

## WORLD MANUFACTURING INDUSTRY: STRUCTURAL AND SPATIAL SHIFTS

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The article estimates countries' and regions' positions on the world ranking hierarchy in the manufacturing industry. The research is focusing on the characteristic of structural and spatial shifts of the world manufacturing industry. These trends have led to the restructuring of the world economy and main shifts in the manufacturing locations both at regional and global levels occurred. Developing countries have got a great chance to become active players in the world economy. Structural shifts occur suddenly both in manufacturing location and in the industrial composition in the recent decades. There have been shifts in the HT-industry composition. The shift to developing Asian countries is revealed.

***Keywords:** industry, structural changes, manufacturing, spatial shifts, high-tech.*

The modern world industry differs by a rather diversified structure. In the end of the 20<sup>th</sup> century and the beginning of the 21<sup>st</sup> century the rapid development of the service sector, the labour productivity growth in the industries and the strengthening of the international competition in the world market of goods have led not only to the reduction of the secondary sector, but also of the share of directly manufacturing industry in the world gross national product. However since the beginning of the 2000s, the share of the secondary sector of economy in the world gross national product and the manufacturing industry share began again to increase. This evolution is due, first of all, to the rapid development of the industry and the growth of employment in the secondary sector of economy and in the sphere of industrial services in China and some other developing countries ("new industrialized" Asian countries – NIC, India, Brazil, Mexico etc.).

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### **Changes in the Structure of the World Manufacturing**

The ongoing changes in the structure of the industrial sector of developed economies differ by their nature from those which occur in developing countries. These changes also differ by speed and nature due to regions' size. The implementation of new technologies and other scientific and technical progress achievements in the production process, the boost of efficiency and quality indicators of production in different countries accurately reflected changes of branch structure of manufacturing industry in the world. Many new industries were formed (bio-industry, manufacture of laser technology, modern medicine and microbiological drugs, etc.). Technological innovations gave birth to microelectronics. Therewith some well-defined stabilization and even a slight decline in production in "traditional" industries of developed countries were observed (production of food and beverages, textiles, basic metals, chemicals and chemical products). The highest growth rates were noticed in production of means of communication (radio, television and communications equipment), computer and office equipment, electrical equipment (*Table 1*).

Among developing countries, the most intensive processes of growth in manufacturing industry occurred in recent decades in China, Mexico, Brazil, India and in the "new industrialized" Asian countries, where the same engineering sub-industries were highlighted, though in the group of less developed countries within the above mentioned states the most significant growth rates were observed in traditional industries - food and beverages and textiles.

Data provided in the following table (*Table 1*) illustrate the obvious increase in the share of communications equipments industry (radio, television and other communication equipment), as well as in structure of the world manufacturing as a whole (structure of world manufacturing value added – MVA) in the selected country groups.

Table 1

**Structure of Manufacturing Value Added (MVA) in Selected  
Country Groups (in %)\*, 1995-2009**

ISIC (Rev.3) – Branch	Industrialized Countries**		Developing Countries		World	
	1995	2009	1995	2009	1995	2009
Food and beverages	10,8	8,1	15,4	12,2	11,8	9,7
Tobacco products	0,7	0,4	2,8	2,4	1,2	1,2
Textiles	2,4	0,9	5,8	4,4	3,2	2,2
Wearing apparel and furniture	2,5	0,7	3,5	2,7	2,8	1,4
Leather, leather products and footwear	0,7	0,2	1,6	1,2	0,9	0,6
Wood products (excl. furniture)	2,4	1,4	1,8	1,1	2,3	1,3
Paper and paper products	3,7	2,4	2,4	2,1	3,4	2,3
Printing and publishing	6,0	3,9	2,3	1,4	5,1	2,9
Coke, refined petroleum products, nuclear fuel	3,1	2,2	7,7	5,0	4,2	3,3
Chemicals and chemical products	10,0	8,8	10,1	11,0	10,0	9,7
Rubber and plastics products	3,2	2,4	3,4	3,5	3,3	2,8
Non-metallic mineral products	4,0	2,5	6,2	4,9	4,5	3,4
Basic metals	5,3	3,6	7,0	10,1	5,7	6,1
Fabricated metal products	7,2	5,0	4,4	3,5	6,5	4,5
Machinery and equipment n.e.c.	9,5	7,4	5,5	5,3	8,5	6,6
Office, accounting and computing machinery	1,8	4,4	1,6	2,0	1,7	3,5
Electrical machinery and apparatus	4,2	4,0	3,3	5,7	4,0	4,6
Radio, television and communication equipment	5,9	27,1	4,7	10,2	5,6	20,7
Medical, precision and optical instruments	2,5	2,7	1,1	1,3	2,2	2,2
Motor vehicles, trailers, semi-trailers	7,7	6,6	4,7	4,8	7,0	5,9
Other transport equipment	2,5	2,5	2,0	2,7	2,3	2,6
Furniture; other manufacturing	3,5	2,8	2,7	2,4	3,7	2,7
Total	100,0	100,0	100,0	100,0	100,0	100,0

