INNOVATION ACTIVITY IN SERBIAN ENTERPRISES

Dijana Štrbac*[1], Đuro Kutlača[1],
[1]University of Belgrade, Institute "Mihajlo Pupin", Serbia
*Corresponding author, e-mail: dijana.strbac@pupin.rs

Abstract: *The purpose of this paper is to identify patterns of innovation activity in Serbian enterprises in terms of their innovation expenditure, innovation turnover and typology of innovation.The data provided in this research are collected through the Community Innovation Survey (CIS) conducted by the Statistical Office of the Republic of Serbia. Innovative activity of Serbian enterprises is presented in a comparative perspective for periods 2012-2014 and 2014-2016. The most important findings are related to the relatively stable share of total innovative companies; increase of product and process innovation and decrease of marketing and organizational innovation; and unfavorable structure of innovation expenditure and innovation turnover. Research results could be considered as a starting point for further investigation and decision making.*

Keywords*: Innovation activity, innovation survey, enterprise, Serbia.*

1. INTRODUCTION

Concept of innovation has received a tremendous attention in the last few decades. The ability to introduce new technologies or processes is considered as the essential element of (re)industrialisation of modern economies.

Terms innovation and innovativeness are used in theory and practice to explain novelties on the level of organisation, sector or economy which improve their performances. The word itself has Latin origin; it comes from the word "*innovare*" which means "making something new". Majority of authors consider innovation as a process of turningopportunity into new ideas and of putting these into widely used practice (Tidd, Bessant & Pavitt, 2005).

Schumpeter is considered as a "founding father" of innovation theory. In the first half of the twentieth century he emphasized that innovation is the driving force of economic development through a dynamic process in which new technologies replace the old ones, and this process is called "creative destruction".

According to Schumpeter, the process of technological change has three phases. The first stage is the invention process, encompassing the generation of new ideas. Invention is forming a new thought having a potential to apply in economy. The second stage is the innovation process which includes development of new ideas into marketable products and processes. Innovation is the first commercial application stage of invention. Developing innovations is determined by the technological and economic conditions of the concrete firm. The third stage is the diffusion stage, in which the new products and processes spread across the potential market (Kaya, 2015).

The most famous definition of innovation is developed by the Organisation for economic cooperation and development (OECD) in Oslo Manual: "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organization or external relations" (OECD, 2005, p. 46). This implies that there are several types of innovation: product innovations, processinnovations, marketing innovations and organizational innovations. Therefore, besides technological innovations, there are non-technological innovations which are not result of R&D, but still can be important for performances of business entities.

Innovation are usually assessed as complex activities, or as a "process through which the nation creates and transforms new knowledge and technologies into useful products, services and processes for national and global markets – leading to both value creation for stakeholders and higher standards of living" (Milbergs & Vonortas, 2004, p. 2). Therefore, innovation includes more activities than pure technology creation. It covers various resources related to product distribution or offering services.

Innovation comprises a number of activities that are not included in R&D, such as later phases of development for preproduction, production and distribution, development activities with a lesser degree of novelty, support activities such as training and market preparation, and development and implementation

activities for innovations such as new marketing methods or new organisational methods which are not product and process innovations. Innovation activities may also include acquisition of external knowledge orcapital goods that is not part of R&D (OECD, 2005).

It is useful to make distinction between terms “research and development” and “innovation” on one side and “technology” and “innovation” on another. R&D is a process of searching for new knowledge or new applications. It includes investments which might be successful or not. On the other hand, innovation means introducing new or improvement of existing products, services or processes. They can be the result of R&D, but not necessarily - can arise as a result of the intellectual process of an individual. Hence, innovation does not necessarily involve the investment of specific financial resources.

In contrast to innovations that represent the introduction of new methods, ideas, products or services, technology is a set of methods and techniques used in the production of goods and services. It usually relates to the development of technique and equipment based on the possessed knowledge. Therefore, innovations involve more activities than the creation of technology. They include a range of resources and activities related to placing products and services on the market.

