

**ECONOMIC TRANSFORMATION IN UKRAINE:
COMPARATIVE ANALYSIS AND EUROPEAN EXPERIENCE**

Composite scientific work edited by Piotr Głowski & Oleksii Kvilinskyi

Warsaw 2017

Reviewers

Kazimierz Pająk

Donat J. Mierzejewski

Proof-reader

Olga Fionik

Cover designer

Maksym Fomenko

Copyright © by **Institute for International Cooperation Development**

ISBN **978-83-944739-0-7**

Published by **Consilium Sp. z o.o.**

00-545 Poland

Warsaw, Marszałkowska 58

Tel. (0048) 730 74 48 84

E-mail: office@clmconsulting.pl

<http://clmconsulting.pl/>

Printed by **Kunke Poligrafia Sp. z o.o.**

88-100 Poland

Inowrocław, Magazynowa 27

Tel. (0048) 667 66 80 00

E-mail: bok@kunke.pl

<http://www.kunke.pl/>

Contents

Introduction	5
Oleksandr Amosha, Gennadiy Pivnyak, Vasyl Shvets, Danilo Cherevatskyi Autarchy vs. globalization in energy resources supply.....	6
Mykola Yakubovskiy, Viacheslav Liashenko, Bożena Kamińska, Oleksii Kvilinskyi Economy modernization of industrial regions (based on the example of Ukraine...)	12
Nadiia Shmygol Complex assessment of plant growing development in the regions of Ukraine to work out recommendations for institutional changes in agriculture.....	30
Olga Popova, Olena Tomashevskaya, Svitlana Popova Decision making based on the principles of sustainability for providing the profitable business activity.....	41
Sergey Kravchenko Scientific and educational complex of the economy as a basis for sustainable development.....	50
Mariya Khmelyarchuk Energy efficiency in the context of countercyclical regulation at the global and national levels.....	61

Sergii Ivanov, Vasyl Perebyynis, Valerii Havrysh, Yuliya Perebyynis	
Low-carbon economy: modern view on energy concept of Serhiy Podolynsky.....	79
Dmitry Lazarenko	
Economic approach to global energy trends.....	91
Nataliya Dalevska	
The institutional determinants of global economic development.....	100
Oleksandr Melnychenko	
E-money payments in sustainable tourism development.....	112
Grzegorz Kinelski	
Improvement of capacity market participants’ efficiency through the implementation of Shared Services Centres in the business.....	126
Wojciech Drożdż, Piotr Głowski, Marcin Pawlicki, Andrzej Midera	
Capacity mechanism as a potential instrument increasing energy security of the European Union.....	137
Viktor Kovalov, Sergii Burlutskiy, Svetlana Burlutska	
The “resources curse” phenomenon in context of socio-economic transformation of Ukrainian economy.....	147
About authors	156

Introduction

Modern development of the unitary states is the result of making use of considerable resources available to each economy. This implies a number of questions in the economic policy regarding how to utilize these resources rationally while maintaining them for future generations. This is a challenge for all those responsible for economic development, which enforces systematic reforms, equipping administration in management competence, rationalization of the legislation at central and local levels, and facilitating business.

The present monograph being problem structured involves important issues of transformation of the Ukrainian economy in various aspects of its functioning. Substantive development by Oleksandr Amosha, Gennadiy Pivnyak, Vasyl Shvets, and Danilo Cherevatskyi in this regard is presented in the material related to autarchy vs. globalization in energy resources supply (pp. 6-11). Mykola Yakubovskiy, Viacheslav Liashenko, Bożena Kamińska, Oleksii Kvilinskyi introduce the economy modernization of the industrial regions (based on the example of Ukraine) (pp. 12-29), while Nadiia Shmygol presents complex assessment of plant growing development in the regions of Ukraine to work out recommendations for institutional changes in agriculture (pp. 30-40). Of interest is also the chapter by Olga Popova, Olena Tomashevska, and Svitlana Popova concerning decision-making based on the principles of sustainability for providing the profitable business activity (pp. 41-49). It is complemented by an article by Sergey Kravchenko “Scientific and educational complex of the economy as a basis for sustainable development” (pp. 50-60).

In subsequent chapters, Mariya Khmelyarchuk discusses energy efficiency in the context of countercyclical regulation at the global and national levels (pp. 61-78), and Sergii Ivanov, Vasyl Perebyynis, Valerii Havrysh, and Yuliya Perebyynis present low-carbon economy: modern view on energy concept of Serhiy Podolynsky (pp. 79-90). In turn, Dmitry Lazarenko discusses the economic approach to global energy trends (pp. 91-99). Subsequently, Nataliya Dalevska gives characteristics of the institutional determinants of global economic development (pp. 100-111), and Oleksandr Melnychenko in his chapter “E-money payments in sustainable tourism development” presents the legal and financial regulations in tourism (pp. 112-125).

The role of the Shared Service Centres is analyzed by Grzegorz Kinelski (pp. 126-136). Energy security instruments are discussed by Wojciech Drożdż, Piotr Głowski, Marcin Pawlicki, and Andrzej Midera (pp. 137-146). Interesting analyses are presented by Viktor Kovalov, Sergii Burlutskiy, and Svetlana Burlutska in “The ‘resources curse’ phenomenon in context of socio-economic transformation of Ukrainian economy” (pp. 147-155).

Warsaw, January 2017

Piotr Głowski, Oleksii Kvilinskyi

Oleksandr Amosha
Gennadiy Pivnyak
Vasyl Shvets
Danilo Cherevatskyi

AUTARCHY VS. GLOBALIZATION IN ENERGY RESOURCES SUPPLY

The problem of meeting the needs of national economy in energy resources is topical for most of the countries including those possessing substantial natural resources. At certain historical moments the matter of choosing the most acceptable model of resource supply was the matter of paramount importance. They varied from model of complete self-sufficiency (autarchy) to total import of fuels. For example in the times of the former USSR there were plans of practically complete cessation of mining in Donbass region. It was supposed to meet the requirements of Ukraine in energy resources by increasing supplies of Siberian natural gas and coal from Kuznetsk Basin [Styrikovich, Sinjak 1986].

Geological conditions of Donbass are very unfavorable for coal mining. More than 80 % of coal reserves are concentrated in gas-bearing and very deep horizons. In the majority of countries such deposits are not developed since it is uneconomical. This fact as well as worn-out capital assets of the Ukrainian coal mining industry predetermines low coal mining production profitability here. At the same time coal is the only energy source which is in plenty in Ukraine. Its production is considered a matter of energy security and energy independence of the country. In many cities coal mining is the main occupation of employable population. Local mines are the main source of city budget revenue. This explains popularity of autarchy ideas, especially ‘coal instead of natural gas’ one. In this regard the slogan put forward by a former coal minister of Ukraine N. Surgai is often cited: ‘Coal will save Ukraine if Ukraine saves coal’ [Surgai 2005]. An appeal of German coal miners: ‘Power security of the country is impossible in the absence of the domestic coal mining’ [Horn 1989]. is also used to support autarchy ideas.

There are also a number of people who support the prevailing use of imported energy resources. One of CEO from System Capital Management says that it is more profitable for companies who own coke and by-product plants to purchase a high-grade Australian coal at \$110/ton on FOB basis, rather than invest hundreds of million hryvnas in domestic production of coal, the cost price of which will finally \$90/ton [Karpenko 2007]. In 2006 the import of coal increased to 8.4 million tons compared to 7.0 million tons in the previous year. During 2007 import of coal reached 9.0 million tons. The further increase of coal imports is restrained only by the absence of deep-water ports in Ukraine.

The arguments in favour of various power supply models are properly substantiated. But all of them leave no room for compromise. That’s why it is

reasonable to examine the prevalent world tendencies in this sphere and try to determine the most rational solution.

As far as in autarchy environment one has to rely on available enterprises and deposits, the efficiency of which leaves much to be desired, it is reasonable either to restrict their production performance due to economic considerations, or to neglect the economic considerations and perform with high workload, e.g. in the state energy security interest. The prominent representative of the Ukrainian coal miners Zvjagil'skii E. reckons that the state coal industry must be deeply modernized to provide the whole country with competitive coal [Zvjagil'skii 2011].

The possibility of sufficient reduction of natural gas consumption in Ukraine in favor of coal fuel usage with the help of new Chinese technologies (coal gasification and water-coal suspension) is being under consideration nowadays. Such an attempt on the coal-gasification technology platform of the Lurgi firm failed in the mid 90-s due to relatively expensive domestic coal and cheap Russian natural gas. At present the situation is different, but very dynamic: innovative technology of shale gas extraction designed and implemented into practice late in the first decade XXI century by the American company “Chesapeake Energy”, led to “quiet revolution” on the natural gas markets. According to British Petroleum data [British Petroleum 2012] in the USA the extraction of gas increased from 468 to 592 m tons o.e. (oil equivalent), i.e. by more than 26% over quite a short period of time; consumption increased from 569 to 626 m tons o.e. (by 10%). In gas fuel production in 2009 the USA outran Russia and the price decrease in 2012 amounted nearly 4 times in comparison with price maximum in 2005 [The Economist 2012]; in the USA there is no affixment of gas prices to oil prices as it is in use in Europe. By the end 2011 the price on gas on the domestic market in the USA was 3 times lower than in Europe and 6 times than in Japan [Ugol' 2012b]. While new technologies of coal processing including construction of the appropriate plants are implemented in life, they can become economically inconsistent. Approximately such a situation emerged with the terminals on natural gases liquefaction in Arab countries: shale gas affected their efficiency very much.

At the same time, when studying the weak points of autarchizm, we can not ignore the current economic situation in the world energy markets such as the “Chinese factor” on the coal markets and deteriorating quality of the traditional oil and gas deposits [Lis, Mazurkiewicz, Pająk 2015, pp. 181-202].

That's why even globalization which is an inherent feature of the modern world did not turn autarchy into an obsolete notion.

On the contrary in pre “shale revolution” period numerous economic publications warned of a possibility of self-sufficient economies revival. This matter is described in the works of a number of analysts such as L. Badaljan. and V. Krivorotov [Badaljan, Krivorotov 2008], S. Tolkachev [Tolkachev 2010], etc.

The world coal market is regulated: its segment covering Asia and Pacific region which is a sphere of influence of Japanese, Korean, Indian and Taiwan corporations consumes mostly the coals supplied from Australia, Canada and Russia and to a lesser extent from South Africa. Supplies to the European (Atlantic) segment of the coal market are effected mostly from South Africa, Columbia, Venezuela, USA and to a lesser extent from Australia.

The overall capacity in the Asian segment of the world coal market is twice as much as of a European segment.

A sharp increase in coal consumption in China, and especially turning China from a coal exporter into a net importer changed the traditional coal trade scheme drastically. China exported 102 million tons of coal in 2004. In 2006 it reduced its exports to 63 million tons still remaining the fifth largest coal exporter in the world. But in 2007 China stopped exporting coal. During the same year it imported 38 million tons of coal.

The abrupt change in the Chinese export-import activities had a double effect on the world coal market since in the absence of coal exports from China the situation was aggravated by the Chinese aggressive import policy. Traditional coal trade schemes turned out to be inadequate in a new economic situation.

As a way out in a new economic situation many companies resorted to forming their own coal sectors abroad. Along with the traditional coal trade which was flourishing in the near past coal mining enterprises are also in a great demand. Being formally an imported product coal serves as a means of achieving self-sufficiency of the Customers and is used for covering their own production needs. By the year 2003 the German concern RAG owned 16 mining enterprises through its subsidiary RAG Coal International. Out of them 13 were situated in USA, 2 – in Australia and 1 – in Venezuela. In 2002 they mined totally 70 million tons of coal. This forms an example of another scheme of coal business.

At the same time the metallurgical and energy companies follow the absolutely different trend. They started creating a sort of vertically integrated structures. Alliance between an Australian raw-materials concern BHP Billiton and Japanese Concern Mitsubishi which comes under the abbreviation BMA can be taken as an example of such structure. Or the Australian subsidiary of the Swiss corporation Xstrata the fifth largest coal mining corporation in Australia owns a number of enterprises in a partnership with many Japanese companies. In the same way share packages of Bulga complex (opencast and underground mines near city Bulga) are owned by Nippon Steel, Nippon Oil and few other Japanese corporations.

The practices of purchasing coal mining enterprises abroad initiated by Japanese and Korean metallurgical companies were adopted later by many corporations. The European concern Arcelor Mittal became one of them after having purchased a number of enterprises in USA, Russia, South Africa and Australia.

While integration reasons of Japanese and Korean steel making companies are quite clear, desire of Australian coal mining companies for partnership is substantiated mainly by necessity to attract new investments. Own assets of Xstrata Coal in its enterprises in Australian Queensland constitute from 55% to 75%, the rest is owned by its partners. Direct foreign investments are the main driving force in the development of coal mining industry not only in Australia but in the other countries as well.

The place of the country in the world economy is determined among the other factors by the activities of transnational corporations based on its territory. As is indicated in publications [Pankevich 2012; Atabyekov, Amosha, Cherevatskyi 2012; Amosha, Kharazishvili, Liashenko, Kvilinskyi, 2016; Pająk, Dahlke, Kvilinskyi 2016 Pająk, Kamińska, Kvilinskyi 2016, pp. 204-217], nowadays not the corporations bear expenses connected with the attempts to enter this or that new regional market but the governments of the countries act as market agents competing with each other in an attempt to attract new businesses. 'The world economic system is no more the market of competing corporations. It turns into the world of competing national bureaucracies'.

Possession of foreign assets allows achieving fundamentally new economic goals. Combining under one ownership of power stations and foreign energy assets allows neutralizing the negative effects of devalued national currencies. What is profitable for the exporter may turn into a disaster for the importer. Devaluation of hryvna makes it unreasonable to import energy resources. Just the other case is when you mine the coal abroad and supplies it to your own power stations.

The operations of the Japanese corporation J-Power can be taken as an example of such use of foreign sector. Super size ships deliver to Japan annually around 9 million tons of coal mined at the Australian enterprises of Idemitsu Australia Resources to process it at the power stations of the parent company.

While Russian energy resource companies enjoying huge energy resources of their own country are not striving for coal supply diversification from foreign sources, the Chinese and Indian transnational corporations are leading a cut-throat struggle trying to seize new prospective deposits all over the world. The geography of the Chinese CNPC expansion spreads over new regions of Africa (Algeria, Mauritania, Guinea, Niger, Nigeria, Chad and Sudan). It also has its subsidiaries in Canada, Venezuela, Peru, Oman, Syria, Iraq, Iran, Thailand and Indonesia. Besides, CNPC and other Chinese transnational corporations compete on a wide scale with the Russian investors in the Central Asia. India ONGC also grows more and more by purchasing assets abroad [Kuznecov 2012].