Source: UNIDO, *Industrial Development Report 2011. Industrial Energy Efficiency for Sustainable Wealth Creation*, Vienna, Austria, 2011 (<http://www.unido.org>).

\* Percentage shares of individual branches in total MVA at constant 2000 prices.

\*\* This report defines developed countries or developed economies as the group identified as “high-income OECD countries” by the World Bank and developing countries or developing economies as all other economies.

Changes in the industrial structure of developed countries, which have recently entered the new post industrial stage determined, in essence, the structural changes in the global industry. In 1995, dominant manufacturing sectors at the world-wide level were food and beverages (11.8 percent), chemicals and chemical products (10 percent) and machinery and equipment (8.5 percent). Radio, television and communication equipment's share in manufacturing rose to 20.7 percent as a result of the surge in demand for electronic goods (*Table 1*). In developing countries this share rose from 5.9 percent to 27 percent.

Specific processes occurred in the same period in post-Soviet space, particularly in the CIS countries, which restructured their entire economies by transition "from a planned to a market" system. During the 1990-1998 period of economic recession in Russia, its industrial output declined by 60 percent and reached its lowest point in August 1998 – 37 percent from 1990 levels. Almost 10 years later, in 2008, the country registered an important development and economic up-rival its industrial production barely overpassing however (on average) 66 percent of the level in January 1990. In other words, in spite of the recovery and reconstruction of the whole country industry, Russia had not a strong and mature economic system, when the global economic crisis appeared. Moreover, it should also be noted the fact that the rate of growth of manufacturing industries (excluding the iron and steel) significantly lagged in the 2000's behind the growth of the economy as a whole, and their share in industrial production declined in the following period. On the first place in the structure of manufacturing industry in Russia there is the metallurgical production and manufacture of fabricated metal products (above 22 percent), and on a second place the production engineering – concentrating also about 22 percent (including the share of electrical, electronic and optical equipment accounts for only about 6%).<sup>2</sup> Other CIS countries displayed a very similar situation in the years 1990-2000's.

As for the developing countries, the structure of their industry also changed. Noticeable changes have especially been registered, due to changes, for only a few of them, such as Brazil, Mexico, the Asian NIC and countries such as Korea, Singapore, Malaysia, Thailand and others of the "first" and "second wave" respectively. At the same time in the industrial structure of these states a shift toward development of knowledge-intensive branches occurred. The proportion of developing countries in the worldwide manufacturing increased significantly (reaching 35%) over the past decade. Over 1990-2010, global MVA grew with 2.8 percent, from 4290 billion dollars to 7390 billion (*Table 2*).

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<sup>2</sup> "Russia in Figures: Brief Statistical Review. Short Stat", *Book / Federal Service of State Statistics (Rosstat), M., 2009-2011.*

