

Macroeconomics

Vitalina KURYLIAK,
Maksym KURYLIAK

**«NEW ECONOMY» IN THE CONTEXT
OF GLOBAL KNOWLEDGE, INFORMATION
AND INNOVATION MANAGEMENT**

Abstract

The article deals with the innovative mechanism of the new economy in the aspects of regional and national peculiarities of its functioning in the global and EU space. The general tendency of strengthening the orientation of national economies towards international trade in services, internationalization of research networks and expansion of creative human resources have been determined. Contrarily, evaluating the results of the Lisbon Strategy has demonstrated the need to prioritize employment, productivity and social cohesion to achieve global leadership. The concentration of scientific and technical potential of the leading countries of the international market on breakthroughs for economic development is an important tendency in the conditions of globalization. It has been shown that the implementation of new economy ideas sharpens competition for the skilled labour as a major component in research, innovation and entrepreneurship. At the same time, there are processes of transition from being an emi-

© Vitalina Kuryliak, Maksym Kuryliak, 2019.

Kuryliak Vitalina, Doctor of Economic Sciences, Professor, Head of the International Economics Department, Ternopil National Economic University, Ukraine. ORCID 0000-0002-3566-7900. H-3672-2017. ternopil2000@yahoo.com.

Kuryliak Maksym, Candidate of Economic Sciences, Associate Professor at the Department of International Economic Relations, Central Ukrainian National Technical University, Kropyvnytskyi, Ukraine. ORCID 0000-0003-1540-0915. kurylyakmax@gmail.com.

gration country to being an immigration one. A comparison of EU and Chinese investment policy has been made, demonstrating the potential of using national sources, community mutual funds and fiscal federalization. It has been argued that the development of innovative products through the integration of science and production is an important factor in the development of new economy.

Key words:

Knowledge; European Research Area; competition for skilled labour; science-production chain; investment in knowledge; innovation; new economy; technology transfer.

JEL: D83, E22, F21, F23, L86.

Problem Statement

Research on development problems based on the concept of a new economy has evolved since the 1980s. For the first twenty years, this idea had many supporters among scientists, politicians and businesspersons. At the turn of the millennium, interest in the idea was somewhat dormant as new terms emerged, the content of which was filled with expressions borrowed from the new economy theory. These are concepts such as information economy, innovation economy, knowledge economy, inclusive economy, etc. However, based on the transition to the fifth and sixth technological eras, the relevance of the new economics as a whole direction of development is on the rise again. The problems of the new economy have been explored by W. E. Deming, A. Dolgin, B. Lundvall, M. Castells, P. Drucker, C. Freeman, L. Soete, and J. A. Schumpeter. O. Amosha, M. Bilopolskyi, V. Heiets, D. Lukianenko, Ye. Saveliev, L. Fedulova and others have investigated the new economics in Ukraine. However, the authors of existing publications have so far been neglecting aspects related to the mechanisms and tendencies of the new economy functioning as a systematic integration of knowledge, information and innovation into the value-adding process.

The aim of the article is to highlight global trends in the development of new economies in EU countries and world market leaders. The research is carried out using the method of systematic analysis of the impact of new knowledge, information and innovation on the world and national economies. The context of the study is the policy of the Ukrainian economy's reforms.

Main Body

1. Terminological discourse on content

The New Economy is a concept that plays a leading role in meeting global technological innovation challenges in today's conditions. The theorists of the new economy concept posit the idea that for the last 20-30 years the development of the leading countries has been «nourished» not so much by traditional factors of production – land, labour and capital, as the new ones – such as knowledge and innovation. This understanding is reflected in the writings of J. Schumpeter and his followers, who consider entrepreneurship and research to be the main sources of growth.

A significant step forward in the theory of the new economy was the work of P. Drucker *The Age of Discontinuity: Guidelines to Our Changing Society* (1966), which at one time was undervalued. The core idea of this book is the definition of new knowledge as a major economic resource [1]. P. Drucker defines the new economy as a «knowledge economy» and the sphere of creation and dissemination of information – as a «knowledge industry» and, accordingly, the whole society – as a «knowledge society». That is, priority is given not to the classic factors of production, but to the knowledge that is a prerequisite for productivity and economic growth.