Foreign sector exists in Ukraine as well. For example, corporation System Capital Management owns coal mining company in Appalachians (USA), holds talks on purchase of coal mines in the Russian part of Donets Basin, etc.

Corporation “Donetskstal-Metallurgical Plant” till recently owned steam coal producing mines in Kuznetsk Basin. But the produce of these mines was not in demand in Ukraine energy sector.

The lack of interest to the foreign coal sector in our country is based mainly on the sentiments of the Ukrainian government desiring to achieve the highest possible degree of self-sufficiency in energy sector. These sentiments are favored by management of big state enterprises and owners of private mines, which are not a part of any business-groups.

Blocking of import of coal to Ukraine is in the interests of coal mining enterprises, coal mining regions and coal mining industry on the whole. But all these micro- and mesoeconomic advantages may finally turn into disadvantages in macroeconomics: the Ukrainian coal is costly in production; it has poor energy characteristics, low acceptability from the ecological point of view. The major part of capital assets of the Ukrainian coal mining industry can not survive without a massive state support.

At the same time the denial of autarchizm does not mean the call for cessation of the national coal mining and state protectionism of the industry. The accident which happened at the Russian coal mine “Raspadskaya” in May 2010 was immediately followed by the Russian government’s measures to limit export of coking coal. By the way these measures aimed at stabilizing the Russian internal market were equally introduced for the traditional coal traders like "Severstalgroup" as well as for such companies like "Evrazgroup", which owns metallurgical plants in Ukraine.

It is clear that in order to have a sort of safety margin in the modern world the Ukrainian power industry needs to develop both national and foreign coal mining sectors. And the correctly balanced combination of both of them can be considered a required compromise.

References

1. Amosha, O., Kharazishvili, Y., Liashenko, V., Kvilinskyi, O. (2016) *Economic security of sustainable development of the regions (based on the example of the Donetsk region)* w: (red.), *Gospodarka niskoemisyjna i jej wplywa na rozwój województwa wielkopolskiego*, Wydawnictwo Naukowe PWN, s. 19-34.
2. Amosha, O, Atabyekov, O., Cherevatskyi, D. (2012). *Autarchy or denationalization of energy resources supply? Globale und länderspezifische sozio-ökonomische Effecte*. Berlin: Forschungsinstitut der Internationalen Wissenschaftlichen Vereinigung Weltwirtschaft und Weltpolitik, pp. 359-366.
3. Badaljan, L., Krivorotov, V. (2008). *Rossija v XXI v. – sverhderzhava ili postavshik syr'ja Zapadu? Vychod mezhdru yekonomikoi proficitov i osvoeniem svoei zony. Yekonomicheskie strategii. 1*, 12-21.

4. British Petroleum. (2012). *Statistical Review of World Energy 2012*. Retrieved from <http://www.bp.com/productlanding.do?categoryId=6929&contentId=70446> 22.
5. Glyukauf. (2004). Process prevrashenija imushestva koncerna "RAG" idet uspešno. *Glyukauf*, 1, 2.
6. Horn H. (1989) Nadezhnost' yenergosnabzhenija nemyslilima bez opory na sobstvennyi ugol'. *Glyukauf*, 23/24, 6-9.
7. Karpenko, G. (2007). "Pavlogradugol': snachala yenergetika, potom metallurgija. Retrieved from <http://www.ugmk.info/print.php?art=1176812484>.
8. Kuznecov, A. (2012). Transnacional'nye korporacii stran BRIKS. *Mirovaja yekonomika i mezhdunarodnye otnoshenija*, 3, 3-11.
9. Lis, P., Mazurkiewicz, J., Pająk, K. (2015). Droga Chin do gospodarki niskoemisyjnej, w: Marszałek-Kawa, J., Pająk, K., (red.), *Polityka energetyczna państw Azji i Pacyfiku*, Wydawnictwo Adam Marszałek, Toruń, s. 181-202.
10. Pająk, K., Dahlke, P., Kvilinskyi, O. (2016) Determinanty rozwoju regionalnego - współczesne odniesienie. *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy*, 9, 109-122.
11. Pająk, K., Kamińska, B., Kvilinskyi, O. (2016). Modern trends of financial sector development under the virtual regionalization conditions. *Financial and Credit Activity-Problems of Theory and Practice*, 2(21), 204-217.
12. Pankevich, N. (2012). TNK: grazhdansko-politicheskii kontrol' v uslovijah denacionalizacii. *Mirovaja yekonomika i mezhdunarodnye otnoshenija*, 3, 34-42.
13. Styrikovich, M. A., Sinjak, YU. V. (1986). Issledovanija dal'nih perspektiv razvitija yenergetiki. *Vesti Akademii nauk SSSR*, 4, 46-54.
14. Surgai N. (2005). *Perspektivy i napravlenija razvitija ugol'noi promyshlennosti Ukrainy. Yenergeticheskaja politika Ukrainy*. 1, 46-48.
15. The Economist. (2012). *Natural gas. Shale of the Century. The "golden age of gas" could be cleaner than greens think*. Retrieved from <http://www.economist.com/node/21556242>.
16. Tolkachev, S. (2010). Poisk modeli neoindustrializacii Rossii. *Yekonomist*, 12, 26-43.
17. Ugol'. (2012). Slancami po atomu. *Ugol'*, 6, 93.
18. Zvjagil'skii, E. L. (2011). Modernizacija ugol'noi promyshlennosti: koncepcija i osnovy strategii. *Gazeta 2000*, 27.

Mykola Yakubovskiy
Viacheslav Liashenko
Bożena Kamińska
Oleksii Kvilinskyi

ECONOMY MODERNIZATION OF INDUSTRIAL REGIONS (BASED ON THE EXAMPLE OF UKRAINE)

The economic nature of modernization in dialectical terms is determined by the progress of society and change of its material basis, i.e. technical, technological and economic bases.

Recently, modernization has obtained a widespread scientific recognition as a contemporary institution for solving structural and technological problems of the economy. However, its use in practice needs the theoretical foundations of the interrelations both with the basic economic theory, and with the specific objectives of industrial policy to be deepened.

This is because industrial policy has always appeared in two contexts. In practical context, it is a system of standpoints and specific actions towards the development of industry, specific industries and enterprises, including goals, objectives and methods of their achieving. In theoretical context, it is an economic category that determines the most important correlations of government, business and society in relation to meeting the needs of the society, the formation of an effective structure of industry, growth of technological level, innovation and industrial competitiveness, but without any impact on specific companies.

In modern scientific practice, such a dualistic interpretation has gained its definition as vertical and horizontal industrial policies. The European Commission, as the highest executive body of the EU, gives preference to industrial policy of horizontal type, i.e. institutional activities of problem solving, making an accent on the fact that government intervention in the market mechanism is justified only when there are significant market failures [Lyashenko 2014]. Under these conditions, modernization reflects not only the general nature of the changes: "renewal" and "improvement", but also the nature of interaction between economic subjects and society, aimed at the implementation of industrial policy, forming a kind of institutional platform of complex solutions to the problems of innovation, efficiency and competitiveness.

This is especially true for the following industrial regions: Dnipropetrovsk region, whose share in the total volume of industrial production reaches 19.2% (data for year 2015), Donetsk region (11.4%, excluding the temporarily occupied territories), Zaporizhia region (8.7%), Poltava region (7.2%), Kharkiv region (6.8%). Close to them are Kyiv region (4.6%) and Luhansk region (1.7%), whose share in the total industrial production although somewhat lower (in the first case because of the peculiarities of business registration; in the second because of the annexation of a part of the territory), but remains quite significant in the overall

structure of the industrial complex of Ukraine. The above-mentioned regions account for nearly 2/3 (59.7%) of industrial production of the country.

System crisis has exposed serious imbalances in the structural and technological systems of the industry, which have recently been looked at even as a de-industrialization trend. Under such conditions, the emphasis of industrial regulation began to shift towards structural and technological change, which allows to consider modernization, as a tool of industrial policy, a manifestation of industrial policy in its dual sense, elements of which may be the measures of both vertical action (changing sectoral structure of production) and horizontal impact, namely stimulation, crediting or taxation. Thus, at certain stages of industrial policy implementation, modernization may have various forms of system definition, based on the conditions, status and problematic displays of the nature of industrial development.

As for the economic modernization of industrial regions, it must be taken into account that its challenges are of general economic origin, but they are materialized at the regional level, significantly affecting the overall condition of both national and regional economy.

The economy of industrial regions is significantly deformed, whereas the following structural contradictions have become critical: small and further declining share of high-tech product types; breaches of technological chains; creation of added value through reduction of the final product output; strengthening of raw material and semi-finished products structure of production.

The economic nature of the structural transformations as a key impact factor on the status and quality of economic processes has received a scientific basis in the works of many scientists and economists. S. Kuznets, a Nobel laureate, pointed out that structural change is a prerequisite for economic growth and, having begun, it further forms, hinders or supports economic development of a country [Kuznets 1969].

On the basis of his theory of cycles, M. Kondratiev identified three types of economic balance violations that are based on structural changes. If fluctuations in the production structure do not change the overall spectrum of production, but only constitute a temporary manifestation of slowing down or acceleration of the development of certain sectors (activities types) influenced by market conditions, he has defined them as a violation of the "first order", the time lag of which corresponds to the short-term business cycle and equals to 3-3.5 years.

Fluctuations in the volumes and flows of capital across sectors and economic activities arousing within a medium-term cycle were referred to by Kondratiev as violations of the "second order". Their consequences are the corresponding changes of inter-sectoral supply and demand; and equilibrium is achieved at a different level of production and consumption. However, even by this form of imbalance, according to him, the volume of productive forces remains unchanged.

The most radical changes in the structure of the economy he attributed to the violations of the "third order", claiming scientific and technological progress to be their stimulant, affecting all production factors and being accompanied by corresponding changes in technological, resource, organizational, infrastructural and social support of production [Kondratev 2002].

Joseph Schumpeter linked the violations of the "third order" directly with the innovative factors. Innovation, as defined by him, is "a new combination ... in economy, art, science, practical life" [Shumpeter 1988].

Indirect, but equally dangerous consequences of structural problems are: strengthening of the raw material profile of production, dependence growth of the regions upon the world market conditions, increased power-intensity of production compared with that in the European countries, and a limited economic impact of the industry on economic development due to small reproductive function of raw material production in the creation of GVA (Gross Value Added).

Since the last quarter of the past century, the developed countries of the world have been showing a revolutionary structural change, forming their own economies of innovational type. Ukraine, although making an accent on its commitment to radical structural changes, shows many signs of a contrary content. In fact, deindustrialization of the country is in place. The share of industry in GDP shortened from 34.4% in 2000 to 22.4% in 2010, and 19.8% in the 2014. The volume of industrial production during the span of 25 years of economic transformation has fallen by almost a third (28.7%). The number of employees has reduced by half (by 44.12%): about 2 mln. employees have been fired. The entire industries have been lost, particularly those belonging to innovative range of activities, namely electronics industry, instrument engineering, machine tool construction, machine instrument engineering, production of agricultural machines, special types of machinery for the mining industry, chemical and metallurgical industries.

We can assume that Ukraine nearly lost the industrial platform, based on which the economy of innovative type is able to develop. Mechanical engineering as a major supplier of innovative changes underwent a decline to 10.2% (2015) in the structure of manufacturing industry, while in economically developed countries, its share is 3 to 4 times larger (29.8% in the UK, 27% in Italy, 48.2% in Germany, 32.1% in the USA, 27.9% in France, 44.4% in Japan). The share of mechanical engineering indicates the degree of industrial development. In Ukraine, it is extremely low, and this creates a serious problem, because innovations need somewhere to mature and be applied. In isolation from the industrial base and from production, and hence from qualified personnel, innovation as such cannot exist.

This problem has affected even the developed countries that have recently yielded in their pace of development to the developing countries. Young "industrial tigers" having recently adopted modern technologies from the developed countries have created a necessary innovative base for industrial

development, which has allowed them to progress at a faster rate. Ukraine, unfortunately, has been late in lending advanced technologies and production on terms of transfer. Now this process can be somewhat complicated because the developed countries have begun to return high-tech productions to their own territories not to lose the industrial base for economic development. We can assume that they will not be too willing to give away not only those new projects, but also projects that have already been implemented, but retain leadership in global markets. However, this should not frighten us, because in terms of European integration certain European countries will prompt to us and help us find a technology niche in the process of modernization, because someone has to "pull the chestnuts out of the fire" on behalf of the developed economies. This destiny, unfortunately, will be true for Ukraine. In this case, all we can wish is that such "chestnuts" were more "high tech" than the existing raw materials specialization.

The current crisis - its first wave (2008-2009) and second wave (2012-2015) - is a direct manifestation of an additional confirmation of so-called raw material sickness of Ukraine. Both the scientific opinion and economic practice with each new wave of critical fall have repeatedly linked the economic pulse of Ukraine with the global market situation in raw material markets. In "The Mirror of the Week" № 1 (247) dd. 16 January 2016, S. Korablin gives his professional opinion on this issue, claiming that "the decline in production, depletion of public finances and currency market along with three-time devaluation of hryvnia are a direct result of our raw materials economy" [Korablin 2016]. This is one of the main contradictions of Ukrainian industry, which is associated with low levels of technological structure, disintegration of technological processes with the loss of the most productive stages, i.e. output of the final product, and consequently hypertrophied dependence on external markets situation.

There are the following modern industrialization models [Lyashenko, Kotov 2015]:

- **"traditional industrialization"** with the prevalence of extractive industries, heavy and low-tech mechanical engineering with the technologies mainly of the 3rd and 4th paradigms and attempts to upgrade them to meet the modern market challenges with the purpose of maintaining competitiveness;

- **"necro-industrialization"**: a state of industries with the technologies of the 3rd and 4th paradigms that are experiencing de-industrialization processes, relatively speaking, of the first type, i.e. the reduction of production capacities resulting from their physical wear and absence of market demand for products;

- **"postindustrialization"**: transition to the prevalence of technologies of the 5th paradigm, which is accompanied by the process of de-industrialization, relatively speaking, of the second type, namely transferring abroad low-tech industries (offshoring), introduction of up-to-date high-tech production facilities oriented at the output with high share of added value, informatization of society, development of modern science-intensive service sphere;

– **“neo-industrialization”**: transition to technologies of the 6th paradigm accompanied by the production of high added value products, which is characterized by individualization, nano-miniaturization, introduction of biotechnologies and cognitive technologies, development of 3D-printing, by means of re-industrialization (reshoring), i.e. an increase in the national economy of jobs based on these technologies mainly in small and medium businesses.