Table 2

**Manufacturing Value Added Levels, by region, 2005-2010**  
(US\$ Billions unless otherwise Indicated)

Region / Country / Economy	2005	2008	2009	2010	Share of World MVA, 2010 (Percent)
<b>World</b>	6570	7350	7020	7390	100
Developed economies	4710	5010	4600	4760	64,4
Developing economies	1870	2340	2410	2630	35,6
<b>Regions:</b>					
East Asia and the Pacific	966	1290	1390	1540	20,8
China	646	920	1015	1134	15,3
Europe	148	176	164	169	2,3
Russian Federation	67	71	63	64	0,9
Latin America and the Caribbean	373	423	397	423	5,7
Brazil	111	121	116	129	1,7
Middle East and North Africa	183	217	216	229	3,1
South and Central Asia	149	185	194	210	2,8
India	91	113	119	131	1,8
Sub-Saharan Africa	47	53	52	54	0,7
South Africa	27	30	28	28	0,4
Least developed countries	24	30	32	34	0,5

Calculated of: UNIDO, *Industrial Development Report 2011. Industrial Energy Efficiency for Sustainable Wealth Creation*, Vienna, Austria, 2011, p. 16.

Developed countries recorded a 1.7 percent MVA growth and a 2% GDP growth, highlighting their waning reliance on manufacturing as a source of growth and the increased role of services such as finance, insurance and real estate in the total GDP. In contrast, the manufacturing sector in developing countries has been buoyant, with a remarkable 5.6 percent annual growth rate in MVA over 1990-2010, slightly higher than the 4.8 percent GDP growth rate. Thus China, Asian NIC and other states (with priority to manufacturing industries) significantly strengthened their positions in the global economy.

In 1990, developing countries were producing about 20 percent of the world GDP. By 2010, this share had risen to 30 percent. Global manufacturing has been shifting from developed to developing economies even faster, with economies such as China, India and Taiwan Province of China building strong manufacturing sectors. In 1990, developed countries accounted for 79.3 percent of the global MVA, and for 72.7 percent in 2005. Their share was of 64.4 percent in the global MVA in 2010<sup>3</sup>.

<sup>3</sup> UNIDO, *Industrial Development Report, 2011*, Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria, p. 142-143 (<http://www.unido.org>).

### **The Effect of 2008-2009 Economic and Financial Recession**

Over the 1990-2010 period, global MVA grew by 2.8 percent annually, from \$ 4,290 billion to \$7,390 billion. The 2008-2009 economic and financial crisis affected manufacturing more in developed countries than in developing ones. Experts of UNIDO consider on their turn the impact of the 2008-2009 economic and financial recession on manufacturing as an important issue to debate. Global MVA registered an average growth of 3.1 percent per year in the 2000-2008 period, reaching at the end of it 7350 billion dollars. In 2009, the global recession led to a 4.6 percent drop, to 7020 billion dollars. The crisis affected developed countries to a larger extent, with MVA falling with 8.1 percent from 2008 to 2009. Economic growth in developing countries slowed to a rate of 2.9 percent in 2009, down from an average of 6.8 percent a year over the previous eight years. The positive growth in developing countries over 2008-2009 masks sharp disparities. The economic and financial crisis affected each developing region differently. MVA grew by 7.7 percent in East Asia and the Pacific and by 4.8 percent in South and Central Asia but in other regions.

World manufacturing value added (MVA) peaked at 7390 billion dollars in 2010 (18.2 % of global GDP) after a sharp drop in 2009, during the global economic and financial recession. MVA's share in GDP declined (from a value of 17.7 percent in 1990 to 16.6 percent in 2010) in developed countries and rose from 18.4 percent to 21.5 percent in developing countries<sup>4</sup>. The financial crisis exacerbated the MVA decline in developed countries, but MVA continued to grow in developing countries.

To sum it all up we should notice the fact that in most developed countries, changes in the structure of industrial production (before the current financial and economic recession in the global economy which appeared since 2008) were a process of gradual restructuring and adjustment of the economy through the introduction of scientific and technological progress in the transition to post-industrial stage of development due to increasing income of population. Priority is given, in the first place, to the most high-tech industries and branches. In the CIS countries (and many other countries with the same "transition economies") ever since the early 1990's, changes in the structure of industry determined the transformation of the economic mechanism and the restructuring of the economy, amplified in the present by general economic problems encountered by this group of countries. For groups of less developed countries structural changes in the industrial sector of the economy expressed in the process of changing the organization and methods of production on a large-scale, in changes in productivity and in the industrial structure due to the deeper involvement of these countries in international division of labor<sup>5</sup>. The multinational companies also have a strong influence on

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<sup>4</sup> UNIDO, *Industrial Development Report, 2011*, Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria, p. 149 (<http://www.unido.org>).

