

# TECHNOLOGY STATUS AND COMPETITIVENESS OF SERBIAN MANUFACTURING INDUSTRY

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**Abstract:** *Manufacturing industry is regarded as a main engine of economic growth. This paper aims to reveal characteristics of manufacturing industry in Serbia in terms of its technology structure, competitiveness and relative position in a group of countries. Technology structure is presented on the basis of OECD classification of industry based on R&D intensity and competitiveness is introduced using Competitive Industrial Performance (CIP) index as an indicator of relative competitive ability. Conducted analysis has shown that Serbian manufacturing industry is lagging behind selected EU countries which has negative impact on economic growth and development.*

**Keywords:** *industry, manufacturing industry, technology structure, competitiveness, Competitive Industrial Performance (CIP) index.*

## 1. INTRODUCTION

Since the first industrial revolution, over the second and third, until the emerging fourth industrial revolution, industry is the main driving force of economic growth and development. This driving force is an integral part of the process of diversification and development of human creativity and its needs, and it depended on technological progress and the dynamics of the development of knowledge, science and technology. The development features and characteristics are based on the development and structural changes of the industry, which includes relative participation of new and technology intensive industries. There are theoretical and empirical arguments proving that the industry, especially the manufacturing sector, is the initiator and driving force of economic development and structural changes of the national economy. Compared to other sectors, manufacturing industry provides special opportunities for capital accumulation, economies of scale and technological progress (Szirmai, 2009).

The main drivers of intensive industry development and its structural changes are: knowledge, skills, innovation, technology, demand, resource efficiency, investments, company size, activities of the value chain, agglomeration and industrial policy (Mičić, 2015). In other words, technology is a factor that largely determines the characteristics of structural changes in the economy and industry.

The process in which the economic structure evolves under technological development can be explained in the following way: investment in R&D drives the development of new technologies, installation of capital stock brings new technical processes into sector production, new and old technical processes within a sector exchange their relative weights in production as they are phased in or out, and sectors evolve or transform over time (Pan, 2006).

Authors exploring economic and industrial development of Serbia consider that the most important problems of Serbian economy are structural discrepancies, obsolete technology, a low level of investments, high production costs, the social function still dependent on companies, inefficiency, ecological requirements, but also low exports, incompatibility with the EU standards, and a lack of comprehension of industrial processes in the EU (Jakopin & Bajec, 2009).

The main feature of structural changes in the economy of Serbia in the last two decades is deindustrialization accompanied by inadequate implementation of transition and privatization. Hence, there is the necessity of formulating new industrial policy that will be based on: export-oriented reindustrialization (Mičić & Zeremski, 2011), identifying and supporting propulsive sectors and industries (Arandžević, Petrović-Randžević, & Marjanović, 2013), and creating incentives for specific companies and sectors by public authorities (Kočović & Radovanovic, 2013).

Analysis of Serbian industry is enriched including topics such as R&D, technology, innovation. New industrial policy in Serbia should be based on research and development (R&D), new technologies, education, effective investments and integrative networking of all key partners in all phases of reproduction (Leković & Mičić, 2013). It also recognized the necessity of introducing innovations in order to increase the technological level of the industry and improve competitiveness in the international market (Savić, Bošković & Mičić, 2012). Starting from the view that the development of science and technology essentially defines the intensity and speed of economic growth, domestic authors are also researching the capabilities of the Serbian economy to create and commercialize knowledge and technology. One of the approaches is the concept of national innovation system, which is based on the assumption that the research system is part of a larger system that includes economy, institutions, academic community and environment (Kutlača & Semenčenko, 2005).

The main objective of this paper is to point out the importance of manufacturing industry structure, technology profile and competitiveness as general conditions of sustainable economic development. In order to reveal relative position of Serbian manufacturing industry, its characteristics are compared to selected industrialized and industrializing EU countries.

## **2. METHODOLOGY**

In empirical studies and literature there are various indicators of industry structure, technology profile and competitiveness. In this paper, base index of industrial production was used with a goal to determine general trend and dynamics of the development of the Serbian economy in the last two decades. As the base period was used 1990 in order to perceive the relative decline in the level of industrial production in the period 1991-2013. Structural changes in the manufacturing industry of Serbia were analyzed on the basis of gross value added (GVA).