In another, more commonly used, sense, the category of new economy is reduced to the use of knowledge-intensive technologies, in particular engineering and knowledge management.

According to V. Arthur [2], key components of the new economy should consist of knowledge and education (often included in the human capital category). They can play one of two roles:

1) business product, that is, educational or innovative intellectual products and services;

2) production asset, that is, a resource that provides for the process of transforming and generating new knowledge according to organizational goals.

Researchers identify interconnected driving forces that change business rules and national competitiveness. In particular:

- Globalization, through which the goods and markets are becoming even more global than before;
- Information technologies;
- Intensity of information/knowledge processes (evidently because effective manufacturing is based on information and know-how, since over 70% of employees use their mental capabilities more often than physical ones);
- New media that promote the creation and dissemination of knowledge, which in turn is transformed into collective knowledge. This development provides much easier access to existing knowledge through online databases that facilitate online user-producer interaction;
- Computer networks and connections («global village» is becoming closer than ever because of the Internet. The overall result is that goods and services can be designed / manufactured, purchased / sold, and even transmitted via electronic networks in numerous cases. New technological application depends on how much this result meets consumer demand).

The analysis of copious research of foreign and Ukrainian scientists allows making a number of generalizations. First of all, they show that the new economy is significantly different from the traditional one in many aspects. These differences form its key identifying features:

1. The economy has no deficit of factors of production rather they are in abundance. In the traditional economy, some resources are usually depleted in use, but information and knowledge can be shared and spread, instead growing with further use.

2. Knowledge and information «flow» into spaces with the highest demand and the lowest barriers.

3. Significantly, a knowledge-intensive product or service can be (and usually is) more expensive than a product / service that is characterized by low knowledge satiation. That is, pricing and cost depend largely on context.

4. Information or knowledge may have different values for different people or in some cases for the same person at different times. Thus, pricing and cost depend heavily on context.

5. Social structures, cultural characteristics and other factors affecting social relations are of great importance for the knowledge economy. Hence the conclusion that communications are increasingly seen as the basis for knowledge flows.

6. Obviously, human capital competencies remain a key component of the value of a knowledge-based company.

These signs of the new economy require new ideas and approaches from both academics and politicians, as well as managers. In fact, the new economy has different dimensions of manifestation, but it will no doubt spread rapidly, creating a model in which even ideas will be recognized and identified as commodities.

2. Development environment inside and outside the EU

During more than 60 years of European integration processes, the foundations of international cohesion of political, economic, state and public structures within the region have been formed. At the same time, contradictions and crises emerged in the integrated space, prompting the need to find new solutions to the functioning of the European Union as a system of united states.

A retrospective look at European development shows that it has been driven by greater openness of national markets and harmonization (albeit incomplete) of a number of sectors, monetary and fiscal convergence. Enlargement of the EU, introduction of the euro, regional cohesion policy, transfer of resources between Member States for the benefit of less developed territories and countries have become a significant factor in European development.

At the same time, the last 20 years have been characterized by unprecedented economic growth processes in the world. They are much higher than growth in the EU and are accompanied by expansion of world trade and global capital flows. The international economy was much more influenced by the BRICS countries than by the EU enlargement, especially within the WTO. According to R. Freeman, the entry of the BRICS countries into the world trading system in terms of their labour resources meant a doubling of the «world» workforce. Such a significant expansion of the Duty Free Trade Area and the deepening of international specialization is likely to require a long adaptation period of more than 30 years to affect the rest of the world [3].

World Bank experts acknowledge that Europe may finally recover from the effects of global economic and financial crises. Moreover, the current situation is complicated by the slowdown in the growth of the Chinese economy. The Ceres-

tial Empire has become the second economy of the world (pushing Japan aside), so its growth rate is affecting the whole world. However, currently it seems China's ability to maintain high growth rates has been exhausted. Years of growth in the Chinese economy at a rate of just under 10% led to wage growth, and China began to lose global competition to its neighbours and (sometimes) Europe. World Bank experts estimate China's economy to grow at 4–4.5% per year in the coming years [4].

It is worth noting that since the Lisbon Summit in March 2000, most of the growth of the world economy has been associated with accelerated market penetration of technological change and easier access to global knowledge. Digital technologies, in particular, easy and cheap access to broadband and the proliferation of the Internet and mobile communication in the world, have been a decisive factor in the rapid and global penetration of advanced technologies into the manufacturing industry. These processes have accelerated due to technology transfers in the form of FDI, licenses and other forms of formal or informal dissemination of knowledge.