<sup>5</sup> RODIONOVA, I., *World Economy: Industrial Sector*, Moscow: RPFU, 2010.

the placement of production facilities on their territory, which strongly came through, for example, in changing of industrial structure in Asian NIC countries with their export-oriented economies. On the contrary, in the less developed countries there were no significant changes in the industrial structure.

### Leaders of the world manufacturing

Most of the technological capacity and industrial production (in value terms) remain concentrated in the developed countries (67% in 2009). At the same time China, very significantly increased its share in world manufacturing value added (MVA), occupying the third place in the world ranking, primarily due to the rapid growth of gross production (*Table 3*).

**Leaders of the World Manufacturing (MVA) and Russia, 2009\***

*Table 3*

Country	Share of world MVA (percent)	Share of MVA in GDP (percent)	Share of world manufactured exports (percent)	MVA per capita (US\$)
USA	23,70	14,8	8,6	5334
China (and Hong Kong)	14,53	35,7	15,7	754
Japan	14,45	20,7	5,6	7929
Germany	6,17	21,7	10,3	5250
The Republic of Korea	3,16	29,4	3,7	4562
United Kingdom	2,91	12,1	3,0	3330
France	2,65	12,6	4,3	2989
Italy	2,43	15,3	3,9	2894
India	1,70	13,7	1,6	99
Taiwan	1,68	26,2	2,1	5101
Brasilia	1,66	13,7	1,0	594
Canada	1,54	12,7	2,1	3236
Mexico	1,42	15,2	2,0	911
Spain	1,39	13,6	2,0	2178
Turkey	1,04	20,3	0,9	950
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Russia	0,89	15,8	1,1	444

Source: UNIDO, *Industrial Development Report 2011, Industrial Energy Efficiency for Sustainable Wealth Creation*, Vienna, Austria, p. 192-199 (<http://www.unido.org>).

\* Value added in 2000 US dollars.

Informatization, according to the leaders of China, is an important strategic resource element, determining the prospects of the entire economic and

social modernization. It is worth emphasizing the fact that the position of China in the world economic system was supported previously by low production costs in the supply of products to foreign markets shallow redistribution (textiles, sportswear, toys) whereas nowadays is provided mostly by increased export earnings from trade in high-tech products.

The current situation in Russia shows it as a consumer of the simplest and most popular technologies. In the present rating our country occupies the 18<sup>th</sup> place, and it accounts for only about 1% of world production of manufacturing industries.

The data presented in table 2 (*Table 2*) illustrate the different performance of leading countries on such indicators as share of world MVA, share of MVA in GDP, share of world manufactured exports, MVA per capita. The analysis shows that yet again Russia has no advantages (we have a ten-fold gap from the leaders). For example, Japan's MVA per capita for 2009 corresponds to 7929 dollars (at constant 2000 US dollars prices), Switzerland – 7384 dollars, Singapore – 6996 dollars, the U.S. – 5334 dollars whereas Mexico – 911, China – 754, Tunisia – 476, Russia – 444, Indonesia – 295, India – 99, and Nigeria – only 23 dollars<sup>6</sup>.

It is also worthwhile to note the fact that the top five leaders of the world industry account for approximately 60% of the world production of manufactures (and the share of the first 15 countries for 80%), indicating a high level of concentration of production capacity to a group of leading countries. Excepting China this group also includes South Korea, India, Taiwan, Brazil, Mexico and Turkey. In countries that create and widely use in practice innovative technologies diffusing them in the branches of parent TNCs worldwide, return on assets is larger in manufacturing industries than in capital-intensive extractive industries and low-technology manufacturing industries

### ***Largest Developing Economy Manufacturers***

Manufacturing in developing economies is highly concentrated. The share of manufacturing value added of the 15 world leading economies account for 83 percent of total production of the developing countries in 2010 (73.2 percent in 1990). The increase is attributed mainly to China, which has emerged as an industrial

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<sup>6</sup> RODIONOVA, I., STEPANOV, A., *The Aspects of the Formulation of the Theoretical Approaches for the Model of Innovation Development of Russia: the Analysis of Structural Shifts of the World Manufacturing Industry and High Technology* // Economic Vestnik of Republik of Tatarstan, no. 1, 2012.

power of the world – more than tripling its share within the developing countries' MVA over 1990-2010, from 10 to 43 percent<sup>7</sup>.