Interaction of the above models is shown in Figure 1.

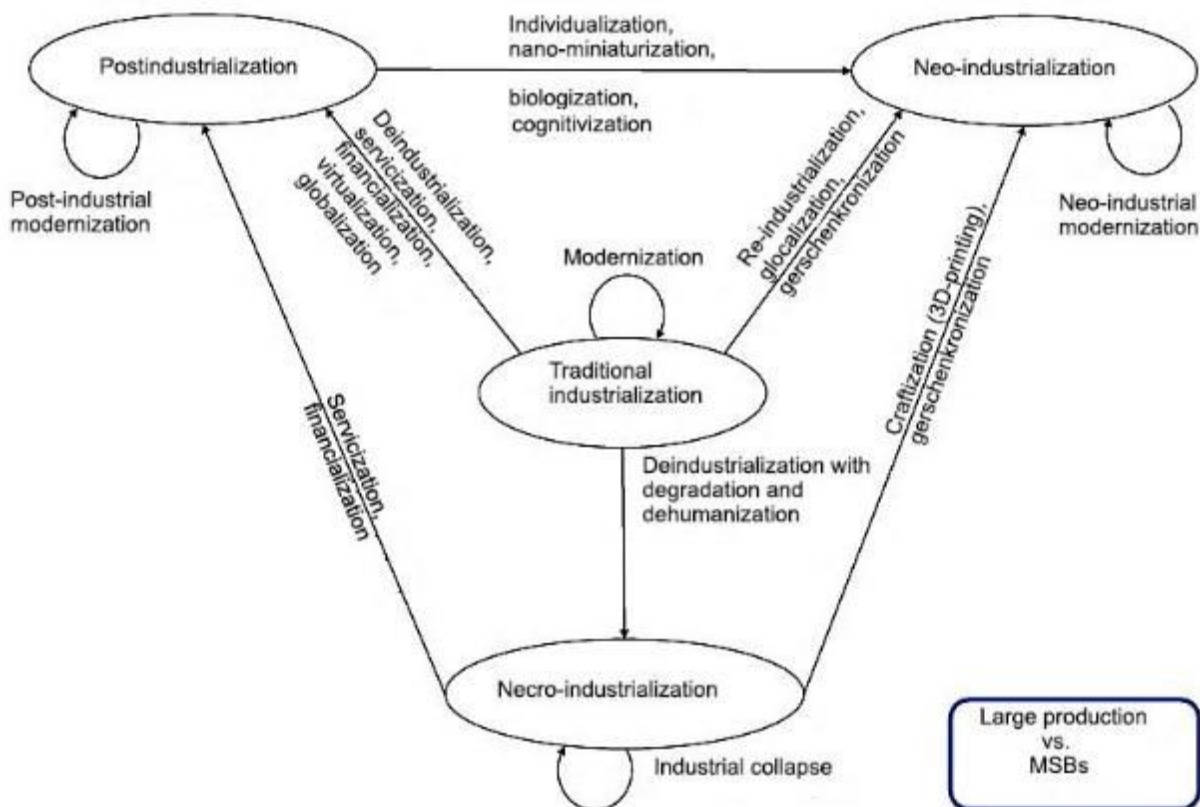


Figure 1 – Interaction of modern models of industrial development

Source: advanced by authors grounded on [Lyashenko, Kotov 2015]

As noted by Y. Kindzerskyi: "The restructuring of industrial production requires appropriately coordinated management decisions, resources and time. Therefore, it should be carried out based on government strategic planning. It involves the development of a system of long-, medium- and short-term forecasts, determining of a number of closely related objectives of socio-economic development and the development of the first, second and third orders, development of long-term concepts, medium-term programs and indicative plans, foundation of institutions for arrangements and implementation of set tasks, establishing of control methods and accountability mechanisms for achieving the intended results" [Kindzerskyj 2013, p. 532].

At present, a new technological system is in transit from the embryo development stage to the phase of growth. Its expansion is restrained by its small

scale as well as defectiveness of corresponding technologies and unpreparedness of socio-economic environment to their widespread use. However, despite the crisis, the expenditures on development of new technologies and scale of their applications are growing at a rate of about 20 to 35 percent annually. The further unfolding of the crisis will be determined by a combination of two processes: destruction (replacement) of the former technological system structures and the formation of new structures. The combination of works along the chain of product life cycle (from basic research to appearance at the market) requires a certain time. Those, who are able to overcome this road quicker and produce a product in a greater volume and of better quality, win the market. The quicker the financial, economic and political institutions re-adjust themselves to meeting the needs of developing brand-new technologies, the earlier the rise of a new longer wave will start. This will change not only the technological structure of the economy, but also its institutional system and structure of leading companies, nations and regions. Success will accompany those who are able to enter the growth trajectory of a new technological paradigm in the shortest time and invest in the components for its production at earlier stages. While the entrance for those who are late will become more expensive with every year, and will be closed with the achievement of maturity phase.

Industrial regions as major media of the industrial brand of Ukraine inherited their basic structural problems, though each of them has its own structural and technological peculiarities and features of economic development, which in each case has to determine the regional nature of modernization strategy.

According to their sectoral structure, industrial regions can be divided into two groups: to the first group belong Dnipropetrovsk, Donetsk, Zaporizhia and Luhansk regions: these are the regions with a prevailing share of the mining and metallurgical industry. The dominant sectors respectively are mining and metallurgical industry (Table 1). The second group comprises Poltava, Kharkiv and Kyiv regions: these are regions of the processing profile and domination of the food industry and mechanical engineering. Their profile orientation creates them more favourable modernization conditions due to a possibility to use existing technology base for the development, while the technological structure of enterprises in the first group hardly provides any prospects for development, remaining conservative because of the raw material factor. Their export orientation in the main heading – non-precious metals - is respectively 81.7%, 89.5, 74.6 and 56.9% (Table 2).

Equally problematic position of foreign economic relations of the industrial regions is import, mainly of high-tech products, which are not manufactured in Ukraine. The demand for machinery has become particularly acute, as it is needed not only for maintaining existing productions, but also becomes a key factor of technological development and economy modernization.

Table 1 - Branch structure of the main economic activity types of industrial regions in Ukraine, % ¹

	Code according to Classification of economic activity types	Dnipropetrovsk region	Donetsk region	Zaporizhia region	Poltava region	Kharkiv region	Kyiv region	Luhansk region
Extraction of raw materials of materials of natural origin	B	25.6	15.7	3.2	28.2	9.5	0.7	17.7
Materials of industrial processing (16-18, 19, 20, 21, 22-23, 24-25)	C	46.6	49.2	44.6	26.5	20.7	33.8	47.5
out of which: metallurgic production	24-25	35.3	38.4	35.4	0.8	3.2	5.5	30.9
Production and distribution of energy resources	Д	14.9	19.5	23.6	7.8	19.1	23.1	17.8
Food production	10-12	7.8	9.2	9.2	27.3	30.9	33.4	3.8
Textile production	13	0.3	0.1	0.2	0.3	1.3	0.8	0.6
Mechanical engineering	26-30, 31	4.8	6.3	19.2	9.9	18.5	8.2	12.6

¹ Activities that are dominant in the regions are **highlighted**

Source: author's calculations according to the data of regional statistical offices in January-November 2015

In Dnipropetrovsk region, for example, import of engineering products exceeds production by almost 1.4 times. Much more vulnerable to import expansion are textile markets (Dnipropetrovsk region: imports exceed its own production by 1.8 times, Zaporizhia region: 2.4 times, Poltava region: 2.6 times), polymer materials (Dnipropetrovsk region: 80.8 % Poltava region: 79.1%, Kharkiv region: 79.1%, Luhansk region: 2.3 times), chemicals (Dnipropetrovsk region: 64.72%, Poltava region: 1.7%, Kyiv region: 4.2 times).

Unbalanced structure of export-import relations turned into the main absorber of the country's foreign exchange reserves. The negative balance reached a volume that is threatening to the economy (Table 3). The crisis slightly calmed down the negative balance, but the currency deficit turned into a detonator of critical processes. This situation is quite predictable, because Ukraine, in order to release industrial product worth 1 UAH, in 2015 had to buy imported goods worth 0.53 UAH, and in 2012 this figure was even 0.77 UAH.

Table 2 - Proportions of foreign trade of the industrial regions by major groups of industrial products, %

	Dnipropetrovsk region	Donetsk region	Zaporizhia region	Poltava region	Kharkiv region	Kyiv region	Luhansk region
Total ¹	78.1 / 37	60 / 19.8	64.8 / 24.2	28.8 / 20.3	21.7/31.2	29.5 / 86.3	23.5 / 37.9
Ready food products	13.6 / 6.3	6.7 / 6.7	13.9 / 1.6	17.3 / 8.5	21.6 / 13.4	17.0 / 14.0	14.2 / 1.1
Chemicals	47.6 / 64.7	Lack of data	79.6 / 54.3	67.3 / 175.7	19.4 / 65.3	46.8 / 417.2	10.4 / 22.2
Polymers	16.3 / 80.8	15.0/33.6	16.5 / 41	41.9 / 74.3	29.3 / 79.1	21.0 / 54.4	64.0 / 233.7
Textile goods	75.8 / 180	19.4/87.1	36.3/237.9	258.4/258.4	68.3/118.7	125.0/432.3	212.5/295.8
Non-precious metals	81.7 / 6.1	89.5 / 3.3	74.6 / 9.8	71.7/126.4	43.1/81.8	45.4/123.0	56.9 / 1.5
Mechanical engineering	65.4/136.8	61.4/24.0	92.9/26.8	43.6 / 30.8	69.7 / 45	60.0/313.4	20.7 / 48.9

¹ Numerator: export orientation of production, denominator: import dependence of production, %

Source: authors' calculations according to the data of regional statistical offices in January-September 2015

Table 3 - Dynamics of Ukraine's foreign trade: goods of industrial group (billions of US\$)

	2007	2010	2011	2012	2013	2014
Export	45.2	44.0	58.6	54.4	49.8	50.4
Import	58.6	57.4	79.3	80.1	72.0	51.0
Balance	-13.4	-13.4	-20.7	-25.7	-22.2	-0.6

Source: calculations in accordance with the data of the State Statistics Service of Ukraine

According to our estimations, industrial regions in general in 2015 are expected to have a positive balance, but in Kharkiv, Kyiv and Luhansk regions, the balance will remain negative (Table 4). The main export positions in these regions are food industry and mechanical engineering products. Due to the European integration and complication of economic relations with Russia, they

are currently engaged in the search for new markets and currently have no significant export offer.

Table 4 - Volume of foreign trade of the industrial regions: goods of industrial group, 2015 (millions of US\$)

	Dnipropetrovsk region	Donetsk region	Zaporizhia region	Poltava region	Kharkiv region	Kyiv region	Luhansk region	Total
Export	6071.0	3631.7	2561.5	1211.0	964.8	882.6	248.7	15571.3
Import	3154.0	1190.2	969.9	904.8	1208.4	3332.3	316.2	11072.8
Balance	2917.0	2441.5	1591.6	309.2	- 243.6	- 2249.7	- 67.5	4498.5

Source: authors' calculations based on the data of regional statistics offices of the State Statistics Service of Ukraine for the year 2015.

With the raw material disease, we associate technological backwardness of the industrial regions. Their industrial structure formed in the middle of the last century. For the years of independence, Ukraine has failed to make any qualitative changes. Today, the structure of industrial production and its technological level look worse than at the beginning of transformational change.

Nearly all industrial regions, forming the whole general condition of the country's technological structure, consist of technologies of medium low and low levels on 9/10.

Zaporizhia and Kharkiv regions, compared to other regions, can be considered technologically more advanced, because they have the largest share of productions of medium high and high technological levels: mechanical engineering and pharmaceutical industry, representing the 5th technological paradigm (Table 5).

Structural imperfection and critical decline of production are the links of the same chain. What shall we start forming a modernization strategy with? Unfortunately, Ukraine has no time for choosing. In our situation, we should simultaneously improve the structure and implement anti-crisis measures.

Critical decline in production equally hit all industrial regions. For the years 2012-2015, due to the traditional critical processes – fall of demand, lower prices, currency fluctuations, and deterioration of credit conditions - the loss amounted to 26%, or annual average of 7.5%, of the volume of industrial production. This factor itself does not create a critical situation. The crisis has a cyclic character and once started, it must end. The situation is worsened by stagnation, when the economy is not dead, but is not alive as well.