In the second decade of the 21st century, it becomes clear that Europe is a region of the world with a number of characteristics that make it particularly vulnerable in the face of global competition. The «soft spots» of the European economy include, first and foremost, demographic factors, such as aging populations and low birth rates in most EU countries. In addition, EU Member States fall behind other developed countries in such areas of global competition as education and professional development, research and development, innovation and entrepreneurship.

Although the dominant trends identified by the Lisbon Strategy towards unification within the EU have been intensifying, the need for the Community to initiate an international cooperation paradigm has become urgent [5]. Research has shown the need to strengthen the European economy's focus on international trade in services, the internationalization of the research network and the expansion of creative human resources outside the EU [6].

World Bank Chief Economist H. Timmer states, «Our estimates are conservative so far – EU GDP growth will not exceed 2-2.5% in the near future. Higher growth is hindered by both external problems, such as China's slowdown, and domestic problems – unresolved migrant difficulties, geopolitical tensions, and the possible withdrawal of Britain from the EU». However, he said that the statistics of recent months allow us to count on a «surprise». The economist says, «Traditionally, growth in exports from the EU has been lower than the world average. However, the situation has changed in recent months. We also see levels of unemployment falling in the EU. Despite the fact that threats to the European economy have not gone anywhere, these data give reason for optimism» [4].

3. Mechanisms for developing new economy in the EU

The Lisbon Strategy aims to increase the EU's global competitiveness through economic rejuvenation and improvement in the social and environmental fields. The European Council has set a task for the European Union to become the most competitive and dynamic knowledge-based economy in the world, capable of growing, able to provide better jobs and closer social cohesion.

The implementation of the Lisbon Strategy has led to an overall increase in efficiency within the EU. However, it has not led to a sufficient accumulation of new knowledge and innovation within the EU. On the contrary, international competition in R&D demonstrates the flows of Lisbon strategy mechanisms for achieving world leadership. Finally, the European Commission has developed a State Aid Action Plan and rules for managing R&D and innovation policy.

Looking at history, in 2005, the Council of Europe considered the 5-year results of the Lisbon Strategy and found that the goals had not been met. The European Community concluded that the social problems are extremely important and their solution makes it possible to achieve economic goals. The updated Lisbon Strategy focuses on knowledge, innovation and the optimization of human capital. Its goals are to create jobs in the EU and boost economic growth through investment in human capital. In 2007, the paper «Scientific Europe in the Global World» [7] identified the main areas of social life in which the greatest demand for R&D is expected and, accordingly, the contribution of science and new technologies up to 2020: employment in a globalized world; health, nutrition, climate change, sustainable growth and the environment. Therefore, European experts have proposed a new concept of «key technologies» – the ones that are able to respond first and foremost to the major social challenges, whose solutions are the basis of economic transformation.

To this end, the new ten-year Strategy 2020, which emerged in the post-crisis era, aimed to achieve employment, productivity and social cohesion goals, and therefore included three areas:

- 1) «Soft» growth aimed at stimulating knowledge, innovation, education and information technologies;
- 2) «Sustainable» growth that addresses environmental, energy and mobility issues, efficient use of resources and increasing competitiveness;
- 3) «Social» growth, i.e. employment growth, creation of conditions for professional growth, advance of education and retraining, accessibility of training, reduction of income differentiation, poverty reduction, social and territorial cohesion [8].

The European Central Bank's monetary policy is subordinated to the EU's new economy development system. It prioritises equalizing economic growth and reducing inflation among EU Member States. The mechanism for regulating the fiscal policies of the Member States in quantitative terms is the Pact for Growth and Stability, which aims to ensure that the member states of the Economic and Monetary Union follow «budgetary discipline» after the introduction of single currency. However, there are no incentives in the EU to promote knowledge and innovation as drivers of sustainable growth for all countries. Given these institutional features, both the Lisbon Agenda and the 2020 Strategy are largely dependent on the efforts and willingness of Member States to give these processes an internal priority.