China also enjoyed faster average growth of MVA than other large developing economy manufacturers during that period. Having experienced a reduced decline in market share, Taiwan Province of China remained the fourth largest manufacturer among developing economies.

In other words, the most impressive results were achieved by the countries that have managed to provide national economic benefits from the globalization of world markets for high-tech products, on which they won a strong position and a significant profit as compared to domestic production costs of high technology products and services (the so-called technological rents).

At the same time in modern Russia the simple use of the intellectual, technical, scientific and technological capabilities of previous years without its building and development dooms the industry and economy to the inevitable and growing backlog. It is worth remembering that this is happening against a background of accelerating the practical application of scientific knowledge embodied in the innovation, and strengthening of scientific and technological capabilities in many countries not only in the economically highly developed ones.

### *Current Trends in the Global Industry*

Knowledge-intensive industries and high technology now plays a major role in the development of economy and social sphere. They materialize the bulk of research and development. They determine the demand for scientific research (and, hence, contribute to the further development of science) and create a base material and offer real innovation and information for all sectors of the economy. The importance of innovation development course was understood long ago by the European Union and the USA.

In recent decades, the global industry (in addition to changes in industrial structure leading towards increasing share of high-technology industries) varies directly the structure of high-tech or knowledge-intensive industries. It is known that the classification of industry or production of a number of high-tech branches adopted in the scientific literature is quite conditional. This group of industries recorded more than a certain fixed level relative cost of R&D in the production of products. This is the proper measure of research intensity, which is determined by expenditure on R&D (including gross value of production per unit).

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<sup>7</sup> UNIDO, *Industrial Development Report 2011, Industrial Energy Efficiency for Sustainable Wealth Creation*, Vienna, Austria. 2011.

Analysis of data showed that in the 1980-2010 period the structure of production of high technology products has changed in the direction of increasing the production of means of communication. These are structural changes in the industry of developed countries that joined the post-industrial stage of development, and these changes were crucial for structural shifts in the global economy.

The largest manufacturers of high-tech products of all types are still the USA, EU, China and Japan; calculations showed that, in the worldwide overall production of high technology products, in 2010, the leading countries were: United States (27.7 percent of the world production, in millions of current dollars), Japan (around 13 percent), China (around 19 percent), Germany (5,5 percent), South Korea (4 percent), Taiwan (4 percent), United Kingdom (3 percent), France (3 percent). The total share of EU countries amounted to about 1/5 of world production<sup>8</sup>.

The share of high-technology products increased both in the structure of the manufacturing industry at the worldwide level and in the industrial sector of the economy of individual countries including developing states – particularly in China and the Asian NIC, and some countries in Latin America. These changes indicate an increase in industry and in the share of mechanical engineering, chemistry and other industries that use the latest achievements of scientific and technical progress.

### **Changes in the Structure of World Manufactured Exports**

The development of high technology and the changes occurred in the structure of the world market reflected the priorities of science and technology policy in different countries.

Leading positions in world ranking in the export of hi-tech production are occupied by highly-developed countries including EU (especially if considering trade among EU countries). But it is necessary to note that China has taken first place (with 23.7 percent) leaving behind USA, Germany and Japan. Even if trade between China and Hong Kong was excluded the share of China exceeds 17 percent in the total of this world indicator. This share equals the volume of trade of such goods among all 27 countries within EU. Asian NIC (newly industrialized countries) have considerable share in world export of hi-tech products (*Table 4*).

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<sup>8</sup> “Calculated on the Database: Science and Engineering Indicators – 2012” (*Appendix Tables 6*), two volumes, Arlington, VA: National Science Foundation, 2012 (<http://nsf.gov>).

