalne konkurentnosti. Prema rang listi konkurentnosti Svetskog ekonomskog foruma, Srbija je 95. od 144 zemlje i nalazi se u grupi od 33 zemlje čija konkurentnost se zasniva na efikasnosti. Ostvareni nivo konkurentnosti domaće privrede i dostignuti nivo privrednog razvoja (Srbija je 75. na svetu prema BDP po stanovniku u dolarima) ukazuje na nisku produktivnost upotrebe raspoloživih (ljudskih, kapitalnih, finansijskih, i dr) resursa uz visoku tekuću potrošnju, što nije situacija koja je održiva na duži rok. U istraživanju se polazi od pretpostavke da razvoj visokotehnoloških aktivnosti i aktivnosti zasnovanih na znanju imaju značajnu ulogu u jačanju konkurentnosti privrede. Uporedna analiza ispituje da li srpska privreda zaostaje u pogledu konkurentnosti i brzini razvoja privrede zasnovane na znanju, u odnosu na većinu visoko razvijenih evropskih zemalja i odabranih zemalja u regionu. Strukturna analiza i poređenje najvažnijih pokazatelja poslovanja (zaposlenost, produktivnost i BDV) preduzeća iz oblastima visoke tehnologije i usluga zasnovanih na znanju pokazuju razvoj i osnovne karakteristike privrede zasnovane na znanju u Srbiji i makro-konkurentsku poziciju Srbije u odnosu na vodeće i susedne zemlje Evropske unije. Ovaj rad takođe ukazuje na najvažnije faktore razvoja privrede zasnovane na znanju u Srbiji, i potrebu da se unaprede mogućnosti za značajan razvoj visokotehnoloških aktivnosti i aktivnosti zasnovanih na znanju kao osnove za buduću konkurentnost domaće privrede. Krajnji cilj rada je da se ukaže na potrebu za snažniji i brži razvoj privrede zasnovane na znanju kao preduslova za postizanje dugoročne međunarodne konkurentnosti i održivog razvoja srpske privrede.

Ključne reči: privreda zasnovana na znanju, konkurentnost, sektori visoke tehnologije

STATISTICAL ANNEX

Table 4 Economic Statistics on High-Technology Actors, 2010

Country	Number of enterprises		Employment		Turnover		Value added	
	number	% in total	in 1000's	% in total	in EUR million	% in total	in EUR million	% in total
European Union 27	863,921	4.8	8,052	4.4	1,495,051*	7.7	600,324*	12.7
Belgium	-	-	211	5.2	-	-	-	-
Bulgaria	7,623	2.7	85	3.4	--	-	-	-
Czech Republic	34,583	4.4	209	5.1	24,513	7.4	6,881	10.5
Denmark	13,311	7.9	148	6.0	31,819	8.6	14,023	15.1
Germany	92,559	5.1	1,627	4.7	294,840	6.8	123,565	10.9
Estonia	2,566	5.9	20	4.2	2,179	7.3	659	12.2
Ireland	-	-	129	8.0	-	-	-	-
Greece	-	-	97	2.8	-	-	-	-
Spain	45,321	2.2	604	3.8	94,181	6.3	39,828	10.4
France	101,586	5.0	1,020	4.5	228,315	7.7	87,763	12.0
Italy	108,061	3.4	742	3.8	153,450	6.5	64,598	11.6
Cyprus	-	-	8	2.5	-	-	-	-
Latvia	3,059	4.2	30	3.9	-	-	-	-
Lithuania	2,026	2.0	26	2.4	1,650	3.7	655	8.5
Luxembourg	1,661	9.3	9	4.7	-	-	-	-
Hungary	35,595	7.5	190	5.9	30,187	14.5	6,397	16.3
Malta	-	-	8	5.5	-	-	-	-
Netherlands	54,030	8.4	322	4.7	72,252	6.7	29,556	12.0
Austria	17,260	6.6	150	4.3	24,812	5.0	10,519	8.3
Poland	53,527	4.4	429	3.6	37,218	6.0	13,141	11.5
Portugal	15,098	2.0	112	2.9	15,289	5.5	5,982	9.6
Romania	16,293	4.2	166	3.0	11,353	6.6	4,214	12.4
Slovenia	6,638	7.1	49	6.1	4,890	7.6	1,937	13.1
Slovakia	9,731	3.2	88	4.6	11,239	9.1	2,960	11.6
Finland	8,806	5.0	141	6.7	45,497	33.3	9,960	30.6
Sweden	50,279	9.6	223	5.5	-	-	-	-
United Kingdom	145,848	10.8	1,208	4.7	255,481	9.0	111,830	14.9
Croatia	5,685	3.4	42	3.7	-	-	-	-
Serbia	8,067	2.8	51	5.1	3,362	5.9	1,317	12.4
*estimate								
*Manufacturing industries and knowledge based services (sectors A, B, D, E and F not covered)								

Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013

Table 5 Economic Statistics on High-Technology Sectors, 2010

	Employment by enterprise	Turnover by enterprise	Productivity
		in hundred EUR	in hundred EUR
European Union 27	9.3	185,7	74,6
Belgium			
Bulgaria	11.2		
Czech Republic	6.0	117,3	32,9
Denmark	11.1	215,0	94,8
Germany	17.6	181,2	75,9
Estonia	7.8	109,0	33,0
Ireland			
Greece			
Spain	13.3	155,9	65,9
France	10.0	223,8	86,0
Italy	6.9	206,8	87,1
Cyprus			
Latvia	9.8		
Lithuania	12.8	63,5	25,2
Luxembourg	5.4	0,0	0,0
Hungary	5.3	158,9	33,7
Malta			
Netherlands	6.0	224,4	91,8
Austria	8.7	165,4	70,1
Poland	8.0	86,8	30,6
Portugal	7.4	136,5	53,4
Romania	10.2	68,4	25,4
Slovenia	7.4	99,8	39,5
Slovakia	9.0	127,7	33,6
Finland	16.0	322,7	70,6
Sweden	4.4		
United Kingdom	8.3	211,5	92,6
Croatia	7.4		
Serbia	6.3	66,3	26,0
*estimate			
*Manufacturing industries and knowledge based services (sectors A, B, D, E and F not covered)			

Source: Eurostat (online data code: htec_emp_sbs2, htec_emp_nat2), Accessed 20/07/2013