In general, European and national policies of the EU Member States have focused primarily on the functioning of the European Research Area (ERA), the dissemination of best innovation practices among Member States or regions, local accumulation and dissemination of knowledge. Meanwhile, significant changes in the field of knowledge and innovation have been occurring outside Europe's borders, which will continue in the near future. Thus, if we compare the R&D expenditures of the most prominent players in the international economy, in the USA they amounted to 473.4 billion USD in 2013, in the EU in 2014 – 334.3 billion USD, in China in 2015 – 409 billion USD. Their share is respectively 2.7%, 1.9%, 2.1% of the gross domestic product (which is the main indicator of the scale of state support for innovation); and the goal is to transform China into an innovative economy by 2020 [9, p.14]. China may surpass the United States in this indicator in a few years' time. The growth rate of R&D spending in China is much higher than in the US and other countries. Thus, in 1996-2007 it averaged 22% at current prices, while in the USA it was 6.0%, in the EU – 6.5% and in Japan – 5.5% [9, p. 30]. China is actively and extensively attracting the resources of Western transnational companies, using the skilled staff of its diaspora, as well as Chinese scientists, engineers and designers who have been educated in Western countries, especially in the US. As a result, China's investments are currently around 61% of US levels and continue to grow [9, p. 14].

The general trend is that economic policy in developed countries with high per capita income is more oriented towards sustaining «creative destruction» processes, favouring insiders, avoiding risk and providing security, promoting profitability and welfare. Instead, in emerging markets, such as the new EU member states, China, India, Brazil, and Ukraine, the new economy policy focuses mainly on industrial science and technology and emphasises engineering, design and accumulation of «experience».

4. The European Research Area and the development of its openness

Investment in knowledge accumulation is an important area of development for European countries. This includes research, development, and innovation in the EU and in individual Member States, as reflected in the 2001 Barcelona indicators, which aim at reaching 3% of GDP.

This indicator concentrates on enhancing geographically driven duplication of European, national and regional R&D and innovation efforts [10]. Due to the high risks associated with the development of new products for the global market, TNCs now prefer to license such technologies or, alternatively, outsource the most risky parts to small domestic or international high-tech companies that may be absorbed if successful. Accordingly, a trend is emerging in which large firms cooperate in R&D investment. In doing so, they seek to reduce risks by collaborating with other companies through state-sponsored programmes (e. g., SEMATEC and IMEC in nano-electronics) or so-called open innovation collaboration.

According to an analysis of nanotechnology publications indexed in Web of Science metrics, leading countries are focusing their scientific and technological potential on these breakthroughs for economic development. In particular, in 2012 the USA published 26% of articles on nanotechnology; China and Japan – 19% and 11%, respectively; Germany, France and the United Kingdom – 9%, 6% and 5%.

At the same time, there is a trend of declining private investment in this sector concurrently with increasing funding for R&D in small EU economies. It is mainly related to the contradiction between the global value of the research results and the local nature of their costs. To some extent, this problem also exists for large companies and countries.

Research and development is largely provided by universities and other government institutions. However, about 20 years ago L.L. Soete [11] pointed to the «deviation» of knowledge in the European Research Network and its possible impact on the European research «cocoon» of the European Networking Programmes. As shown by G. Georghiou, research networking programmes (RNP) consist of a large number of small and loosely related projects, which do not aim at real changes to the end results in the studied directions. [12]. In his view, the financing of RNPs should be linked to high- and medium-level challenges such as climate change, food and energy security, so that it is flexible in response to demand and new scientific and technological opportunities. Over the years, there has been a gradual expansion of research priorities to include both local and global long-term issues. The issues of pan-European importance have largely

been raised that require the development of European networking programmes. These RNPs involved many participants and were open to other researchers and external co-financing of researchers from non-EU countries.

5. Competition for human capital

Global dimension to the future European education and employment strategy is linked to the growth of the international competition for access to skilled labour. It's about accessing talent as a major component in research, innovation and entrepreneurship. This should take into account the requirements of the policy for combating unemployment, which prevents the layoffs of workers. Access to skilled labour is an important historical feature of the development and transfer of knowledge within Europe, as well as between Europe and the rest of the world. Many European countries have moved from an emigration to an immigration country (Ireland can be considered an extraordinary case). Nevertheless, from the point of view of the receiving country, especially the EU, the migration of highly skilled labour is always important not only for the growth of the economy, but also for achieving wider benefits such as entrepreneurship, increased demand for goods and services, attracting capital, etc.