*Table 4*

**Exports of High-Technology Goods, by Region / Country / Economy:  
1995–2010 (%)**

<b>Region/country/economy</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>
World	100,0	100,0	100,0	100,0
World excluding intra-EU and intra-China/Hong Kong	80,0	80,1	77,8	76,4
EU (total)	31,1	30,0	31,0	28,9
China and Hong Kong ( total)	6,9	8,5	18,2	23,7
United States	17,0	17,2	11,5	11,6
Germany	7,5	7,5	8,0	7,5
Taiwan	4,1	5,0	5,3	5,7
Japan	14,7	10,4	7,0	5,0
Singapore	6,8	5,3	5,1	4,9
Korea, South	4,2	4,6	4,8	4,7

“Calculated by: Science and Engineering Indicators – 2012”, (*Appendix: Tables 6-18*), two volumes, Arlington, VA: National Science Foundation, 2012.

Thus it is necessary to consider that even in the conditions of the present world financial recession the rates of growth of China haven't considerably decreased (especially in comparison with other countries of the world). The epoch of the cheap Chinese goods comes to an end, China facing a new level of development of manufacture. In 2009 it overtook for the first time the former leader Germany in volume of export of goods, and export of hi-tech products. Thus China has already come out on a top position in the world for the volume of foreign trade and the export of production of mechanical engineering and electronics (1590 bln dollars and 933,4 bln dollars accordingly). In 2010 mechanical engineering and electronics production amounted to 60% in the total export of China.<sup>9</sup>

### **Conclusion**

In conclusion we would like to underline the the fact that information technologies play a more and more important role in the world economy. Moreover, the so-called “digital rupture”, that is a backlog of the poorest countries from the rich ones by volumes and quality of use of these technologies, is gradually reduced. Those countries which have managed to get advantages of globalization of the world markets of hi-tech production have achieved the most considerable results.

The Asian vector in the world industrial development clearly stands out. Though from the point of view of the characteristics of the spatial organization

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<sup>9</sup> www.crirussian.ru – China International Broadcasting Network – CIBN, “*Economical Bulletin Programme*”, February 2011 г.

of industrial production at global level – disparities still remain on a line “North”-“South” (developed-developing countries).

Nevertheless the world industry faces a spatial regrouping of the worldwide dominant regions in creation and exchange of industrial production, distribution of the capital, technologies and production capacities.

The former leader of the world industry, the North American region led by the USA, has lost its position. As a whole the European region (EU countries) has strengthened its rank in manufacturing industry. The CIS countries (including Russia) have weakened very considerably their positions in the world industry. Meanwhile the “Asian” or the “Far East pole” has had the most active upward dynamic, gaining practically the leading position in the world on manufacture of many kinds of industrial products (fast developing China, Japan, Korea, Taiwan, Singapore, Malaysia, Thailand, etc.).

In the open economy conditions the Russian goods proved to be noncompetitive on foreign markets, quickly lost competitiveness on internal one as well, being superseded by import. In these conditions entire branches start to lack financial resources, situation that sooner or later leads to their irreversible technological degradation or a total disappearance. A positive tendency is however the fact that after years of reforms Russia is in a search for sale markets.

Considering the weakness of the industrial potential of the Russian Federation, the strategy based on the trade of technologies can become productive. However, the activity of the Russian applicants on the foreign markets of technologies is still insignificant.

If radical measures to innovate economy are not undertaken during the transition period, Russia and other CIS countries can remain at the level of the developing states, basically exporting raw energy resources. It is necessary to create by common efforts an innovative economy of the Commonwealth of Independent States, through modernization of industrial and technological base and labour productivity growth.

In the conditions of the modern crisis the necessity of the transition to the innovative model on the basis of interstate cooperation has sharply appeared, whose synergetic effect will help the CIS countries to pass to an advanced technological pattern. Nowadays a priority is the creation of a single market of the CIS countries. The use of intellectual, scientific, technical and technological potential of the last years without its escalation and development in modern Russia and other CIS countries dooms the industry and economy of our countries to an inevitable and accruing backlog. Thus it is worth to remember that the practical use of scientific knowledge embodied in innovations accelerates and strengthens at the same time, scientific, technical and technological possibilities for a variety of the countries, not only the advanced ones.

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