Table 5 - Technological level structure of the industrial regions according to activity types, %

Technological level	Ukraine	Regions						
		Dnipropetrovsk	Donetsk	Zaporizhia	Poltava	Kharkiv	Kyiv	Luhansk
High	1.6	0.1	0.1	0.9	0.2	3.2	2.2	2.1
Manufacture of computers, electronics and computer facilities	0.6	0.1	0.0	0.7	0.1	1.0	0.8	1.8
Manufacture of basic pharmaceutical products	1.0	0.0	0.1	0.2	0.1	2.2	1.4	0.3
Medium high	10.1	6.3	6.9	16.9	10.2	15.8	7.5	21.4
Manufacture of electronic equipment	1.5	0.6	1.6	4.6	0.5	4.5	2.0	0.1
Manufacture of machinery and equipment not included in other groups	2.3	1.1	3.4	1.6	1.9	6.6	1.8	0.6
Manufacture of vehicles	2.8	1.6	0.4	9.0	6.9	3.3	1.4	11.0
Manufacture of chemicals	3.5	3.0	1.5	1.7	1.4	1.4	2.3	9.7
Medium low	35.2	70.6	64.1	45.4	52.8	22.9	22.4	60.4
Metallurgic production	16.6	37.7	41.7	35.4	0.8	3.2	6.5	38.2
Manufacture of charred coal and oil refinery products	3.3	1.7	6.1	4.4	22.9	3.6	0.1	3.0
Extraction industry and surface mines exploitation	10.8	26.8	14.3	3.2	28.2	9.5	0.7	18.4
Manufacture of rubber and plastic items and other non-metal mineral products	4.5	4.4	2.0	2.4	0.9	6.6	15.1	0.8
Low	53.1	23.0	28.9	36.8	36.3	58.1	67.8	16.1
Food, drinks and tobacco production	21.2	8.3	7.2	9.2	27.3	30.9	38.1	1.2
Textile production, manufacture of clothes, leather and other materials	0.8	0.3	0.2	0.2	0.3	13	0.7	0.2
Timber and paper production, printing	3.1	1.5	0.5	0.5	0.4	3.7	9.4	5.1
Manufacture of furniture and similar items	2.1	1.7	2.0	3.3	0.5	3.1	2.7	0.8
Supply of electricity, gas, steam and air	24.6	9.5	17.0	22.8	7.3	17.5	15.7	8.2
Water supply, sewage, waste treatment	1.3	1.7	2.0	0.8	0.5	1.6	1.2	0.6

Source: authors' calculations based on the data of the State Statistics Service of Ukraine

Table 6 - Industrial products indices of Ukraine's industrial regions

	2010	2011	Period		2012	2013	2014	2015	Period 2012- 2015	Approximate evaluation of the recovery term needed for restoring production to the average rates of the years preceding crisis
			2010- 2011	Average annual						
Ukraine	111.2	108	120.1	109.6	99.3	95.7	89.9	87.0	74.3	
Dnipropetrovsk region	116.1	105.4	122.4	110.7	102.2	98.5	92.5	92.0	85.7	2 years
Donetsk region	114.7	113.6	130.3	114.2	94.6	93.6	68.5	65.3	39.6	7-10 years
Zaporizhia region	107.8	106.3	114.6	107.1	96.8	97.1	96.8	95.3	86.7	2 years
Poltava region	112.6	99.6	112.1	105.9	100	94.7	92.1	96.2	83.9	3 years
Kharkiv region	105.8	105.5	111.6	105.6	97.6	94.5	94.8	88.2	77.1	5 years
Kyiv region	108	110.6	119.4	109.3	96.8	99.1	101.6	93.0	90.6	1,5 years
Luhansk region	107.1	115.8	124.0	111.4	92.5	91.1	58.0	34.0	16.6	15-20 years

Source: compiled by the authors based on the data of Head Statistics Offices of the regions

Before the second critical fall in 2010-2011, industrial regions demonstrated relatively high growth rates (table 6); it gives hopes that with active anti-crisis measures, lost production volumes can be recompensed within 2-3 years. Another matter is Donetsk and Luhansk regions, where the main reason for the production decline is local separatism and external military aggression: production capacities have been destroyed, especially affected is the industrial infrastructure, particularly transport system.

According to sectoral and technological structure of production of the industrial regions, their modernisation will have the following peculiarities:

- Regions not directly affected by the military conflict that saved the main profile of their specialization will likely have to continue to develop and complete it with modern enterprises of related productions, creating regional and interregional clusters;

- Military conflict regions (Donetsk and Luhansk region) have got a chance to carry out virtual character modernization, i.e. by creating new production sites of modern progressive technological growth instead of the destroyed facilities and infrastructure.

Military destruction of production facilities in these regions gives a wide scope for innovative action [Meshkov, Bondaryeva, Kvilinskyi 2016]. It will be a shame not to take advantage of this opportunity. In Donetsk and Luhansk regions, the term "renewal" should be considerably limited in any case, if not completely excluded from the vocabulary of modernization. It is hardly advisable to renew unprofitable coal mining, open-hearth steel production or production of only primary metal types. They will not improve the technological structure of the industry. Besides, it might be problematic to attract investments for the renewal of the enterprises of the 3rd technological paradigm.

Modernization must ensure fundamental changes in the technological profile of Donbass. It is recommended to develop a national project that would promote the development of intellectual, scientific, industrial and labor potential of the region, and enable achieving high quality standards of production, transforming Donbass from all-Ukraine forge into a national innovation techno-park [Ivanov, Lyashenko, Kamińska, Kvilinskyi 2016].

The uniqueness of industrial development history, culture and living environment in Donbass, together with the "national modernization project" should become an effective factor in attracting people, investment and modern technologies for dynamic development.

Competitive advantages of Donetsk region can be significantly increased thanks to its favorable geographical position: close to the national developed regions and economies of other countries, it is only necessary to actively develop inter-regional and cross-border cultural, scientific and production relations and promote the increase of life quality of human capital.

At the same time, the following risks hindering the competitive development of the region need to be minimized:

- Mono-structural organization and raw material orientation of production (metal, coal);
- Violation of infrastructural bonds through military action, which limits the migration of people, capital, goods and information;
- Ecological situation approaching its critical point, making living and production conditions difficult;
- Loss of human resources, especially of intellectual capital due to deterioration of life conditions.

Therefore, solving strategic tasks of the structural and technological modernization of Donbass requires careful attention to the optimization of industrial complex production structure, to priorities of technological growth and setting criteria of economic feasibility and environmental efficiency of industries, and the effective use of the land.

Donbass has to be transformed from the coal and metallurgic region with traditionally low-technology production structure (3rd technological paradigm) into the region of creative economy, based on knowledge, new development models, new types of social relations and a new cultural paradigm [Ivanov, Lyashenko, Tolmachova, Kvilinskyi 2016, pp. 9-34].

Strategic future of Donbass looks like the future of the region with high technological culture. It should retain the role of the country's industrial center, but the notion of industry needs to be enriched with neo-industrial contents through the introduction of both domestic and global scientific and technical achievements. Despite the inefficient metal and coal production dominants, the strategy of structural and technological modernization does not imply refusal from traditional industries; however, their subsequent formation has to be made only based on their own resources.

Governmental support should only be aimed at new high-tech industries, whose products will be oriented at import substitution, meeting domestic demand and development of export potential. This scenario is based on a critical evaluation of the model of forming industrial products commodity resources that arose in Donetsk region. Only one-third of commodity resources is formed by virtue of their own production, the remaining share is compensated with import, which requires considerable currency resources. According to our estimation, in 2015, the volume of industrial products import in Donetsk and Luhansk regions will reach 2.5 billion US\$.

Import prevails in meeting the region's needs in high-tech chemical products (64.7% of domestic production volume), polymers (80.8%), textiles (180.7%), mechanical engineering products (136.8%). Positive overall balance of foreign trade of industrial goods is only possible due to the export of metal products. However, there are serious reasons to expect further complications in balance proportions of foreign trade. During 2011-2014, exports of non-precious metals from Ukraine decreased by 26.7%.

Prospects of the industrial revival of Donbass are seen, first of all, in the development of mechanical engineering, chemical and polymers industry. These are general guidelines of industrial development. Nevertheless, innovativeness and high-tech character should be ensured by the implementation of new technologies, namely:

- production of rare earth metals that is based on the own raw materials in the form of waste of coal, metal and mining industries;

- development and use of light beam technologies - photonics - as one of the promising areas of nanotechnology. The use of photonics allows for a significant increase in labor efficiency in the activities that are traditional for the region: metallurgy and mechanical engineering, particularly in the operations of cutting, welding, thermo-treatment and polishing of parts;

- mastering of wind power generation facilitated by the natural conditions, i.e. wind activity in the region, as well as by progressive changes in the structure of power generation: reduction of heat power generation capacities due to lack of coal (anthracite). Mechanical engineering industry of the region would receive a high-tech niche of providing wind power generation with the necessary equipment: towers, electrical generators and power distribution equipment;

- development of technologies and equipment aimed at improvement of energy and resources efficiency in basic industries; this is a key prerequisite for the foundation of energy efficient and waste-free economy. The use of "green" technologies will significantly raise the technological level of the region's economy and create the basis for international cooperation [Amosha, Kharazishvili, Liashenko, Kvilinskyi, 2016, pp. 19-34; Blagodarnyi, Tolmachova, Kvilinskyi, 2014, pp. 30-37; Ivanov, Lyashenko, Tolmachova, Kvilinskyi 2016, pp. 9-34; Kharazishvili, Liashenko, Zaloznova, Kvilinskyi 2016, pp. 108-119; Kvilinskyi, 2012, pp. 140-147; Lyashenko, Kvilinskyi 2016, pp. 9-24; Lyashenko, Tolmachova, Kvilinskyi 2016, pp. 155-164; Melnychenko, Hartinger 2016, pp. 9 – 19; Meshkov, Bondaryeva, Kvilinskyi 2016, pp. 120–134; Pajak, Lyashenko, Kvilinskyi 2015, pp. 18-23; Pajak, Dahlke, Kvilinskyi 2016, pp. 109-122; Kvilinskyi, Kravchenko 2016, pp. 101-112; Lis, Mazurkiewicz, Pajak 2015, pp. 181-202; Pajak, Kamińska, Kvilinskyi 2016, pp. 204-217].

Traditional productions of Donbass require an innovation push too, including metallurgical and chemical enterprises. Among the substantive proposals of recent years as for ensuring the innovativeness and competitiveness of domestic industry, there have been regular calls for establishing public-private partnership. Of course, this measure deserves attention. However, this is not so simple. The owners of enterprises built in the last century form the basis of today's business elite. Having taken raw material and semi-finished product niches of the global market, even using obsolete technologies, they gain considerable benefits. According to M. Porter, for companies that have rooted themselves in an old technology, it is difficult to understand the significance of a new technology that has just appeared, and even harder is to react to it [Porter 1993]. Therefore, one can hardly count on

effective public-private partnership with them in neo-industrial modernization. They do not even pay attention to the modernization of their enterprises. More than 50% of metal products in Ukraine are manufactured on the equipment that exceeded its normative exploitation life [Sobkevych, Suxorukov, Savenko, Vorobjov, 2011]. Despite its technological backwardness, Ukraine is among the exporters of metal products, competing with Japan, Russia and China. However, this status is maintained in a rather peculiar way, namely by the increase in export of products with low added value, i.e. export semi-finished products that still remain competitive due to own raw materials and cheap labor force.

However, price competition does not provide sustainable benefits, especially when there is an excess capacity in the world. According to the World Steel Association, it reaches 750 mln. tons, of which 450 mln. tons are accounted for by China. Which strategy should Ukraine choose to save its own metallurgic industry? Among scholars and practitioners, two strategies are actively discussed. The first one is to shift from exports to the domestic market, the second one is to make steel products more competitive through modernization.

By and large, these two strategies complement each other, and we support the idea of combining them. Advantages of this approach are demonstrated by such world leading steel producers as Voest Alpine (Austria), Thyssen Krupp (Germany), Posco (South Korea). They have significantly improved their competitive positions through the implementation of investment projects in the segment of high-tech products with an output of high-quality metal of premium class: special steels, automotive sheet, high-pressure pipes, etc., demand for which remains high in both domestic and foreign markets.

Without any production modernization in metallurgic industry, Ukraine may lose not only external but also its internal market. Now (2015), Ukraine has been importing non-precious metals and products from them of a more high-tech range than its own products worth US\$ 2 bln., which corresponds to 21.1% of the volume of steel products export. A similar situation can be observed in the chemical industry. Priority is given to export-oriented production of nitrogen fertilizers, raw material for which is imported natural gas. At the same time, almost nothing is being done for the development of such chemical materials as organic chemicals, pharmaceuticals, tanning agents and dyes, cosmetics, polymers, chemical fibers and other that are of extreme importance to the economy and society.

Among the advanced technologies that can significantly raise the innovation level of traditional industries is electrometallurgy. Economic feasibility, eco-friendliness, technological effectiveness belong to yet incomplete list of benefits of electroarc method of smelting metals. Globally, production of steel with this method is steadily increasing. In technologically advanced countries, it accounts for 30% of steel production. Ukraine lags behind significantly, with around 5%.

Spreading of electroarc metal production technology would allow, by speeding up technological process and manufacturing automation, to significantly raise productivity in the industry. Ecological situation in the industrial regions

would also improve, as the electroarc method reduces harmful emissions compared to open-hearth and converter methods by hundreds of times. High smelting temperatures in electrical furnaces allow for an expansion of the technological capabilities of production: for manufacture of alloyed steel grades, increase in the range of products, quick change of chemical composition of the metal as required.

Historically, Ukraine possesses all basic conditions for electrometallurgy. Electroslag resmelting technology was developed by the Institute of Electric Welding named after Y.O. Paton. The world's first smelting was performed at Dniprospsstal plant in Zaporizhia (1958). Currently, electrometallurgy plants in Donetsk and Kurakhovo, Dniprospsstal in Zaporizhia and Energometproekt in Kramatorsk use this technology.

Implementation of electrometallurgy helps minimize metallurgic enterprises, bring them closer to the consumers of metal, maintain normal environmental conditions in production areas, expand the range of produced metals and alloys through the use of chromium, titanium, zirconium, close the production chains, particularly in the production of titanium sponge, alloys and rolled steel. Domestic business starts to pay attention to the opportunities of electrometallurgy; to accelerate the process, it is necessary to provide it with government support.

Formulation and implementation of structural and technological modernization scenarios of Ukraine's industrial regions should be carried out within the long-term economic development strategy of the country, where industrial policy should play a leading role in addressing structural imbalances, promoting modernization and creating new high-tech industrial sectors. Along with the official recognition of the strategy of industrial development and modernization, it is necessary to legislate the ideology of industrial development, both at the state and regional levels, which, under decentralization conditions, will create favorable legal environment for economic entities and local authorities when taking modernization measures. For this purpose, it is advisable to elaborate and adopt the Law of Ukraine "On the Modernization of Industrial Regions" with the definition of the role and responsibilities of local authorities in the industrial development of their own territories.

References

1. Amosha, O., Kharazishvili, Y., Liashenko, V., & Kvilinskyi, O. (2016). *Economic security of sustainable development of the regions (based on the example of the Donetsk region)* w: (red.). *Gospodarka niskoemisyjna i jej wpływa na rozwój województwa wielkopolskiego*. Wydawnictwo Naukowe PWN, s. 19-34.
2. Blagodarnyi, A. I., Tolmachova, H. F., & Kvilinskyi, O. S. (2014). Investigation of the impact of regional characteristics on the development of small businesses. *Economics and Law*, 1, 30-37.