2. INNOVATION AND ECONOMIC GROWTH

One of the most stable findings in macroeconomics is that innovations are an engine of economic growth. Innovations result in new technologies, products and services which boost productivity, create new market opportunities and improve standard of living.

The neoclassical growth model, also known as the “Solow-Swan” model, was probably the first modern model of economic growth to explicitly recognize the role of technology as a central driver of economic growth (Feige, 2015). Solow’s starting point was production function and main conclusion that the basic growth factors are: labour increase (population growth), capital increase (savings and investment) and improvements in technology. In his model, technology is produced exogenously and it is crucial for sustainable economic growth.

The assumption of neoclassical growth models that technology is created outside the model was criticized starting form 1970s since it was not in line with the fact that innovation activities are very much determined by the decisions of companies and individuals. One of the endogenous growth theories is Romer’s model which addresses technological spill overs (inwhich one firm or industry’s productivity gains lead to productivity gains in other firms or industries) that may be present in the process of industrialization (Todaro & Smith, 2012).

Different approaches have been used for exploring the relationship between technological change and economic growth starting from the historical perspective of Abramovitz (1986) to the neoclassical framework of Keller (2004), from the industrialization-focussed theory by Lall (1992) to the Evolutionary and Neo-Schumpeterian theories by Freeman and Louça (2001), Perez (2002)and Nelson (2006). The general consensus of these approaches is that the source of the development process is productivity growth which emerges as a result of technological progress (Bogliacino, Perani, Pianta, & Supino, 2009).

Relationship between innovation and economic growth can be investigated through a production function in which economic growth is result of growth in increase in labour and capital inputs, as well as increase in multifactor productivity (MFP). In such framework, contribution of innovation to growth can be found in three processes (Figure 1):

- a contribution resulting from technological progress embodied in physical capital; for example, investment in more advanced machinery or in new computers.
- a contribution resulting from investment in intangible capital, or knowledge-based capital, such as R&D, software, design, data, firm-specific skills or organisational capital.
- a contribution linked to increased MFP growth, reflecting increased efficiency in the use of labour and capital, a substantial part of which can be attributed to innovation, including social and organisational innovations as well as the spill over effects of investments in technology or knowledge-based capital, including at the global level (OECD, 2015).