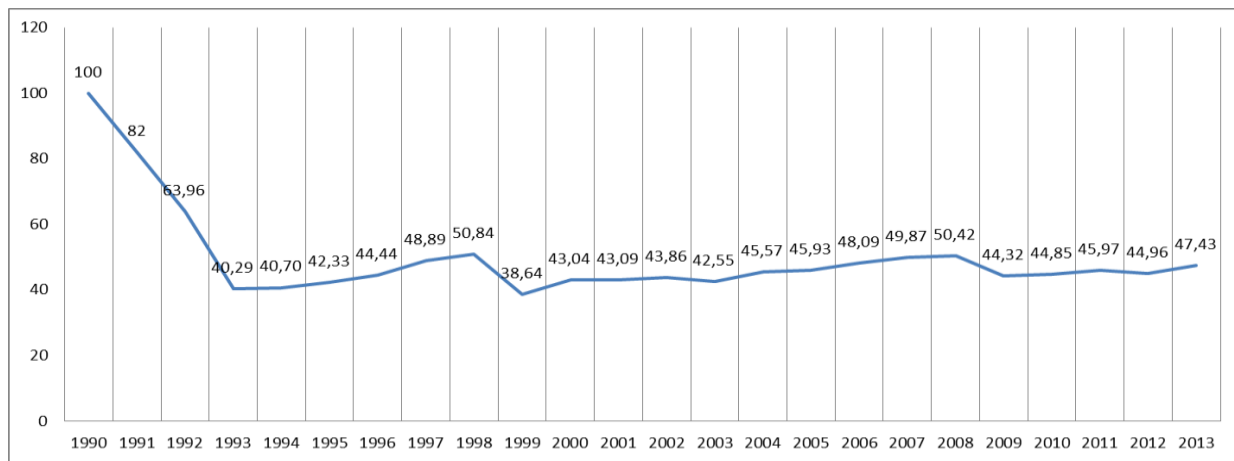
Comparative research method was applied for evaluation of growth rate of manufacturing industry. Growth in industrial production in Serbia was compared to the growth rates of manufacturing industry of selected industrialized and industrializing economies. Countries were classified in two groups according to the classification presented by United Nations Industrial Development Organization (UNIDO, 2013). Selected countries from group of industrialized economies are: Czech Republic, Hungary, Slovenia, Slovakia and from industrializing - Bulgaria, Croatia, Poland, Romania, Serbia.

Technology structure of Serbian industry was analysed using OECD classification of industries by technological intensity. Starting from the premise that technological advances are a key determinant of productivity growth and international competitiveness, OECD has made a classification of industries based on technological intensity. An analysis of investments in research and development and the results of this activity, the OECD has ranked all manufacturing industries in 4 categories: high technology, medium-high technology, medium-low technology and low technology (OECD, 2005).

Competitiveness of manufacturing industry was analyzed using data on CIP index which is based on understanding industrial competitiveness as the capacity of countries to increase their presence in international and domestic markets whilst developing industrial sectors and activities with higher value added and technological content. The CIP index consists of eight sub-indicators grouped along three dimensions of industrial competitiveness: 1) countries' capacity to produce and export manufactures, 2) technological deepening and upgrading, 3) world impact (UNIDO, 2013).

## **3. INDUSTRY STRUCTURE AND INDUSTRIAL GROWTH IN SERBIA**

After the Second World War, Serbian economy was characterized by rapid industrialization that affected the overall socio-economic revival of the country. After 1990, breakup of the federal state, civil war and economic sanctions led to the disintegration of industrial system of Yugoslavia. Transition process after 2000 brought intense structural transformation and creation of a market economy. Although in this period was planned an industry recovery, the process of deindustrialization is continued. Hence, many authors point out that it is necessary to carry out the process of re-industrialization in Serbia. Performance of Serbian industry after 1990 can be perceived using base index of industrial production (Figure 1). Base indexes of industrial production show that the period after 1990 was characterized by a drastic decline in industry production, and even after 2000 industrialization has not been stopped. In 2013 industrial production amounted only 47.43% of the industrial production in 1990.