Labour migration has a negative impact on the country of origin, exacerbating inequality and slowing economic growth. On the other hand, there is also a positive impact of migration on the formation of human capital. Being able to emigrate to a higher wage country can encourage people to get a college degree in hopes of finding a higher paying job abroad. As a result, a country that leaks highly skilled labour abroad benefits from emigration because it motivates the rest of the population to pursue higher education, which ultimately leads to a highly skilled workforce cycle. Such mechanisms have been used successfully by South Korea and now by China.

6. Regional inequality in the development of new economy (EU versus China)

The European Union has developed a dual system of investing in knowledge. Its sources are national resources and community resources. In doing so, innovative and economic development programmes (networking programmes, European Research Area, regional cohesion policy, etc.) are used. In other countries, the local government, together with the central government, plays a leading role in the innovation system. The Chinese fiscal system uses the federal principle. In China, national and local taxes are levied separately by the various tax of-

fices and central government or local government, which supports research, innovation and economic development. Such fiscal federalization inevitably leads to strong regional disparities in growth and development.

Thus, the EU and China are characterized by an increase in regional disparities. The EU is a unique association that faces huge disparities in income and levels of development, but at the expense of the Structural Funds provides the least developed regions with infrastructure and intangible investments. The EU provides funding from its own financial source, the European Investment Bank. This ensures the transfer of resources between Member States in order to develop and streamline the industry structure of less developed regions. The gradual enlargement of the EU has certainly complicated the solution to this problem. However, centralized EU resources have remained a unique political tool to promote social cohesion and support the development of cultural identities in these regions, reducing emigration pressure on more prosperous countries. That is, while the process of economic convergence of new Member States was triggered by economic integration and the influx of private FDI, European Regional Policy helped to offset some of the regional disparities that emerged between EU Member States.

In China, the inequality of economic development between regions and provinces is quite significant compared to the EU. This is reflected in the fact that better developed and geographically advantageous regions are approaching the level of world productivity and income. For the EU, the policy of equalizing economic development levels between Member States has been a cornerstone of the economic integration process as opposed to other regional economic, trade or monetary integration zones.

Local governments in economically developed regions of China have larger R&D budgets than in less developed regions. Fiscal federalism and the autonomy of local governments cause the segmentation of resources for the development of science, technology and innovation, which is manifested in the availability and accessibility of scientific instruments, equipment for experiments and databases. Experimental technical equipment purchased by various organizations and institutions is generally not provided to other organizations in China. Scientific databases and information are limited to the institutions that created or purchased them. The segmentation of resources for science, technology and infrastructure certainly exacerbates the duplication and spending of scarce funds. Ministry of Science and Technology, National Commission for Development and Reforms, Ministry of Education and Ministry of Finance in 2004 launched an initiative aimed at integrating all investment in education and science infrastructure and helping to utilize the resources allocated to science and technology effectively.

This so-called «Scientific and Technological Infrastructure and Platform Development» initiative consisted of six platforms that facilitated the combined use of research centres, scientific and experimental instruments, scientific data-

bases and literature, envisaged the sharing of project information, technological transfer and the creation of research networks.

In the EU, as in China, the share of R&D expenditure to GDP is lower than in the US, but a strong innovation infrastructure has been created here, consisting of two components – national and supranational. National infrastructure functions within the national borders of the EU Member States. Innovation infrastructure is particularly strong in countries such as Germany, France and the United Kingdom, as well as Finland and Sweden. Supranational infrastructure concerns innovation within the EU apparatus: innovation funds, programmes, projects and mechanisms for promoting innovation across the EU integration space. Financing of innovation in Europe is also done through the so-called Framework Programmes for Socio-Economic Development. According to the Seventh Framework Programme, EU R&D expenditure in 2007-2013 increased annually by \$10 billion; in the Eighth Framework Programme that is calculated for the period of 2014-2020, this increase will amount to \$15 billion per year [13]. The EU annually allocates \$10 billion in research grants. In 2012, 16,000 researchers received them. However, the matter is not limited to the EU. There are such contracts and joint EU projects with the US, with China and other Asian countries, especially with Japan (over 30 countries in total). The EU carries out more than 200 research projects annually with China alone. Overall, R&D spending in the EU has increased despite the global economic crisis. In 2012, it was approximately \$340 billion, or up to 78% of the US level [14].