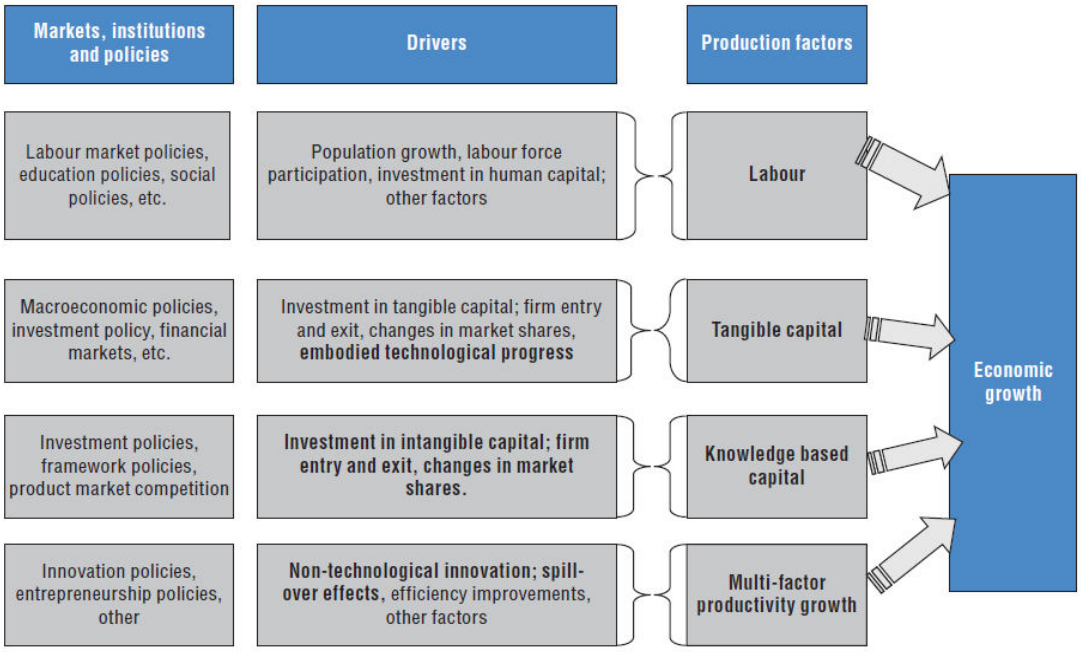

Figure 1: A simplified framework to analyse economic growth
Source: OECD (2015).The Innovation Imperative: Contributing to Productivity, Growth and Well-Being,OECD Publishing, Paris.DOI: http://dx.doi.org/10.1787/9789264239814-en, p. 18.

The innovative performance of a firm or a national economy very much depends on the overall framework in which innovative process is being conducted, i.e. on relationships and cooperation between different actors in a society. These actors are from business sector, academic institutions and government sector. The complex linkages between these sectors can be in forms of joint projects, staff exchange, cross patenting, co-publishing and may other. The network of these institutions and relationship between them is defined in literature as a national innovation system (NIS).

National innovation system in Serbia has many disadvantages. On a strategic level, Serbian NIS lacks the following: vision of technological development, national development priorities, relevant innovation policy and strategy, evaluation of programs, projects and organisations. There are also limitations of the Law on innovation activity which hamper innovation activity of the firms (Kutlača & Semenčenko, 2015).

There are significant differences between innovative activity in developed and developing countries. Bogliacino, et al. (2009) have summarized several stylized facts on innovation in developing countries:

- developing countries have distinct patterns of innovation from countries at the technology frontier,
- innovation needs both resources and integration of national systems,
- innovation is pushed by industrialisation and pulled by growth of markets,
- large firms are more likely to engage in innovation or spend for it,
- being exposed to international competition spurs innovation,
- in multinational corporations there is more innovation,
- the main obstacle to innovation is its economic cost and the lack of finance,
- the evidence of effects of innovation on productivity is weak.

These “stylized facts” explain the main difficulties in innovation activities in developing countries but also highlight the areas in which innovation policy could make improvements.

3. MEASURING INNOVATION ACTIVITY

Measuring technological change and innovation is important in term of calculating its effects on economic growth. The need for better understanding processes related to innovation activities and technology are also relevant for planning, implementation and evaluation of policies and programmes in this field. For example, decision makers should have information on the results in this area in order to make decision on the resources which will be invested in certain fields of science and technology.

Organisation for economic cooperation and development has developed a set of manuals which enabled international standardisation of methodology for measuring innovation activity on micro and macro level. Relevant publications are presented in Table 1.

Table 1: Standards for measuring scientific and technological activities

Scope	Publication title
Research and development	Frascati Manual: Proposed Standard Practice for Surveys of Research and Experimental Development, OECD, 2002. R&D Statistics and Output Measurement in the Higher Education Sector. "Frascati Manual Supplement", OECD, 1989.
Innovation	Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, OECD, 2005.
Patents	Using Patent Data as Science and Technology Indicators –Patent Manual, OECD, 1994
Human resources in R&D	The Measurement of Human Resources Devoted to Science and Technology – Canberra Manual, OECD, 1995.
Technology balance of payments	"Proposed Standard Method of Compiling and Interpreting of Technology Balance of Payments Data –TBP Manual", OECD, 1990.
Classification of industry per technological level	"Revision of the High-Technology Sector and Product Classification", OECD Science, Technology and Industry Working Papers, 1997/02.
Globalisation	OECD EconomicGlobalisation Indicators, 2010.
Bibliometrics	"Bibliometric Indicators and Analysis of Research Systems: Methods and Examples", OECD Science, Technology and Industry Working Papers, 1997/01.