**Figure 1:** Indexes of industrial production in Serbia from 1990-2013.  
Source: Statistical Office of the Republic of Serbia.

The decline in industrial production in Serbia after 2000 is followed with structural transformations visible in the structure of production and employment. In addition to a global trend that is reflected in the growth of the service sector and a reduction in the share of industry and agriculture, it is important to analyze the changes in the structure of industry gross value added (Table 1). The structure of industrial production in Serbia shows that the manufacturing industry had the largest share in the structure of gross value added. However, in the period 2000 to 2014 there was a reduction in the share of manufacturing industry and increase in the share of the other three industry sectors (mining and quarrying; electricity gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities). According to the presented data, decline of manufacturing industry share in the reporting period was 7.9%.

**Table 1:** Gross value added by activities (current prices, structure, %)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mining and quarrying	1,1	0,9	1,3	1,4	1,3	1,3	1,4	1,2	1,2	1,1	1,3	1,5	1,6	1,5	1,1
<b>Manufacturing</b>	<b>23,6</b>	<b>22,6</b>	<b>18,4</b>	<b>16,9</b>	<b>15,0</b>	<b>14,4</b>	<b>13,8</b>	<b>13,9</b>	<b>14,0</b>	<b>14,0</b>	<b>13,6</b>	<b>14,1</b>	<b>15,1</b>	<b>16,1</b>	<b>15,7</b>
Electricity, gas, steam and air conditioning supply	0,6	0,7	2,4	2,6	2,8	2,8	2,8	2,7	2,6	3,0	2,8	2,9	2,9	3,6	2,9
Water supply, sewerage, waste management and remediation activities	0,8	0,9	1,0	1,2	1,2	1,2	1,2	1,1	1,0	1,0	1,1	1,2	1,2	1,2	1,2

**Source:** Statistical Office of the Republic of Serbia.

Average growth rate of Serbian manufacturing industry in the last 15 years was 0.75% which is considerably lower than in selected countries in both country groups (Table 2). For example, average growth rates in Slovakia, Poland and Czech Republic were 8.58%, 6.05% and 4.54% respectively. Since growth rates of manufacturing industry represent and indicator of total economic results in certain period, general conclusion is that manufacturing industry of Serbia has insufficient impact on GDP and productivity growth.

It is interesting to note that almost all observed countries have high volatility of growth rates of manufacturing industry (which shows their standard deviation) and very low minimal values. This is mainly due to the impact of Global economic crisis which resulted in extremely negative growth rates of manufacturing industry in 2009.