There are similarities between instruments proposed by the Ministry of Science and Technology of China and goals and policy instruments that characterize the EU under the auspices of various well-accepted network programmes such as technology platforms (Framework Programme 6) or the new concept of Joint Technology Initiatives (Framework Programme 7). Accordingly, there is a great deal of scope for exploring EU and Chinese experience on policy tools for the use of research networks and less duplication of research efforts.

7. Innovation as a result of the integration of science and production

The success of Chinese economic reforms and the growth of innovation capacity since the 1980s is partly due to national FDI promotion policies. However, due to the huge inflow of FDI, China's strong dependence on foreign technology has emerged. In addition, the rapid expansion of Chinese exports over the last twenty years has largely been based on the growth of low-wage manufacturing sectors.

Foreign direct investment in China's economy is steadily increasing: from \$45.3 billion in 1995 to \$117.6 billion in 2013. China attracts FDI by providing physical and institutional infrastructure and fiscal incentives. The Chinese government has more or less consistently introduced tax benefits for foreign investors, but has gradually shifted fiscal policy towards high-tech manufacturing and services instead of low-tech and labour-intensive industries. For example, in July 2007, the Ministry of Commerce amended the list of low-tech goods, the production of which is restricted in China. These amendments restricted the development of foreign firms operating in the low-tech manufacturing business in the eastern coastal zone, but contributed to the development of domestic producers in the central and western regions, where the economy was relatively underdeveloped. The number of goods on the previous list was about 394, but it was increased to 2247 in the new version. The amendments signalled huge changes in China's policy on trade in low-tech goods and sent a clear message that low-tech FDI is no longer welcome in the country. In addition to regulating foreign investment, the Chinese government has increased its support for entrepreneurial innovation. Programme 863 (National Programme for Research and Development, one of the three major science and technology funding programmes), supported by the central government, is constantly providing more and more money for projects in the industry since 2001. Fourteen percent of programme funds went to businesses in 2001. However, the share of these funds increased to 35.3% in 2004. Business support structures such as science parks and incubators are now well developed in China. More than 400 business incubators and 53 high-tech development zones were created at the national level before 2002 thanks to state support, mainly through the Torch Programme. In 2014, the number of business incubators in China was at 1,200 [16].

To finance innovation, China also aims to build a viable financial system, especially a venture capital system to support small and medium-sized technology enterprises. Local authorities and government organizations have begun to play an active role in setting up a fund to support venture capital recently. Shanghai Pudong Municipal Government set up \$1 Billion fund to support venture capital in the region. This money was not used to invest directly in start-ups, but were used to create new funds with private equity. The proportion of funding from the Pudong government did not exceed 33% in the new fund. The government did not aim to profit from the fund's operations, but rather to use capital to invest and raise private capital for venture projects in the district of Pudong.

The EU has had difficulties in moving towards a knowledge economy and in using soft policy instruments such as the Open Method of Coordination, given the differences between Member States. In comparison, China's policy measures to transform its national economy into a high-tech one with a higher share of added value, first and foremost, involve a significant government intervention. However, some Chinese policy measures (such as the creation of a financial venture system) may also be potential opportunities for the EU – for example, to make more effective use of the financial instruments at its disposal, such as the

European Investment Bank. An example of concrete actions is the European Investment Bank initiative, which focuses on three objectives: improving access to quality education and training; supporting talent in research, development and innovation; promoting the dissemination of information and communication technology networks, including audio-visual activities. Therefore, despite the huge differences between economic systems, the Chinese experience has elements that are worthy of implementation if the particularities of other countries in the transition to a knowledge economy are considered. Thus, the EU may also benefit from the Chinese experience.