Source: Authors.

The purpose of innovation metrics is to explain complex processes in modern economy based on knowledge and new technologies. The ways for measuring technological change and innovation process can be classified in three broad groups: innovation surveys, individual innovation and technological indicators and composite indicators.

Innovation surveys are a new source of information on technical change. It was realised some time ago that R&D do not tell the whole story about technical change as innovation is essentially an interactive process which involves a variety of types and sources of knowledge (Radošević, 1999). The most famous survey for measuring innovation is "Community Innovation Survey" (CIS) which represents the main statistical instrument for assessing innovation in the European Union (EU). CIS survey collects data on innovation activity in enterprises, i.e. on product, process, marketing and organizational innovation. The survey collects data on innovativeness per types of companies, types of innovation, innovation expenditures, cooperation in innovation activity, limiting factors, etc. Community innovation survey is launched every two years in all EU member states and countries members of European statistical system (Including Serbia).

Community innovation survey is a very broad research which includes various data sources: 1) internal (within the firm or within the enterprise group), 2) market (suppliers, clients, competitors, consultants and commercial labs, 3) education and research institutions (universities and other higher education institutions, government, public and private research institutes) 4) other sources (conferences, fairs, exhibitions, scientific journals and technical publications, professional and industrial associations) (Biagi,Pesole&Stancik,2016).

Community innovation survey in Serbia is conducted by the national Statistical Office since 2006 under the title „Research on innovation activity of business entities in Serbia". Companies which participate in this research have the legal obligation to provide accurate, complete and updated data, with the content and form corresponding to the demand of the official statistics. Also, there are penalties for the respondent if they fail to timely provide the requested data of if they supply incorrect data (Official statistics law,2009).

Interpretation of innovation surveys results should always take into account limitations of innovation statistics. For example, within the CIS the most used indicator is the average ratio of innovative companies. However, this indicator does not completely explain the scope of innovative activities of the company. If some company introduced only one new product it is counted equal with another firm introduced more innovations. Also, this survey collects only little information on the impact of innovation. It would be important to know how information affects productivity and profit of the companies (Szunyogh, 2009).

The connection between science, technology and innovation is reflected, among other things, through the existence of science, technology and innovation indicators. Individual innovation and technology indicators

are generally grouped into two broad categories: inputs and outputs. Inputs include indicators such as expenditures on R&D, human resources, while outputs include results such as publications, patents or innovations.

In addition to the basic division of scientific and technological indicators into inputs and outputs, there are also further classifications. One of them is division into inputs, outputs, results, and impact (Danish Agency for Science, Technology and Innovation, 2014).Inputs represent investments in an innovation process such as human and financial resources engaged in R&D. Outputs include activities that arise from the aggregation of inputs and other resources. Examples of output are scientific publications and international co-publications. Results are the consequences of research and innovation activities such as patents and citations. Impact indicators measure the economic and non-economic effects that research and innovation creates for the society as a whole. Examples of impact indicators are improving the quality of life and life expectancy, increasing total factor productivity and return on investment in R&D.

Individual indicators of scientific and technological development are used to a large extent for the creation of composite indicators that allow perception of the country's position in terms of the technological and innovative level achieved. There are a number of international initiatives to create aggregate indicators in this area. Some of them are: Summary Innovation Index, Knowledge Economy Index, Global Innovation Index, Global Competitiveness Index.

4. INNOVATIVE ACTIVITIES

Research of the Statistical Office of the Republic of Serbia on the innovation activity is carried out on the basis of a representative sample. The sample covers around 3500 small, medium and large enterprises. The obtained results are weighted and calculated at the level of the population of business entities.