**Table 2:** Growth rates of manufacturing sectors from 2001-2015, in %.

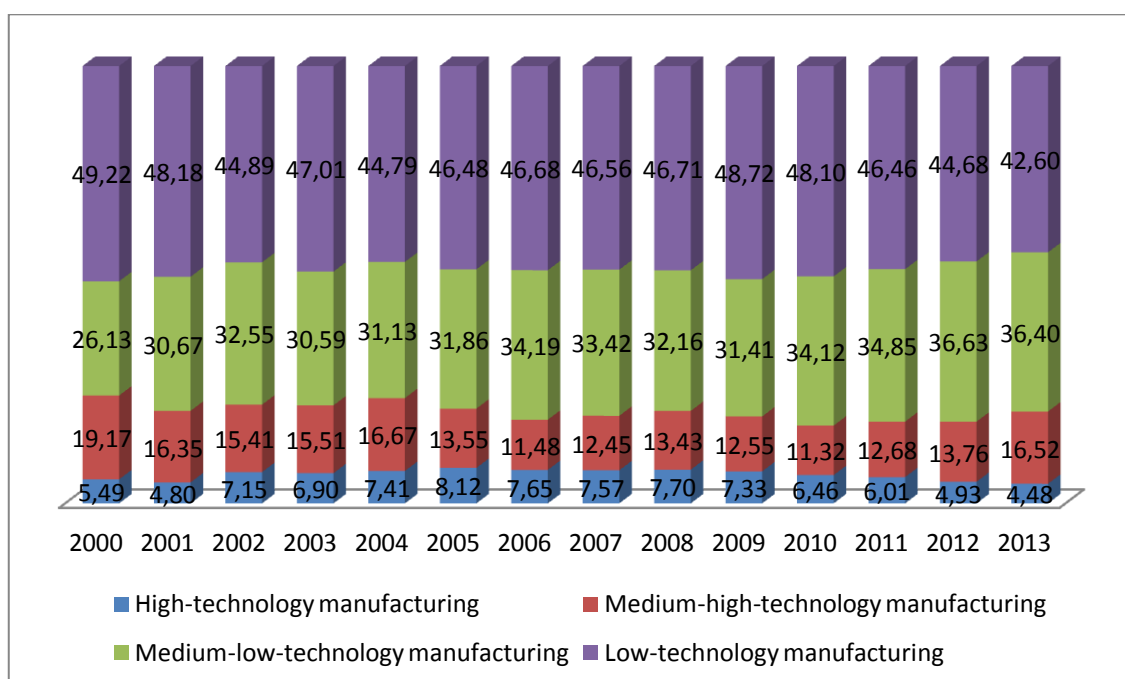
Country group/ country		Average	Min	Max	Standard deviation
Industrialized economies	Czech Republic	4,54	-14,70	12,40	6,92
	Hungary	4,43	-18,20	11,70	7,41
	Slovenia	1,83	-19,10	8,50	6,55
	Slovakia	8,58	-18,70	21,60	10,24
Industrializing economies	Bulgaria	4,40	-22,40	17,60	9,12
	Croatia	1,23	-10,40	6,20	4,79
	Poland	6,05	-3,50	14,50	5,45
	Romania	4,06	-6,60	13,30	5,44
	Serbia	0,75	-15,90	7,70	5,63

Source: Eurostat

The reason for very modest results of Serbia in terms of growth rates of industrial production lies in the development model applied in the observed period. It was a development strategy based on the significant role of the service sector, import and foreign direct investment. This model of development has not contributed to the increase in production and employment in those industries that could realize high productivity and rapid economic growth. Bearing in mind the developments in the last two decades it can be concluded that economic and industrial policy should be based on increase of production and productivity in the sectors of tradable goods and a reduction in costs in the non-tradable goods sectors, which will in turn affect the growth of competitiveness and creating an attractive investment environment.

#### 4. TECHNOLOGY STRUCTURE AND COMPETITIVENESS OF SERBIAN MANUFACTURING INDUSTRY

In addition to the low growth rates, Serbian industry is characterized by unfavourable technological structure. As presented in Figure 1, in the structure of Serbian manufacturing industry dominate industries of low and medium-low technology intensity, while the lowest share have high and medium-high technological intensity industries. Average share of low-technology manufacturing in the period 2000-2013 is 46.51% and average share of high-technology manufacturing is 6.57%. In the observed period, only medium-low technology industries tend to increase, while other technology groups tend to decrease.



**Figure 2:** Technology structure of Serbian manufacturing industry.

Source: Calculated by the author on the basis of data from Statistical Office of the Republic of Serbia.

Unfavourable technology structure of Serbian industry proves that its production has low level of technology intensity, low level of finalization and a low added value. Such products are generally intensive with labour and natural resources, which has low impact on economic growth and development. Also, these results imply extremely small investments in improving the technical level of the industry, but also a lack of implementation of the results of scientific research in industrial production.

Presented data on the structure of GVA, growth rates and technological intensity of manufacturing industry of Serbia show inefficient structural reforms implemented after 2000. Structural changes have not been based on increasing the technological intensity of production which resulted in the inability of Serbian manufacturing industry to achieve a satisfactory rate of growth and competitiveness in the world market.

Manufacturing industry is not just an ingredient of development - it is the essential ingredient. Namely, manufacturing industry is: applying technological progress to production, driving innovation, diffusing innovation, developing new skills and attitudes, leading institutional development, producing beneficial externalities, stimulating modern services, generating dynamic comparative advantage, internationalizing economies, modernizing enterprises (UNIDO, 2002).

The competitiveness of a country arises from the manufacturing industry performances. Therefore, it is important to see relative positions of countries in terms of manufacturing industry competitiveness. In order to understand relative competitive position of Serbian manufacturing industry it is used Competitive Industrial Performance (CIP) index.