3. Ivanov, S., Lyashenko, V., Kamińska, B., Kvilinskyi, O. (2016). Koncepcja oceny modernizacji. *Współpraca Europejska / European Cooperation*, 12 (19), 86-101.
4. Ivanov, S., Lyashenko, V., Tolmachova, H., & Kvilinskyi, O. (2016). Właściwości modernizacji sfery przedsiębiorczej w kontekście państwowej polityki gospodarczej na Ukrainie. *Współpraca Europejska*, 3 (10), 9-34.
5. Kharazishvili, Y., Liashenko, V., Zaloznova, Y., & Kvilinskyi, O. (2016). Impact of infrastructure component on socioeconomic approach to modernization of the region. *Współpraca Europejska / European Cooperation*, 8 (15), 108-119.
6. Kindzerskyj, Yu. V. (2013). Promyslovist Ukrayiny: strategiya i polityka struktarno-texnologichnoyi modernizaciyi: monografiya. NAN Ukrayiny, Kyiv, 536 s.
7. Kondratev, N. D. (2002). *Bolshie tsikli kon'yuktury i teoriya predvideniya: izb. trudyi*. Moskva: Ekonomika, 767 s.
8. Korablin, S. (2016). Derzhbyudzhet: kry`za za rozkladom. *Dzerkalo ty`zhnya*, 1, 5.
9. Kuznets, S. (1969). *Model ekonomik Growth*. Yale University Press, 456 p.
10. Kvilinskyi, O. (2012). Formation of additional advantages of small-scale enterprises functioning and development. *Economy of Industry*, 3-4 (59-60), 140-147.
11. Kvilinskyi, O., Kravchenko, S. (2016). Optimization of innovative project realization conditions. *Zeszyty Naukowe Politechniki Poznańskiej. Seria: Organizacja i Zarządzanie*, 70, 101-112.
12. Lis, P., Mazurkiewicz, J., Pająk, K., 2015, Droga Chin do gospodarki niskoemisyjnej, w: Marszałek-Kawa, J., Pająk, K., (red.), *Polityka energetyczna państw Azji i Pacyfiku*, Wydawnictwo Adam Marszałek, Toruń, s. 181-202.
13. Lyashenko, V. (2014). *Pershiy etap modernizatsyyi ekonomiki Ukrayini: dosvid ta problem*. Institut ekonomiki promislivosti NAN Ukrayini, Klasichniy privatniy unIversitet. Zaporizhzhya: KPU, 798s.
14. Lyashenko, V. I., & Kotov Ye. K. (2015). *Ukraine XXI: neo-industrial state or failure?: monograph*. Institute of Industrial Economics of the National Academy of Sciences of Ukraine. Poltava University of Economics and Trade, Kyiv, 196 p.
15. Lyashenko, V., & Kvilinskyi, O. (2016). Evolutionary aspects of reflective processes in economic systems in case of political history of Ukrainian-Polish relations. *European Cooperation*, 1, 9-24.
16. Lyashenko, V., Tolmachova, A., & Kvilinskyi, O. (2016). Państwowa polityka rozwoju przedsiębiorczości w kontekście stabilności społecznoekonomicznej (na przykładzie Ukrainy). *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze*, 4, 155-164.

17. Melnychenko O., & Hartinger, R. (2016). Role of blockchain technology in accounting and auditing. *Współpraca Europejska*, 7(14), 9 – 19.
18. Meshkov, A. V., Bondaryeva, I. A., & Kvilinskyi, O. S. (2016). Factors of the region's investment climate formation under modern socio-economic conditions. *Vestnik Permskogo universiteta. Seria Ekonomika = Perm University Herald. Economy*, 2(29), 120–134.
19. Pająk, K., Dahlke, P., & Kvilinskyi, O. (2016). Determinanty rozwoju regionalnego - współczesne odniesienie. *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy*, 9, 109-122.
20. Pająk, K., Kamińska, B., Kvilinskyi, O. (2016). Modern trends of financial sector development under the virtual regionalization conditions. *Financial and Credit Activity-Problems of Theory and Practice*, 2(21), 204-217.
21. Pająk, K., Lyashenko, V., & Kvilinskyi, O. (2015). Operation of a business entity in the context of globalization. *Economic Herald of the Donbas*, 4(42), 18-23.
22. Porter, M. (1993). *Mezhdunarodnaya konkurenciya*. Moskva: Mezhdunarodnyie otnosheniya, 968 s.
23. Shumpeter, Y. (1988). *Teoriya ekonomicheskogo razvitiya*. Moskva: Ekonomika, 324 s.
24. Sobkevych, O. V., Suxorukov, A. I., Savenko, V. G., Vorobjov, S.L. (2011). Restrukturyzaciya promy'slovosti Ukrayiny` u procesi postkry`zovogo vidnovlenya. Kyiv: NISD, s.14, 25.

**COMPLEX ASSESSMENT OF PLANT GROWING DEVELOPMENT
IN THE REGIONS OF UKRAINE TO WORK OUT
RECOMMENDATIONS FOR
INSTITUTIONAL CHANGES IN AGRICULTURE**

Introduction. Development of institutional direction in modern economic science has become an objective response to the systematic failure of the economic mechanism, dysfunction of market institutions, ideological crisis of society. The national economy provides for appropriate social and economic institutions through which it is concretized and adapted to reform [1].

The agricultural sector plays a major role in the Ukrainian economy. Ukraine has approximately 43 million hectares (ha) of agricultural land, including 32 million ha of arable land, an area equivalent to one third of the arable land in the European Union (EU). Half of it is black soil, the highest productive soil type in the world and a commodity in such demand that an illegal market has developed in selling it [2].

There is a fact that some transnational agribusinesses are increasingly investing in Ukraine, including Monsanto, Cargill, and DuPont. The named corporations are taking over all aspects of Ukraine's agricultural system [3].

A general assessment of the agricultural sector and rural areas is crucial for the development of proper strategies and policies [4].

Although the essence of the agricultural sector performance analysis and institutional reforms modeling to ensure the competitiveness of the agro-industrial complex of the country has much in common with other sectors of the economy, however, the specifics of agriculture has some features to consider. These include:

1. Results of agribusiness activities have a strong dependence on climatic conditions of the geographical area. Therefore, given taking into account the significant territorial area of farmland in Ukraine and its geographic location, it is appropriate to divide the whole territory of Ukraine in different areas, which are connected to each other by common existence conditions, for example, administrative grounds characteristics.

2. Areas of agriculture in any country are characterized by a pronounced vivid production seasonality, with a period of one year. Consequently, there is uneven application use of labor, non-current and current assets, for example, some types of agricultural machinery are used only 20-30 days a year.

So, long period of production cycle with the uneven use of the resources and capital in agriculture leads to fact that the full analysis of the results of activities must be performed on the result of the whole year. Also when we are building models for the agricultural sector of the country, it is advisable to use a discrete type models, where the simulation period is one year.

3. Because of As farming deals with living organisms its level of development is influenced not only by economic factors, but also by biological and physico-chemical properties and laws. This significantly complicates the predictability of the industry and assessment of impact factors on the formation of the final result.

So, unlike traditional industries, related with material and non-material production, where the results of economic are well described by mathematical economic models, the agricultural sector is characterized by a high degree of uncertainty.

This leads to the fact that using economic and mathematical models, based on the scenario approach, can provide only general advice on management of the sector. However, the final result of the agricultural sector activities during the year it is almost impossible to calculate with an acceptable level of accuracy.

4. The main production resource is agricultural land, which performance (crop yield) is not the subject to the exact calculation. In addition, with proper use, including implementation of the complex of agro-technical actions, this resource can not be worn out, and also able to increase its productivity.

We also know that in the industry it is possible to produce certain products on **using** certain equipment type. Land in this case is versatile production factor: it can be used for the cultivation of any crop. In terms of economic and mathematical modeling it means high mobility for growing different kinds of crops.

5. A large number of similar types of agricultural enterprises, unlike in other sectors of the economy, allows us to group the results of their activity: in terms of forms of management, on a territorial basis or according to other types of features for further comparative analysis.

Literature review and the problem statement. The reasons for insufficiency of agrarian reforms efficiency and opportunities for improving agriculture of Ukraine are actively studied by national and foreign scholars, including: M. Lendel [5] V. Golyan [6] M. Revenko [7] P. Sabluk [8] O. Skydan [9], V. North [10] P.Makarenko [11] T. Sigg [12], Van Leeuwen, M., Salamon [13], Van Winden [14], Visser, O. A. [15], Warner, M. [16] and others.

To justify the need for institutional changes in crop production we must take into account the appropriate specifics of agricultural production in some areas. Development of crop production in Ukraine is not homogeneous in its quality. Therefore, the primary objective of the state is to create conditions through the reallocation of resources and facilitate the introduction of new forms of economic activity in the regions, which in terms of agriculture today is depressed.

The aim of the article. Thus, we are faced with important scientific problem of crop production assessment of the development of each individual administrative unit's (region's) with subsequent comparative analysis and implementation of recommendations for institutional changes in the industry.

Research results. The prerequisites for such a generalizing evaluation are as follows:

1. The result of any economic activity depends on quantitative (extensive) and qualitative (intensive) factors. Quantitative factors require attraction of additional resources, and quality - more efficient use of available resources. In terms of crop production to increase the efficiency of agricultural activity can be due to the better use of agricultural land, as well as by an increase in average crop yield per 1 hectare. Therefore, integral indicator of the crop production of each region should be based on ratios of extensive and intensive load. In order to be able to ensure the comparability of the results, these factors should be normalized from 0 to 1. Thus, integral index of crop production of each region will be calculated by the formula:

$$K_i = k_{i,\text{ext}} \times k_{i,\text{int}}, \quad (1)$$

where K_i - integral index of the i -region development of plant cultivation;
 $k_{i,\text{ext}}$ - extensive load factor of the i -th region;
 $k_{i,\text{int}}$ - intensive load factor of the i -th region.

Conditions for rationing should provide that the best coefficients of extensive or intensive load are when they are closer to 1, and vice versa. With this limitation, our target indicator will also take values from 0 to 1.

2. The extensive load factor represents the degree of agricultural land use and is calculated using the formula:

$$k_{i,\text{exc}} = \frac{S_{i,p}}{S_{i,v}}, \quad (2)$$

where $S_{i,v}$ – area of the available agricultural land of the i -region, ths. of hectares;

$S_{i,p}$ – area of agricultural land which were used of the i -region, ths. of hectares.

Since the $0 \leq S_{i,p} \leq S_{i,v}$, extensive load factor $k_{i,\text{ext}}$ will vary from 0 to 1. Larger values $k_{i,\text{ext}}$ will fit better usage of the land fund for agricultural production.

3. Intensive load factor $k_{i,\text{int}}$ should reflect the effectiveness of land fund using, that is, the average yield, which is produced from agricultural land of the i -region. However, the average yield can not directly serve the basis for calculation $k_{i,\text{int}}$, because the structure of sown area of each region is heterogeneous. Available data from statistic reports about the production of agricultural crops in different regions are grouped in the following main types of crops:

- Grains and legumes;
- Technical culture;
- Potatoes, vegetable-melon crops;
- Forage crops.

Each of these groups has its own crops and the highest possible average annual yield. For example, the yield of potato and vegetable-melon crops, according to statistics, is 4-6 times higher than the yield of grain and leguminous crops, if the other conditions being equal (tonnes / ha). Therefore, if in one region, cultivated area in the first type of crop occupies the largest share, and in another area - the second type of crop, comparing them with each other in terms of average yield is incorrect.

In this study, calculating of intensive load factor $k_{i,int}$ it is offered, primarily to carry out procedure of yield rate normalization for each group of crops separately. To do this we offer a conventional symbols. Let matrix of acreage be S, the volume of crop production be Q, and productivity be Y are as follows:

$$S = \begin{vmatrix} s_{11} & s_{12} & \dots & s_{1m} \\ s_{21} & s_{22} & \dots & s_{2m} \\ \dots & \dots & \dots & \dots \\ s_{n1} & s_{n2} & \dots & s_{nm} \end{vmatrix}; \quad Q = \begin{vmatrix} q_{11} & q_{12} & \dots & q_{1m} \\ q_{21} & q_{22} & \dots & q_{2m} \\ \dots & \dots & \dots & \dots \\ q_{n1} & q_{n2} & \dots & q_{nm} \end{vmatrix}; \quad Y = \begin{vmatrix} y_{11} & y_{12} & \dots & y_{1m} \\ y_{21} & y_{22} & \dots & y_{2m} \\ \dots & \dots & \dots & \dots \\ y_{n1} & y_{n2} & \dots & y_{nm} \end{vmatrix} \quad (3)$$

where s_{ij} , q_{ij} та y_{ij} – accordingly, sown area, the volume of crop production and average yield of j -th of crops and the i -th region.

Columns of considered matrices characterize value of targets in each area for j -th groups of crops. Matrix lines - value targets for each group of crops in i -th region.

Matrix S and Q are incoming and are formed according to the annual state statistical reporting. Accordingly, the matrix Y elements are calculated based on them using the following formula:

$$y_{ij} = \frac{q_{ij}}{s_{ij}}, \quad (4)$$

For the next calculation of integral indicator crop development in each area will perform normalization of matrix Y elements, using the following formula:

$$\bar{y}_{ij} = \frac{y_{ij}}{\max_i (y_{ij})}, \quad (5)$$

That is, first we find the maximum yield value for each column of the matrix Y, and then divide on them each element of the matrix. The result is a

matrix of normalized yield values Y , where for each j -th group of crops normalization was done separately. That is, each column of the matrix Y takes values from 0 to 1. Moreover, the normative value 1 is the region with the highest yield in Ukraine from this group of plants. So we offset neutralize the fact that different groups of crops have different values of maximum yield and therefore the area with different structure of acreage could not be compared with each other.

Then, intensive load factor $k_{i,int}$ according to a weighted arithmetic mean formula takes the form:

$$k_{i,int} = \frac{\sum_{j=1}^n \overline{y_{ij}} \times p_{B_{ij}}}{\sum_{j=1}^n p_{B_{ij}}}, \quad (6)$$

where $p_{B_{ij}}$ – the proportion of cultivated area j -th crop and a i -th region.

Substituting formula (2) and (6) (1), we get the final look view of the integral index of the plant industry development in the i -th region:

$$K_i = k_{i,ext} \times k_{i,int} = \frac{S_{i,p}}{S_{i,v}} \times \frac{\sum_{j=1}^n \overline{y_{ij}} \times \frac{S_{ij}}{\sum_{j=1}^n S_{ij}}}{1} = \frac{S_{i,p}}{S_{i,v}} \times \frac{\sum_{j=1}^n \left(\frac{y_{ij}}{\max_i(y_{ij})} \times \frac{S_{ij}}{\sum_{j=1}^n S_{ij}} \right)}{1} \quad (7)$$

Depending on the values K_i we can perform ranking of Ukraine regions` in terms of crop development considering extensive and intensive factors, thus:

- on the one hand, indicator K_i assesses the level of acreage using which is in our possession;
- on the other hand, indicator K_i also takes into account the efficiency of their use due to the reduced weighted average yield.