4.1. Structure of innovation expenditures and innovation turnover

Survey on innovation activities of enterprises in Serbia covers innovation expenditure which are grouped in several categories: in-house R&D (current and capital expenditures for R&D only); external R&D; acquisition of machinery, equipment, software & buildings (R&D expenditures excluded); adoption of external knowledge from other business entities or organizations focused on innovation (know-how, patents, licenses); other innovative activities (design, training, marketing and all other expenditures).

The majority of innovation expenditures in Serbian enterprises are related to the acquisition of machinery, equipment, software and buildings in both observed periods (Table 2). Furthermore, the percentage of this type of innovation expenditures increased from 64,3% in the first observed period to 71,4% in the second observed period. This implies that Serbian companies are focused on purchase of already developed machinery and not on technology transfer processes which is in line with general trends in developing countries identified in literature.

Table 2: Structure of innovation expenditures

	Structure of innovation expenditures	
	2012-2014	**2014-2016**
Acquisition of machinery, equipment, software & buildings	64,30%	71,40%
In-house R&D	12,30%	18,90%
Other	11,30%	6,30%
External R&D	2,60%	1,80%
Acquisition of existing knowledge from other enterprises or organisations	9,50%	1,70%

Source: Statistical Office of the Republic of Serbia (2015). Indicators of Innovative Activities in the Republic of Serbia, 2012-2014, Release number 276;Statistical Office of the Republic of Serbia (2017). Indicators of Innovative Activities of the republic of Serbia, 2014-2016, Release number 197.

Consequently, only 12,3% (in period 2012-2014) and 18,9% (in period 2014-2016) of innovation expenditures are related to in-house R&D. External R&D has decreased in the second observed period and

in 2014-2016 it included only 1,8% of total innovation expenditures. This indicates a very low cooperation between business and research sector, which has been explored in various reports and studies.

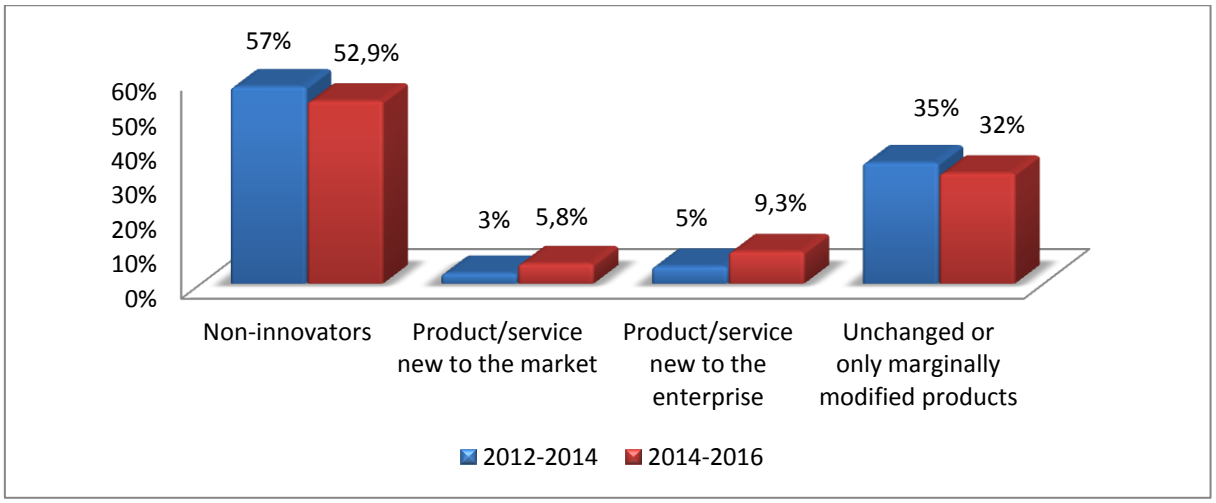

Figure 2: Structure of innovation turnover in Serbian enterprises

The data on the structure of innovation turnover show that the share of turnover from sales of unchanged or marginally modified products is dominant in both observed periods (Figure 2). However, it is visible that the share of turnover generated from product/service new to the market and new to the enterprise has improved in period 2014-2016. Namely, it has increased from 8,8% to 14,3%. Therefore, there is a slight improvement in the structure of innovation turnover in the second period, but these figures are still on a low level.