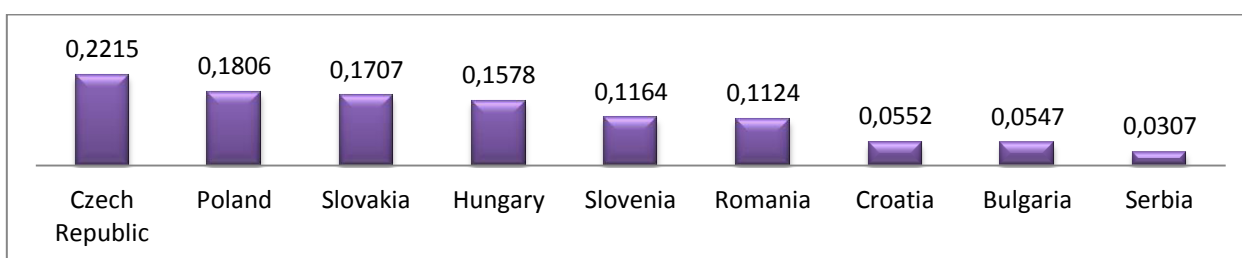
Competitiveness of the manufacturing industry in Serbia is at a very low level, which reveals 74th place in 2012 out of 140 analyzed countries (Table 3). All selected countries in both country groups have higher ranks which are result of more successful performances of their manufacturing industries. If the competitiveness of Serbian industry is observed in the last two decades, it can be seen that after the sharp decline during the 1990s, there was no significant improvement after 2000. Unlike Serbia, Poland, Hungary and Slovakia have significantly improved their relative competitiveness in the last twenty years.

**Table 3:** Ranks of competitiveness of manufacturing industries for selected countries

Country group/ country		CIP index rankings			
		1990	2000	2010	2012
Industrialized economies	Czech Republic	25	24	19	18
	Hungary	36	27	26	27
	Slovakia	37	41	27	25
	Slovenia	28	31	32	33
Industrializing economies	Bulgaria	43	63	59	59
	Croatia	33	50	54	57
	Poland	51	33	24	23
	Romania	34	44	35	34
	Serbia	54	79	75	74

Source: UNIDO, 2015.

If the CIP index value in 2012 is observed (Figure 3), industry of Serbia has the CIP index of 0.03 which is several times lower than in other countries surveyed. These data show extremely low performances of manufacturing industry in Serbia.



**Figure 3:** CIP index values in 2012

Source: UNIDO, 2015.

Although CIP index has important functions in monitoring and benchmarking industrial competitive performances, it is necessary to take it into account as a preliminary indicator of countries' industrial competitiveness. This means that using CIP index for creating industry should be complemented with other analyses on different levels (sector, industry, production task, institution, company, etc.) and topics (infrastructure, technology, labor and capital costs, innovation types).

## 5. CONCLUSION

Empirical analyses and economic reality have shown that successful industry and especially manufacturing industry is one of the basic determinants of long run sustainable growth. Manufacturing industry is the prime creator of value added and jobs in the economy; it is a field for application of technological development in production generates positive externalities for the rest of the economy and therefore it is a source of a country competitive ability. Manufacturing industries with higher technological intensity will create greater value added in the economy and higher growth rates.

Structural transformations in Serbian economy after 2000 were visible in the decrease of manufacturing industry share in the structure of gross value added. This was followed with variable growth rates and low average growth rate of manufacturing industry (0.75% in the period 2001-2015). The reason for this is a development strategy in this period which was based on significant role of import, foreign direct investment and service sector. Manufacturing industry was also characterized with unfavourable technology structure which means that those industries that require most R&D investments had the lowest share in Serbian GVA. According to relative industrial competitiveness indicator, CIP index, Serbian manufacturing industry competitiveness is one of the lowest in the group of industrializing countries.

Low performances of Serbian manufacturing industry indicate that there is a need to change industrial and development policy in order to re-industrialize the economy and increase production in industries that can create high productivity. To achieve this, it is critical to address constraints on technology development as important part of strategy for improving competitiveness of manufacturing industry.

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