8. Deepening ties in the «science-production» chain

Since the 1980s, the intensification of industry-science ties has become one of the priorities of the global economy. This trend is being followed in China quite successfully. The government of the country has initiated a so-called push-and-pull policy aimed at developing special connections between industry and science. On the one hand, the push policy has gradually reduced government funding for science and technology institutions. This strategy motivated them to work with businesses. Technical assistance provided to enterprises and joint research and development projects and funded by industry has become more important to science and technology institutions, as it has earned them a large share of overall profits. L. Xue pointed out that the level of government contribution to the budget of science and technology institutions declined by roughly 5% on average every year from 1986 to 1993 [16]. Since 1985, these institutions, especially those involved in experimental and development activities have been encouraged to integrate with businesses. Last round of reforms transformed hundreds of science and technology institutions into enterprises or non-profit organizations. Meanwhile, the government has concentrated funding on unchanged institutions, which mainly provide basic research.

On the other hand, the delay policy has focused on the formation of intermediary organizations whose task was to accelerate technological transfer from science to industry. The transfer was reinforced by the Technology Contract Act, adopted in 1987 and subsequent relevant regulations. After more than 20 years of development, the Chinese system of intermediary organizations at national, provincial, municipal and rural levels is well developed. It consists of technology markets, performance centres and technology consulting organizations, etc.

Similar to the EU, the government supports joint technology centres as a means of boosting innovation in enterprises and improving science-production relations. The 2007 initiative, implemented by central government agencies and coordinated by the Ministry of Science and Technology, has formed four consor-

tia for research and development and innovation in the steel, energy, agricultural equipment and coal mining sectors. The consortium included 26 large enterprises, 18 top universities and 9 research institutions. Government intends to improve industry-science collaboration in these four sectors from contract projects to more complex forms of strategic alliances.

China's innovation policy is an example of government efforts to develop and implement effective innovation policies to accelerate economic and social development, which can be applied to other economic systems. At this stage, it is interesting to compare it with EU innovation policy, especially since the latter is implemented in various EU Member States, widely covered and methodologically tested. Comparison shows that China has made significant progress in innovation policy in recent years, especially since its launch of China National Strategy for the Development of Science and Technology 2006-2020 and the 50 accompanying policies, rules and guidelines in succession in March 2006. In most of the policy areas the EU has focused on, China has developed and implemented its own policy, although it uses elements of the European strategy.

It is worth highlighting the R&D mechanisms that characterize the differences and commonalities between China, the EU, the US and Japan, the BRICS countries and others. According to the OECD 2014 Science, Technology and Industry Forecast, R&D budgets in the EU, Japan, and the United States reduce the share of advanced economies in scientific and technological research, patent applications, and scientific publications, giving China the path to become the country spending the most money for research and development in 2019.

Gross domestic R&D expenditures in 2012 were \$257 billion in China, \$397 billion in the US, \$282 billion in the EU28 and \$134 billion in Japan. China is moving ahead fast, catching up with the US and EU in innovative investment and product output, as measured by growth indicators. These include gross expenditure on research and development (GERD), R&D staff growth, and the growth of the share of triple patents (patents simultaneously registered with three leading patent organizations in the US, Western Europe and Japan).

According to the OECD study, China is ready to outstrip the US in R&D spending as early as 2019. Other important indicators characterizing profiling global trends are:

- In OECD countries, R&D spending exceeded \$1.1 trillion in 2012, totalling \$330 billion in BRICS (Brazil, Russia, India, Indonesia, China and South Africa).
- BRICS countries produced about 12% of the highest quality publications in 2013, almost twice as much as 10 years ago, though behind the US, which accounts for 28%.

- In most countries, between 10% and 20% of business spending on R&D is funded by the state, using various investment tools and government funds.

Conclusions

After more than 60 years of European Union history, there is an urgent need for a new and open to external challenges European strategy for the knowledge-intensive economy. A number of researchers point to the risk of EU losing its global positions if it does not improve innovation efficiency to maintain high levels of economic achievement and sustainable living standards for its citizens. The EU needs to prioritize international, external challenges that it will likely face in the decades to come. One of the most recent polls of Western TNCs with headquarters in the US and Europe shows that more than 70% of respondents expect growth in R&D in China in the next three years, and about 49% expect growth in India [17]. Since the geographical boundaries have become blurred with regard to the research and development activities of these TNCs, the formation and dissemination of progressive knowledge will not be limited to the developed world, but increasingly concentrated in emerging markets such as BRICS countries.

As we tried to show in the article, it was time to create new EU Lisbon Coordinates – the beginning of an external-oriented Europe that is fundamentally different from the old Treaty of Rome, internal-oriented Europe. Such repositioning must take into account, more than ever, that the innovations and changes in global demand that are currently occurring have a key role to play in European and national discussions on the allocation of science and technology resources, on access to and dissemination of knowledge, on innovation.