Using the method of integral estimation of crop development, we will make the appropriate ranking of Ukraine regions according to the area of sown crops in Ukraine, calculate value of extensive load factors $k_{i,ext}$, i.e the percentage of agricultural land usage. This coefficient K_i fluctuates within the range from 47,33% (Zakarpathia Oblast) to 93,39% (Kirovohrad Oblast). Ukraine's average percentage of agricultural land use is 78%.

Extensive load factor on a territorial basis is not uniform proportional due, primarily, to differences in climatic conditions, existing infrastructure, financial

resources and material, technical equipment of agricultural enterprises. At the same time many regions of Ukraine have significant reserves to improve the indicator . Among them there are such areas as: Zakarpattia Oblast, Luhansk Oblast, Lviv Oblast, Volyn Oblast, Zhytomyr Oblast, Chernihiv Oblast, Chernivtsi Oblast, Rivne Oblast etc. Percentage of using their farmland does not exceed 70%.

Leaders by using of agricultural land are Mykolaiv Oblast, Vinnytsia Oblast, Dnipropetrovsk Oblast, Cherkasy Oblast, Poltava Oblast and Kirovohrad Oblast with the index, exceeding 88%.

The elements of the matrix Y have been calculated according to the formula 4, Tab. 1.

Table 1 - Average crop yields in 2014 in areas, tonnes / ha

oblast of Ukraine	Including			
	grains and legumes	technical crops	Potato, vegetable and melon	forage crops
Ukraine	4,31	3,33	18,83	13,22
Vinnytsia Oblast	6,03	7,54	21,00	19,15
<u>Volyn Oblast</u>	3,81	9,51	17,72	8,65
Dnipropetrovsk Oblast	2,83	1,73	16,21	10,46
Donetsk Oblast	3,32	1,72	15,40	9,22
Zhytomyr Oblast	5,07	3,66	22,05	10,24
Zakarpattia Oblast	3,85	1,11	22,11	5,91
Zaporizhia Oblast	2,73	1,29	15,01	7,87
Ivano-Frankivsk Oblast	4,80	3,74	16,02	10,97
Kiev Oblast	5,97	4,66	19,86	15,39
Kirovohrad Oblast	4,34	2,35	13,34	13,42
Luhansk Oblast	2,97	1,53	11,19	4,99
Lviv Oblast	4,68	8,94	19,14	9,73
Mykolaiv Oblast	3,02	1,70	19,32	11,19
Odessa Oblast	3,09	1,82	17,36	11,56
Poltava Oblast	5,06	4,52	21,24	18,13
Rivne Oblast	4,72	6,48	20,42	10,72
Sumy Oblast	6,20	1,88	21,44	18,88
Ternopil Oblast	5,48	10,63	21,59	19,02
Kharkiv Oblast	4,47	3,94	18,64	14,21
Kherson Oblast	2,79	0,72	18,00	8,43
Khmelnyskyi Oblast	6,01	6,94	23,56	15,38
Cherkasy Oblast	5,79	3,94	16,03	19,52
Chernivtsi Oblast	5,25	1,91	21,55	10,43
Chernihiv Oblast	5,61	2,50	19,20	14,68
Maximum productivity	6,2	10,63	23,56	19,52

Source: www.ukrstat.gov.ua

Also the table. 1 shows the maximum average yield for each group of crops, which are necessary for the normalization procedure.

As you can see, the average yield in Ukraine, the maximum and minimum yield on areas for different crops are as follows:

- grains and legumes - 4.31 tonnes / ha to 6.2 tons / ha in Sumy region and 2.73 tonnes / ha in the Zaporozhye region;
- technical cultures - 3.33 tons / ha against 10.63 tonnes / ha in Ternopil region and 0.72 tonnes / ha in Kherson region;
- potatoes, vegetables and melon - 18.83 tonnes / ha against 23.56 tonnes / ha in the Khmelnytsky region and 11.19 tonnes / ha in the Luhansk region.

These data show that the maximum yield per hectare for different crops are in northwestern Ukraine, and the reduced productivity - in the southeastern. This is because the South-East of Ukraine belongs to the zone of risky agriculture, primarily because of the high probability of dry weather and lack of irrigation of agricultural land. In addition, the zone of the antiterrorist operation in the Luhansk and Donetsk regions also adversely affect on the agricultural development of these areas.

To calculate intensive load factors $k_{i,int}$, were found normalized values of the yield $k_{i,int}$ and the proportion $k_{i,int}$ of cultivated area of j-th type of crops in i-th region. Within each crop, indicator $k_{i,int}$ can take values from 0 to 1. Based on the calculation of the normalized value of maximum yield for each crop, we brought them to a comparable form. According to the calculations we see that for example, the sown area of Vinnitsa region was distributed as follows:

- Grains and legumes – 52%;
- Technical culture- 32%;
- Potatoes, vegetables and melon – 8%;
- Forage crops – 9%.

Finally, we calculate integral index of crop development in each area tabl. 2.

According to this Integral indicator K_i , we have carried out procedure of ranging areas, column (5). For best value K_i the less rank corresponds, and vice versa.

As we can see, among the leaders in the development of crop in Ukraine are the Vinnytsia, Ternopil and Cherkasy region. At the same time, Lugansk, Zaporozhye and Kherson regions have the worst indicators of value, compared to other regions.

In addition, Table. 2 contains data on the average value of factors and for the whole Ukraine. These value of factors may make the starting point of reference for the classification of areas on the development of crop production. A graphic idea of this can be obtained from Fig. 1.

Table 2 - The results of calculation of integral index crop development in each areas of Ukraine, according to 2014

oblast of Ukraine	$k_{i,ext}$	$k_{i,int}$	K_i	rank
Ukraine	0,780	0,583	0,454	–
Vinnytsia Oblast	0,883	0,885	0,781	1
Volyn Oblast	0,641	0,643	0,413	16
Dnipropetrovsk Oblast	0,886	0,376	0,333	19
Donetsk Oblast	0,750	0,413	0,310	20
Zhytomyr Oblast	0,646	0,641	0,414	15
Zakarpattia Oblast	0,473	0,607	0,287	21
Zaporizhia Oblast	0,763	0,321	0,245	23
Ivano-Frankivsk Oblast	0,763	0,639	0,488	9
Kiev Oblast	0,763	0,765	0,584	6
Kirovohrad Oblast	0,934	0,476	0,444	13
Luhansk Oblast	0,496	0,330	0,164	24
Lviv Oblast	0,621	0,741	0,460	12
Mykolaiv Oblast	0,882	0,390	0,343	18
Odessa Oblast	0,839	0,422	0,354	17
Poltava Oblast	0,933	0,705	0,658	4
Rivne Oblast	0,687	0,709	0,487	10
Sumy Oblast	0,754	0,766	0,577	7
Ternopil Oblast	0,831	0,920	0,765	2
Kharkiv Oblast	0,793	0,620	0,492	8
Kherson Oblast	0,806	0,337	0,272	22
Khmelnyskyi Oblast	0,758	0,845	0,641	5
Cherkasy Oblast	0,914	0,747	0,683	3
Chernivtsi Oblast	0,686	0,631	0,433	14
Chernihiv Oblast	0,649	0,731	0,475	11

Source: by the author

The dotted line in Fig. 1 indicated calculated values and for the whole Ukraine. Accordingly, we can distinguish 4 sectors, which are characterized by the following features:

– I sector – the most successful region in Ukraine in terms of crop production development. As for the indicator of using of available agricultural land, and on the weighted normalized level of productivity we have a higher level than the average in Ukraine. The first sector includes: Vinnytsia, Ternopil, Cherkasy, Poltava and Kharkiv region. Recommendations for state regulation of institutional change is the full cooperation of market relations development in the sphere of production, supply and marketing of agricultural products; prevent monopolization of the market and so on.

– II sector – its composition includes the same region with high yield, Khmelnytsky, Lviv, Sumy, Kiev, Chernigov, Rivne, Zakarpattia, Zhytomyr, Volyn, Chernivtsi and Ivano-Frankivsk region. However, the level of use of existing farmland in this case is substantially inferior to average Ukraine index. This applies particularly to Zakarpattia, Lviv, Zhytomyr and Volyn regions. Public policy regulation in the field of institutional changes should be focused on attracting additional investment

resources to the industry, expansion of production and promotion of small and medium businesses.

– III sector – characterized by a high level of use of the available land resources, however, the level of productivity is lower than the average in Ukraine. These criteria is inherent in Kirovograd, Odessa, Mykolaiv, Dnipropetrovsk and Kherson regions. Particular attention should be paid to Kherson and Dnipropetrovsk regions, where the yield is very low. State policy in the sphere of agriculture should be focused primarily on the study of the causes of the low productivity in the regions. Soil fertility can be improved by reducing the load on the ground efficiently using various types of fertilizer, change crops grown. However, the problem of the crop in these areas is the lack of efficient irrigation systems and dry, hot climate in the summer. Households, farmers and other private enterprises can not solve this problem on their own because of the lack of investment expenditures and high capital investment required. Therefore, the policy of institutional changes at the national level should solve this problem by involving public and private investment, long-term development programs target lending entities, etc.

– IV sector – the least successful region in Ukraine for the development of the crop. They are inferior to other regions both in yield and in terms of useful use of available land. Their composition include: Among them are Lugansk, Donetsk and Zaporozhye region. Such an objective state of affairs is a reflection of the geopolitical processes taking place in recent years. Government steps in institutional change must be based on a comprehensive development program for agricultural development because it has all the problems of the regions listed above for regions with sectors II and III.

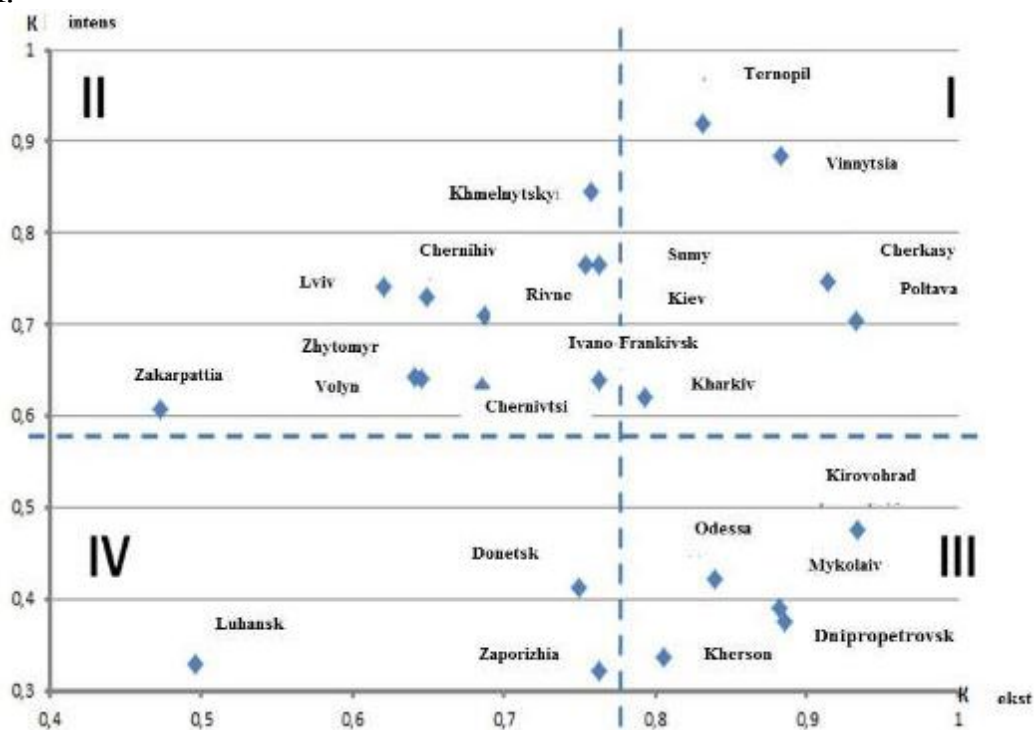


Figure 1 – Classification of regions of Ukraine according to the crop development

Source: by the authors

Conclusion. Thus, deciding important scientific objectives of the comprehensive crop development assessment and classification condition of each area, we were able to formulate recommendations for the necessary urgent institutional changes at the national level.

References

1. Obozna, A. (2014). State regulation of the institutional changes in the agri-food sector of Ukraine: Monograph. Mykolaiv, 164 p
2. Review of Agricultural Investment Policies of Ukraine (2015) Retrieved from http://www.oecd.org/globalrelations/Agricultural_Investment_Policies_Ukraine_ENG.pdf
3. Corporate Takeover of Ukrainian Agriculture (2008) Retrieved from <http://fliphtml5.com/gpyl/tlxi/basic>
4. Assessment of the Agriculture and Rural Development Sectors in the Eastern Partnership countries (2012) H-1068 Budapest Hungary. Retrieved from <http://www.fao.org/3/a-aq674e.pdf>
5. M. Lendel (2001) New institutional mechanisms for regional development in Europe. Regional studio. Vol. 1., p. 18-28.
6. V Golyan (2006) Problems of institutional environment of the national economy in market conditions. Actual problems of economy. № 5 (59), pp. 4-11
7. Revenko M. (2011) Improvement of state regulation of agrarian sector. Economics of Ukraine. № 12, pp. 51-55.
8. Sabluk P.T., (2011) Institutional frameworks for Transformations in Agriculture. National Research Center "Institute of Agrarian Economy", p. 64
9. O. Skidan (2010) Institutional mechanisms of the agro-food areas of region. Balanced regional development in a globalizing. International scientific conference. Zhytomyr. Ruta, p 404.
10. North V. Institutions "Journal of Economic Perspectives". Vol. 5. №1. Winter. 1991, 109 p.
11. P. Makarenko (2006) Market transformation of the agricultural sector: Theory and Practice [monograph]. Zaporozhye, Zaporizhzhya National University. 2006, 373 p.
12. Sigg, T. (2014), "Essay on Development Policy, Sustainable impact of organic market development and posts of contribution of development cooperation to organic market development", NADEL-MAS Cycle 2012-14
13. Van Leeuwen, M., Salamon, P., Fellmann, T., Banse, M., von Ledebur, O., Salputra, G., and Nekhay, O. (2012), "The agri-food sector in Ukraine: Current situation and market outlook until 2025", JRC Scientific and Policy Reports, European Commission, Luxembourg, <http://sjrcsvqpx101p.jrc.es/pub/EURdoc/JRC71776.pdf>.