4.2. Types of innovations

The percentage of companies that have introduced new or significantly improved products in period 2012-2014 was 20,4%, while in period 2014-2016 it was 26,9% (Figure 3). Percentage of product and process innovation show increase between the two periods, while organisational and marketing innovation show decrease. The percentage of product and process innovation seems fairly highand can be partially explained as bias towards innovative firms which are more likely to respond to the survey.

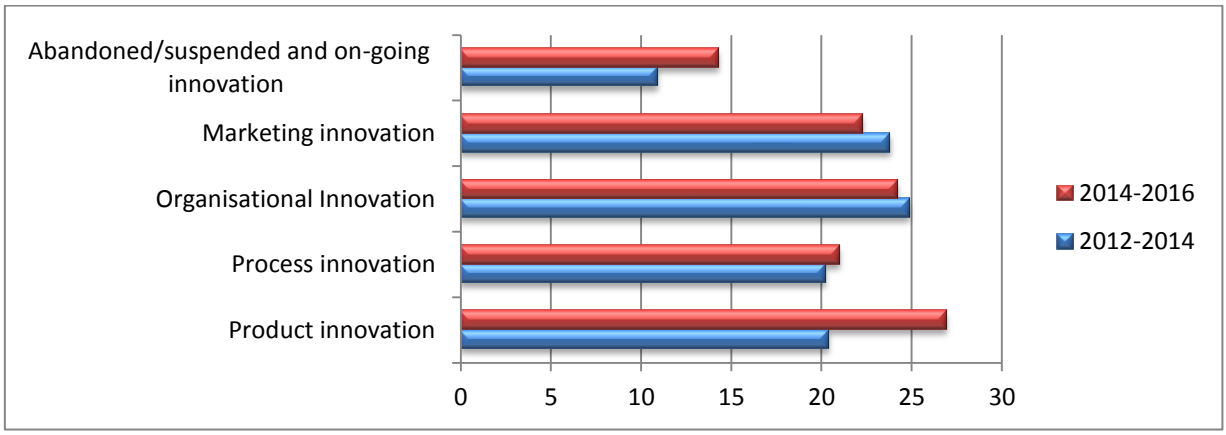

Figure 3: Types of innovation (in %)

In total, in period 2014-2016 around 41,2% of Serbian companies have introduced some type of innovation, while in the previous observed period this was 40,5%. Manufacturing enterprises were more innovative than services companies in both observed periods (Figure 4).

Relationship between the firm size and innovative activities is positive, i.e. large firms are more innovative. Percentage of innovative small companies is around 38% in both periods, while around 68% of large firms are innovative. This result is in accordance with many empirical studies which explore relationship between firm size and innovation activity.