China has its own «Lisbon strategy» with its priorities and challenges. As noted above, emerging market governments, such as China, have sought to absorb advanced world technology, knowledge and talents by facilitating huge foreign investment and providing incentives for national and foreign firms to innovate. Similarly to the EU, the goals set out in the China National Innovation Strategy for 2006–2020 prioritize technological advancement, R&D activities at enterprises and creation of new knowledge. Political challenges in China considered for comparison with Europe will undoubtedly encourage the production and use of knowledge to compete with developed countries. In general, opportunities for comparative learning, sharing of experience and joint initiatives are important. In our opinion, the global challenges facing Europe require common solutions within the millennium goals: climate change and sustainable development, infant mortality, infectious diseases, HIV, poverty and malnutrition, urbanization and development.

References

1. Drucker, P. (2007). *The Age of Discontinuity: Guidelines to Our Changing Society*. Moscow: Williams, 336.
2. Arthur W. (1996). Increasing Returns and the New World of Business. *Harvard Business Review*, 100-109.
3. Freeman R. (2010). What Really Ails Europe (and America): The Doubling of the Global Workforce. *The Globalist*, URL: <https://www.theglobalist.com/what-really-ails-europe-and-america-the-doubling-of-the-global-workforce/>
4. Panchenko Yu. (2016). European Economy and New China – Who Wins, Who Loses. *Yevropeiska Pravda*, URL: <http://www.eurointegration.com.ua/articles/2016/04/8/7047446/>
5. Courela P. (2007). *The Lisbon Strategy and Foreign Policy: The Missing Link*, mimeo.
6. Rodrigues M. (2012). *The New Knowledge Economy in Europe*. Cheltenham, UK: Edward Elgar.
7. Communications from the Commission Europe 2020. (2010). A strategy for smart, sustainable and inclusive growth. Brussels, COM(2010) 2020, 32.
8. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of Regions. (2010). Europe 2020 Flagship Initiative Innovation Union. SEC(2010) 1161. Brussels, 8-10, URL: http://ec.europa.eu/research/innovation-union/pdf/innovation-union_communication_en.pdf#view=fit&pagemode=none.
9. Grueber M., Studt T. (2013). 2014 Global R&D Funding Forecast. *Battelle and R&D Magazine*, 36, URL: <https://www.battelle.org/docs/default-source/misc/2014-rd-funding-forecast.pdf?sfvrsn=2>
10. Muldur, Ugur, Corvers F., Delanghe H., Dratwa J., Heimberger D., Sloan B., Vanslebrouck S. (2006). *A New Deal for an Effective European Research Policy*. Dordrecht, the Netherlands: Springer.
11. Soete, L. (1997). The impact of globalization on European economic integration. *The IPTS Report*, 15, June, 21–28.
12. Georghiou, L. (2008). Europe's research system must change. *Nature*, 452, 935–936.
13. European Commission Press Release. (2013). Horizon 2020 launched with €15 billion over first two years. Brussels, 7, URL: http://europa.eu/rapid/press-release_IP-13-1232_en.htm.

-
14. Grueber M., Studt T. (2013). 2014 Global R&D Funding Forecast. *Battelle and R&D Magazine*, 36, URL: <https://www.battelle.org/docs/default-source/misc/2014-rd-funding-forecast.pdf?sfvrsn=2>
 15. Fedchenko A. (2016). Adaptation of Best International Practices in the Development of Business Incubators in Russia. *Problems of Economy and Management*, (5 (57)), 179-184, URL: <https://cyberleninka.ru/article/v/adaptatsiya-peredovogo-mezhdunarodnogo-opyta-v-razvitii-biznes-inkubatorov-v-rossii>
 16. Xue, L. (1997). A historical perspective of China's innovation system reform: a case study. *Journal of Engineering and Technology Management*, 14, 67–81.
 17. Thursby, J., Thursby M. (2013). Here or there? A survey of factors in multinational R&D location. Report to the government–university–industry research roundtable, *National Academy of Sciences, National Academy of Engineering, Institute of Medicine*. Washington DC: National Academies Press.

The article was received on October 10, 2019.