14. Van Winden, A. (2013), “Greenhouse industry: the competitive edge”, Paper presented at the 4th International Conference “Commercial Horticulture in Ukraine” 21 February 2013, Kyiv.

15. Visser, O. and Mamonova, N. (2011), “Large-scale land acquisitions in the former Soviet Union - A study of rural social movements and land conflicts”, IS Land Academy Report (revised version).

16. Warner, M., Kahan, D., and Lehel, S. (2008), “Market-oriented agricultural infrastructure: appraisal of public-private partnerships”, Agricultural Management, Marketing, and Finance Occasional Paper No. 23 of the United Nations Food and Agriculture Organization, <http://ftp.fao.org/docrep/fao/011/i0465e/i0465e00.pdf>.

Olga Popova
Olena Tomashevskaya
Svitlana Popova

DECISION MAKING BASED ON THE PRINCIPLES OF SUSTAINABILITY FOR PROVIDING THE PROFITABLE BUSINESS ACTIVITY

The global economy is coming under the pressure to pay attention on restoration of damaged environment as well as continuing the development of society (which includes people and business). The crisis of modern economic development is accompanied by increasing of operation costs owing to limitations in natural resources and high level of competition between producers for the right to be owner or user of such resources. As a result prices for output finished goods have to be increased to cover all expenses of enterprises and companies. But considering the limited financial capability of consumers the purchase probability will be intensively cut down. It leads to overproducing of goods. In respect of this a producers have to decline a prices, so the risk of profit loss is more obvious but such decision is more cheap at first blush for owners then to invest in projects for creating a new products.

Profitability has always been the ultimate goal of any enterprise. Depending on circumstances, this goal can be achieved either by extensive growth or by constantly increasing the efficiency of the existing approaches and practices on every level of value creation. Despite the former being widely used, it is the latter that has become of increasing importance for many companies around the globe, taking into consideration the limited amount of resources and population growth. These factors combined create economic and social tension that can be eased by implementing sustainable practices in day-to-day operations. Procurement is the field of operations that can have significant environmental impact, since it may encompass all stages of a product's lifecycle. This implies that optimising a company's procurement activities and implementing sustainable approaches may largely contribute to the reduction of the overall environmental impact and reaching sustainable development.

The necessity to increase the sustainability of the procurement process has been widely recognised not only by companies (such as TDK, Konica Minolta, Suntory, etc.) but also by governmental institutions as well as by international organisations and governing bodies (the United Nations, the European Commission, etc.). Albeit the definition of procurement practices aimed at reducing environmental impact may vary ("responsible procurement" [University of Manchester], "green procurement", "sustainable procurement" [UNDP, 2008, p.4]), its main principle in many cases lies in "the purchase of products and services which have less impact on the environment and human health compared with competing products or services that serve the same purpose." [UNDP, 2008,

p. 4] According to the Department of Treasury of the State of Victoria, Australia key efforts in reducing the environmental impact should be concentrated in the following areas:

- Optimisation the consumption and reduction of wastes;
- Assessing the environmental impact considering all stages of a product's lifecycle;
- Consideration of the environmental impact in the value-for-money assessment;
- Purchasing from suppliers that are committed to sustainable performance.

The reduction of environmental impact can be achieved by combining the efforts of authorities and market commitment. The former includes the regulation of environmental performance by means of legislation. The latter implies a better market performance of companies implementing the principles of sustainable procurement. The economic benefits of green procurement include, for instance, cost reduction due to a more efficient use of resources, especially in the long run. The attempts to reduce the environmental impact of procurement also creates the incentives for innovation and indirectly affect small- and medium-sized companies, helping them find markets for innovative products. Lastly, the implementation of green procurement solution results in price reduction of environmental technologies, which, in turn, further affects total production costs.

Kyoto Protocol cannot solve this problem of society in general thinks. So economic instruments must be able to integrate itself in market and therefore be prepared to manage fast every environmental disaster. The considered problem in historical aspects passed a few milestones. The next factors were arising during last century to the present tense:

1. New technologies, especially those associated with the "second industrial revolution," from the 1920s to the 1960s;
2. Expanded labor inputs as a result of growth in the working-age population and higher female participation in the workforce;
3. Urbanization, which acts as an accelerator for technological modernization and productivity growth;
4. Increased use of resources: materials, water, land, energy and other forms of (largely unpriced) natural capital;
5. Fast-moving changes in needs and ways for satisfaction of customer's needs;
6. Ambition of producers to reduce a cost based on using alternative recourses of energy and materials;
7. Zero waste management.

Sustainability is a concept that, over the past decades of last and current centuries, has gained and continues to gain traction in a wide range of enterprises and companies, from top management to local governance in company, from commercial to tourism public activities, and from extracting of natural resources

through manufacturing and delivering to consumption. The many enterprises and companies have articulated business decisions centered on sustainability, using it as a framework on which to base integrated strategies covering the ecological, the economic and social axis in the classical interpretation of 3-D Model of sustainable development.

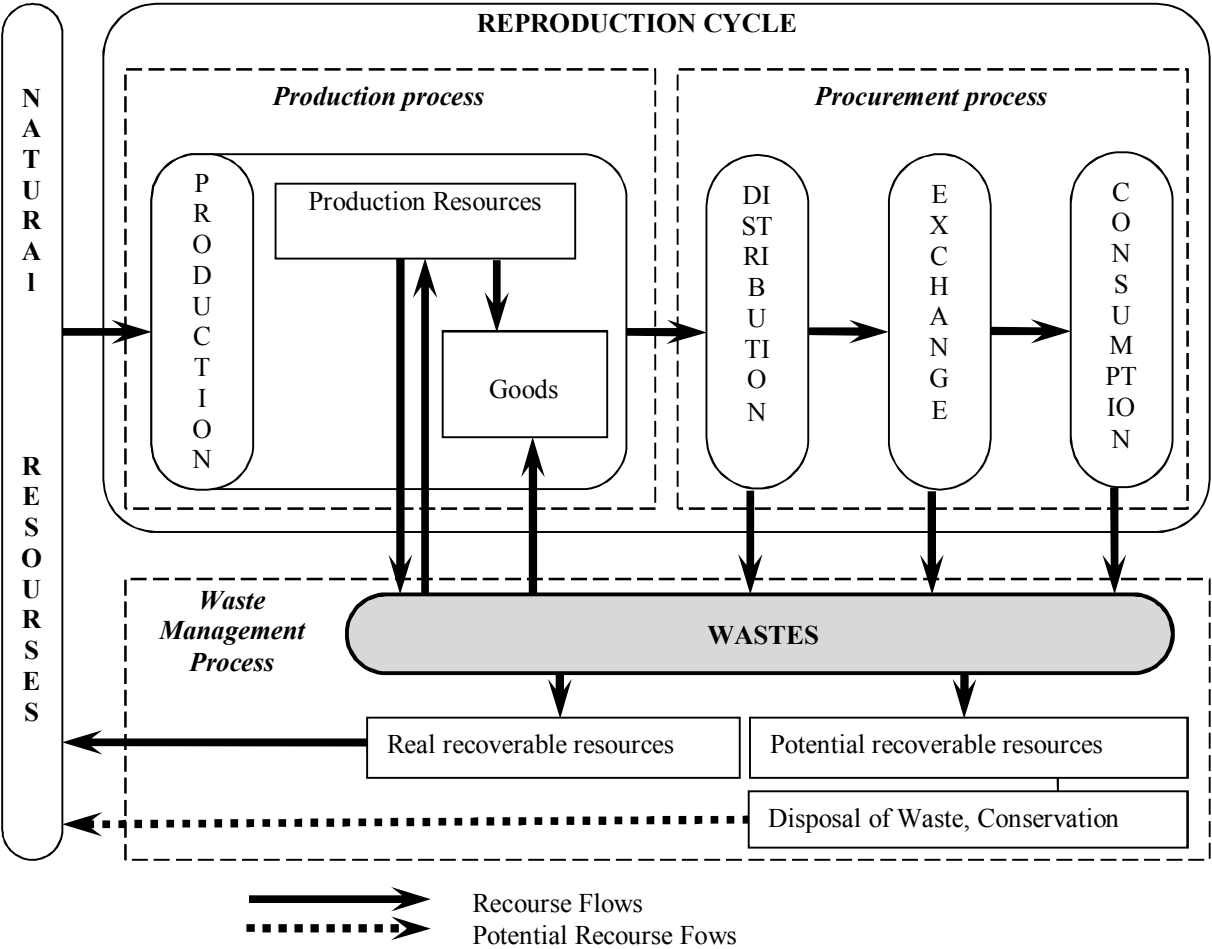


Figure 1 – The structure of reproduction cycle

Source: advanced by authors grounded on [Mennillo, G., Elmar, T., Friedric, E. 2012; Bleischwitz, R., Welfens, P., Zhang, Z. 2011; Lang, A., Murphy, H. 2014)

The sense of "sustainability" is complex and multifaceted and can be described from different points of view. For the first let's start from general philosophy context in which we can consider the core of sustainability as a one type of motion and a direction of development of matter. It is very important to reach stable form of motion. Otherwise, chaos in motion and unstable motion of matter will lead to collapse and destruction of motion. And to check the objective preconditions and subjective preconditions would be impossible. The character of relationship will be not valuated and the matter will be destroyed as a result of stochastic effects of unknown factors produced by external and internal environment. External and internal factors of sustainability based on philosophy

context are provoking by maturity phase of relationships between enterprises and companies with supplies and clients as an entire system of the Reproduction Cycle (Fig. 1).

From the Fig. 1 it is clear that sustainability in Reproduction Cycle can be considered as complex processes of systems interaction with fuzzy effects. Sustainability as a processes and result of processes can be described also from another different sides:

- in technology "sustainability" is understood as the object characteristic to perform the necessary functions during a given vibration and to keep values of parameters, within standards;

- in environmental explanation "sustainability" is interpreted as "the ability of the ecosystem to maintain its structure and functional properties by external factors";

- as institution vector "sustainability" can be presented as system of laws and rules (formal and non-formal) which are forming the ability of enterprises and companies to produce an output according to their mission and to the conditions of external information, social, political and economic environment without conflicts and with efficiency maximization for all participating persons in supply, production and consuming processes;

- in social dimension "sustainability" combines and integrates the participation and engagement, interaction quality of life or well-being, built on shared knowledge and values of Stakeholders and community;

- as a strategy "sustainability" is setting corporate social responsibility policies and goals, as well as their results to become more energy efficient and to reduce pollution and waste while continuing to shape its business responsibly and increase its economic success with the long-term preservation and enhancement of natural resources and nature, increasing of social capital based on new kind of knowledge in ecological economics and development of financial capital by identifying emerging challenges and opportunities to gear up production, to expand market share, to cut costs and improve profits.

- from the position of economic "sustainability" is interpreted as "the ability of the enterprises or companies to use natural and artificial resources to their best advantage in current conditions of business environment adjusted for the sensibilities of the stakeholders and customers to chops and changes of market situation.

ILO-Labour Conference 2007 assumed that "Sustainable enterprises should innovate, adopt appropriate environmentally friendly technologies, develop skills and human resources, and enhance productivity to remain competitive in national and international markets". The main focus on sustainability and its role in long-term exiting of enterprises and companies is at the moment that the main (primary) task is to prevent natural environment from damage and depletion of natural resources and in the same time to decline the ecological damage of previous periods. But in this case the main rule of efficiency valuation will be frustrated.

So the conclusion about role and place of sustainability in business activity has to be done as following - sustainability operates a business so as to be viable in long-term, economic grow based on social well-being of staff, society, state and earn different types of benefits measured in economic, social, environmental, institutional and inter-generational equity. The crown of sustainability for enterprises and companies is to earn profit. Considering that *the enterprise operates* by big varieties of business partners including but not limited to shareholders, *creditors, regulators, employees, customers, suppliers, and the community we can structure* type of potential benefits in sustainable development of enterprise or company.

So acting sustainable also not only benefits its reputation, such kind of acting benefits with real monetary profit. This enhances the image of enterprises and companies as an environmentally-committed and responsible business, giving good PR in a competitive markets and creating high level of sureness for clients in safe and clear of ecological danger the style of consumption. In this case enterprises and companies will create a new additional needs of client to feel environmental responsibility during an act of consuming but the level of payment will be too less in end-price of goods for customers and not so appreciably from the side of costs but with perceivable benefit for customers and producers (see Table 1).

Table 1 – Type of benefits for enterprises and companies and customers

Type of benefits	Content	
	for enterprises and companies	for customers
1	2	3
Economic	New business opportunities; Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles; waste management practices; Green procurement; tax optimization.	Green design; cost savings; providing better information for customers.
Social	New jobs; new sources of employment and potentially lifting communities out of poverty.	High education; Low unemployment; High quality health care systems; Minimizing the consumer cost which leads to increased volume of customer's box.
Environmental	Reducing, reusing and recycling, and minimizing resource extraction, wastes and damage.	The most energy-efficient goods.

1	2	3
Institutional	To restrict: - financial mismanagement; - corruption; Exploring the potential for information and communications technology (ICT) to increase sustainability.	To decrease: - information and communication restriction; - criminality and violence.
Inter-generational Equity	More robust economy for subsequent generations; to eliminate trade tariffs for low-carbon technologies and environment-friendly products and services.	Fairer and more inclusive society and cleaner environment; reduction of carbon emission.

Source: advanced by authors grounded on [Dayal 2014; Colombo, Bologna, Masera 2013; Taticchi, Carbone, Albino 2013; Salomone, Clasadonte, Proto, Raggi 2013; Lis, Mazurkiewicz, Pająk 2015; Pająk, Dahlke, Kvilinskyi 2016, pp. 109-122].

The concept of sustainable development can be determined as an aim to attain social and economic development by the means that will not exhaust the earth's finite natural resources. The demands of the world nowadays are huge and immediate and that is why it is urgent to invent methods to satisfy these demands. It is considered, that the next generations will struggle to satisfy their demands in the way it can be accomplished today, because of the lack of natural resources and extreme environmental change in the future. There are several common practices of sustainable development. First group of practices can be named as first-order practice for the reason that each company or enterprise can use primary natural resources for producing of goods. So economic and ecological benefit will belong to each individual commercial or non-commercial person via:

- Renewable energy. Solar and wind energy, for example, is considered to be unlimited. These sources are supposed to diminish the human dependence on oil, coal and other limited energy sources.