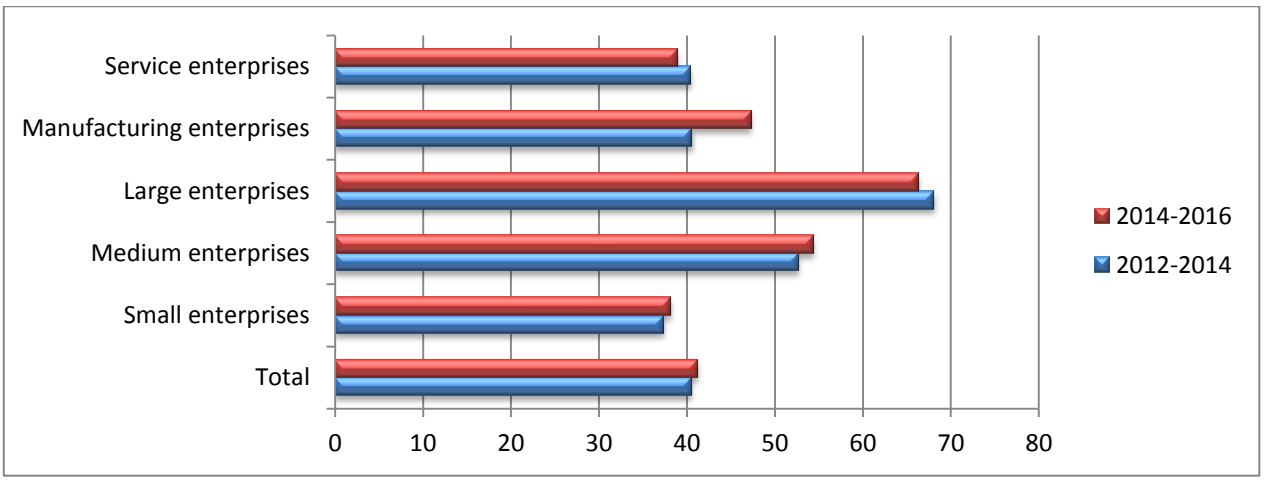

Figure 4: Structure of innovation per company size and type

When observed per NACE sections, in almost all economic activities there was an increase in the share of technological innovation (product and process innovation). The highest percentages of technological innovators are in the following economic activities: Administrative and support service activities; Professional, scientific and technical activities; Manufacturing and Electricity, gas, steam and air conditioning supply (Table 3).

Table 3: Share of product and process innovators by NACE sections

	Share of product and process innovators	
	2012-2014	**2014-2016**
Agriculture, forestry and fishing	18,7	32,2
Mining and quarrying	12,3	18,6
Manufacturing	34,2	**40,7**
Electricity, gas, steam and air conditioning supply	36,7	**40,3**
Water supply; sewerage, waste management and remediation activities	22,3	24,2
Construction	23,1	31,7
Wholesale and retail trade; repair of motor vehicles and motorcycles	23,4	21,5
Transportation and storage	23,3	25,2
Accommodation and food service activities	34,8	26,9
Information and communication	30,5	32,1
Financial and insurance activities	25,4	25,4
Real estate activities	9,6	5,1
Professional, scientific and technical activities	30,4	**41**
Administrative and support service activities	29,7	**43,8**

Source: Statistical Office of the Republic of Serbia (2015). Indicators of Innovative Activities in the Republic of Serbia, 2012-2014, Release number 276;Statistical Office of the Republic of Serbia (2017). Indicators of Innovative Activities of the republic of Serbia, 2014-2016, Release number 197.

5. CONCLUSION

There are theoretical and practical proofs that innovation boosts productivity, leads to higher economic growth and improves well-being of nations. The core of innovation policy agenda includes exploring various measures for assessing innovation activity on different level of economic system.

This paper elaborates only part of the results of two last Community Innovation Surveys in Serbia.Although there are various limitations of innovation surveys as a method of collecting data, the results of this research can serve as a good starting point for decision makers and creators of economic and innovation policies.

In general terms, innovation activity in period 2014-2016 is more favourable than in the previous observed period (2012-2014). However, the structure of innovation expenditure in both periods indicates: 1) strong focus on purchase of already developed machinery and not on technology transfer processesand 2) low cooperation between companies and research institutions in Serbia. The share of turnover from sales of unchanged or marginally modified products is dominant in both observed periods. Positive trend is increase of the share of turnover generated from product/service new to the market and new to the enterprise has increased for 5,5% in period 2014-2016 in comparison with the period 2012-2104.

In both observed periods, percentage of companies that have introduced some type of innovation was around 40%. Manufacturing companies are more innovative than companies from the service sector. Also, the percentage of innovative enterprises increases with firm size.Share of product and process innovation recorded increase between the two periods, while organisational and marketing innovation have decreased.

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