- Sustainable construction. Buildings, premises and other structures that include recycled and renewable building materials are supposed to be more energy efficient and able to last for long period of time.

- Crop rotation. A lot of agrarians are using this way as a chemical free method to avoid soil diseases and provide their crops with better characteristics and increase the growth.

- Water fixtures. One of the most important criteria of sustainable development is water preservation. For that reason, there are nowadays a fast growing trend for the products that are aimed at minimization of water consumption. For example, toilets, showers, dishwashers and others.

Second group of practices can be named as second-order practice for the reason that many kinds of natural resources have to be transformed before the using in production process. In this case responsibility for environmental and all reached benefits must be divided between group of companies or enterprises involved in manufacturing process. For this reason the decision on the subject of business decisions centered on sustainability must take in the attention a synergistic effect of sustainable entrepreneurship.

So decision-making to use the sustainability as the modern base of the profitable business activity can be shown as following system of equations:

$$\sum_i E_i \leq E_{ECON} + E_{ENV}$$

whereas E_i – economic effect of independent activity of the enterprise i ;
 E_{ECON} – economic effect of joint activities;
 E_{ENV} - environmental effect of joint activities.

$$E^S = (E_{ECON} + E_{ENV}) - \sum_i E_i$$

whereas E^S – a synergistic effect of sustainable entrepreneurship.

The system of constrains for decision-making can be presented as a following preconditions for Θ and Δ :

$$E^S \geq \sum_i \Theta_i$$

whereas Θ_i – the stability boundary, which is determined by the individual reserve ratio of financial assets to cover environmental costs.

$$\sum_i E_i \geq \sum_i \Delta_i$$

whereas Δ_i – the minimum rate of return which are sufficient and necessary for sustainable cooperation.

A logical scheme for using the system of equations for decision-making can be given below.

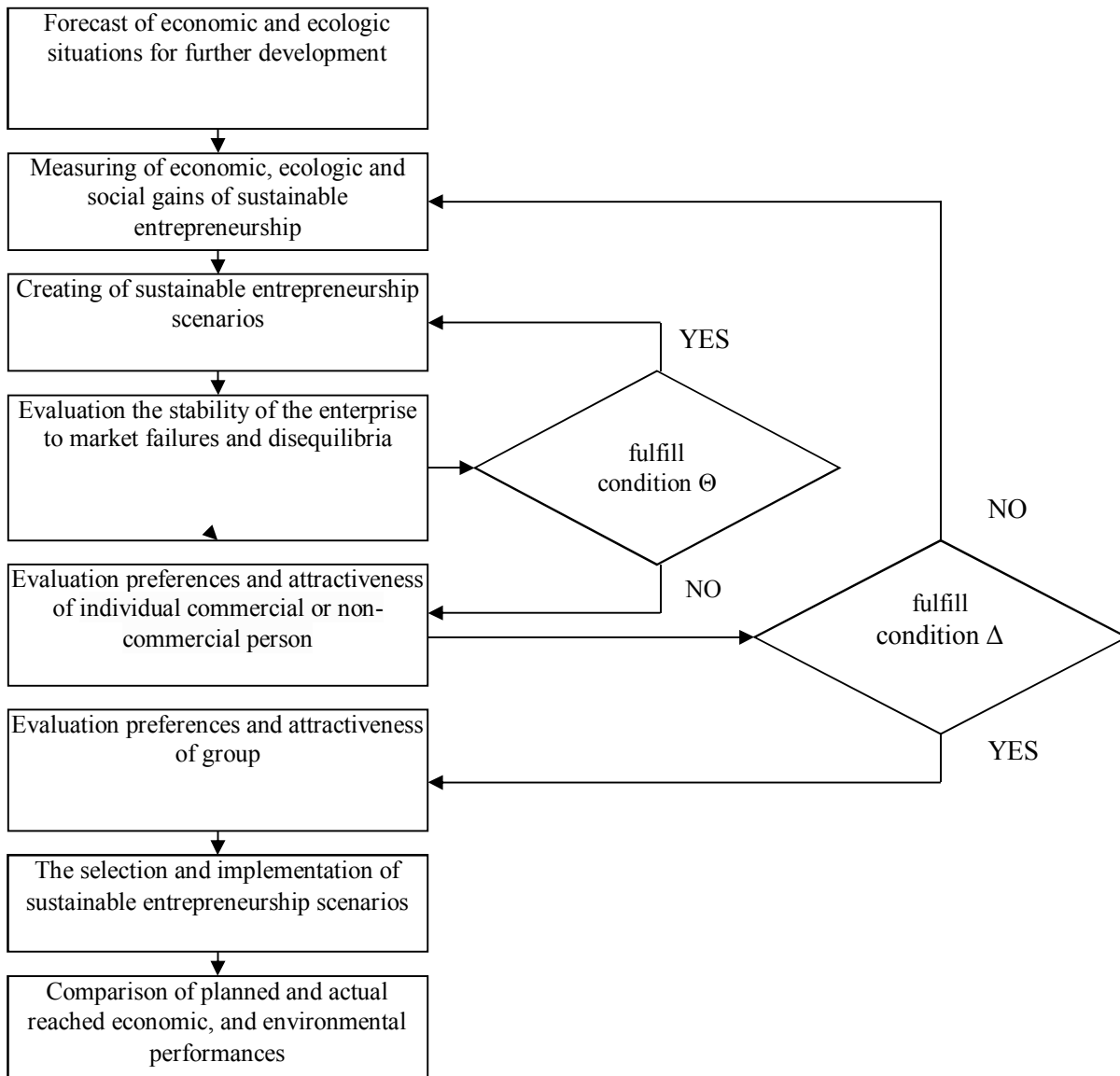


Figure 2 - Decision making to use the sustainability as the modern base of the profitable business activity of companies

Source: author's design

So cheap sustainable incentives will provide for producers additional attractiveness in a competitive markets paid by clients. This approach ensures fundamentally new products with long-term sustainable characteristics which at the same time provide additional margins as a general target of each kind of business activity. Business combinations in a strategic alliance to improve the efficiency of water supply on the basis of raw materials, energy, geography (proximity to water sources) and ecological principles allow to reduce the pressure on the environment, the production costs and to increase the financial performances. The practical significance of the research is that the developed block diagram of decision-making can be used by industrial enterprises, which

are combined into a single technological chain or a strategic alliance to increase the efficiency of natural resources consumption.

References

1. Bleischwitz, R., Welfens, P., Zhang, Z. (2011). *International Economics of Resource Efficiency, Eco-Innovation Policies for a Green Economy*, Heidelberg: Springer-Verlag Berlin Heidelberg.
2. Colombo, E., Bologna, S., Maserà, D. (2013). *Renewable Energy for Unleashing Sustainable Development*, Cham; s.l.: Springer International Publishing, Imprint: Springer.
3. Dayal, V. (2014). *The Environment in Economics and Development. Pluralist Extensions of Core Economic Models*, New Delhi; s.l.: Springer India; Imprint: Springer.
4. Lang, A., Murphy, H. (2014). *Business and Sustainability. Between Government Pressure and Self-Regulation*, Cham; s.l.: Springer International Publishing ; Imprint: Springer.
5. Lis, P., Mazurkiewicz, J., Pająk, K. (2015). Droga Chin do gospodarki niskoemisyjnej, w: Marszałek-Kawa, J., Pająk, K., (red.), *Polityka energetyczna państw Azji i Pacyfiku*, Wydawnictwo Adam Marszałek, Toruń, s. 181-202.
6. Mennillo, G., Elmar, T., Friedric, E. (2012). *Balanced Growth. Finding Strategies for Sustainable Development*, Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg.
7. Pająk, K., Dahlke, P., Kvilinskyi, O. (2016). Determinanty rozwoju regionalnego - współczesne odniesienie. *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy*, 9, 109-122. (j. polski)
8. Salomone, R., Clasadonte, M. T., Proto, M., Raggi, A. (2013). *Product-Oriented Environmental Management Systems (POEMS)*, Dordrecht: Springer Netherlands.
9. Taticchi, P., Carbone, P., Albino, V. (2013). *Corporate Sustainability*, Berlin, Heidelberg: Springer Berlin Heidelberg.

Sergey Kravchenko

SCIENTIFIC AND EDUCATIONAL COMPLEX OF THE ECONOMY AS A BASIS FOR SUSTAINABLE DEVELOPMENT

Introduction. During the last 15 years, there is a growing interest in researches and literature toward the interdependence of social and economic components of the sustainable development. Actually, an economic development is closely linked to the level of achievements in the field of education, professional skills and new technologies. These factors are conditioned by the environment (infrastructure) in which companies and their employees operate.

The social infrastructure development is crucial for economic progress. Thereby, improvements in the education (as a part of the social infrastructure) are investments in human capital and contribute to the economic development as well as investments in production and other resources. A number of theoretical and empirical studies supports these findings related to the influence of social infrastructure objects on economic growth [Wang, 2007].

Literature review and the problem statement. Questions of social infrastructure and its role in the socio-economical development were developed by A. Govorin, Y. Gorbatovsky, A. Gritsenko, V. Kazakov, M. Komarov, V. Medvedev, J. Toshchenko V. Fedko, B. Homelyansky, Sharipov, S. Yaschenko etc.

Problems of institutional design of the intellectual capital of corporations, providing their competitiveness are presented in works of G. Azoeva, A. Arkhipova, I. Berezin, A. Verbitsky, Y. Dneprova, L. Derevyagin, A. Doolin, N. Klimova, T. Tazhibova, etc.

Issues of development of business education systems were discussed in details in the works of such foreign researchers as J. Walton, D. Adrissen, J. Attali, E. Blass, M. Bonyan, R. Branson, T. Davenport, R. Jacobs, P. Drucker, R. Katz, C. Long, J. Meister., H. Mintzberg, I. Nonaka, Knowles M. Senge, P., Smith, P. Sparrow, X. Takeuchi, P. Feyerabend, M. Heim, G. Schroeder, etc.

Problems of formation and development of human capital, determined in the development of business education are presented in works of L. Andreeva, V. Belolipetskii, A. Berdashkevicha, N. Eletski, Yu. Osipov, V. Chekmareva, R. Chernyaev, B. Pietrykowski, etc.

With the aim of developing the scientific researches on this subject, the purpose of this article is to review the process of creating corporate universities as a way of solving tasks of social infrastructure. The content of the article could be revealed through the following tasks:

- determine the place of education in the region's infrastructure through the concept of the social component of the infrastructure;
- corroborate the importance for the social infrastructure of private sector educational services development;

- consider the process of creating and commercializing corporate university;
- identify the benefits of regions, country and companies from creating corporate universities.

Research results. The growth of scientific and technological progress required a sharp increase in quality of the workforce through the development of intelligence, health promotion, and change of work motivation factors. All that affected the development of various spheres of infrastructure. Thus, social infrastructure is a complex of objects (enterprises, institutions, organizations and structures), which provide the conditions for the functioning of social production and population, forming physically and intellectually developed, socially active individual. It contains health care, recreational facilities, physical culture and sports, social security, culture and art and, of course, education. The main purpose of the social infrastructure functioning is complete and comprehensive human development by satisfying his domestic, spiritual and cultural needs [Golyakov M, Ganina, 2002].

Figure №1 displays interrelation of education (as part of the social infrastructure) and human needs, the satisfaction of which is the aim of the social infrastructure. Taking into consideration that in general meaning education is the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits.

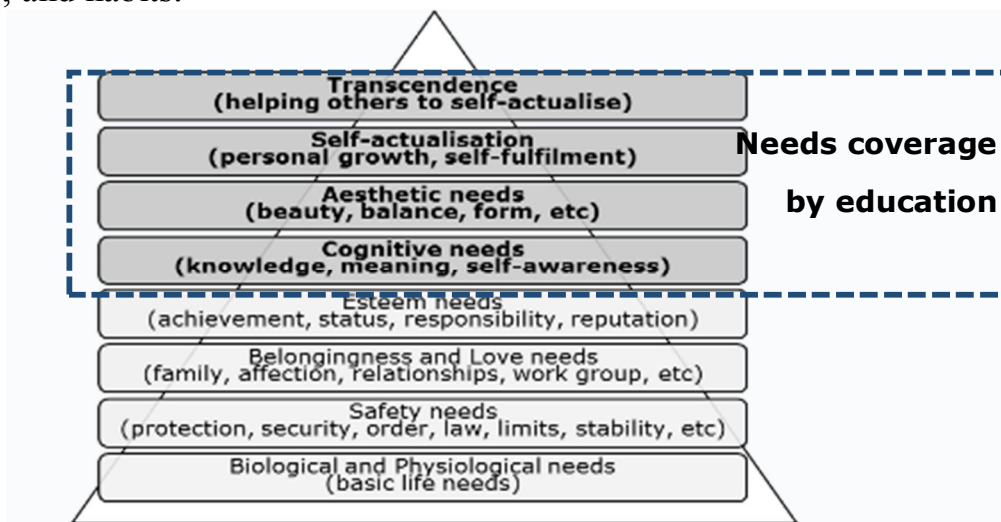


Figure 1 – Interaction of human needs and education

Source: compiled by authors grounded on [Huitt 2007]

As we see from the modified Maslow hierarchy of needs [Huitt 2011], such needs as the self-actualization, cognitive needs, aesthetic understanding of the needs and transcendence (in case of teaching) are covered by the education system and socio-cultural adaptation, which occurs in the learning process. Thus, we can conclude that education is a critical component of social infrastructure, which plays a significant role in the socialization and person’s development.

Today the businesses diversification is a very important factor of social infrastructure development. At the same time, many countries show rather low levels of innovation and high-tech products on the market. Obviously, this task of overcoming the technological gap could be made only in case of ensuring the effective integration of education, science and industry [Sanderatne 2011; Kharazishvili, Liashenko, Zaloznova, Kvilinskyi 2016, pp. 108-119; Kvilinskyi, Kravchenko 2016].

According to McKinsey's research, public entities around the world need more than \$8 trillion to fund social infrastructure projects through 2020. This figure exceeds the capital requirements of the oil and gas and mining industries combined. More than 40% of the \$ 8 trillion is required for the creation of social infrastructure in developing countries. With public finances tighter than ever, expectations for public-private partnerships (PPPs) are growing. While private sector interest in the financing of infrastructure projects has increased in recent years, barriers to private sector involvement remain. Many government agencies do not have the capacity and capabilities for the planning, execution and management of PPP projects. At the same time, the performance of educational processes needs improvement. Managing this complexity can be a hard task even for developed countries.

The integration of scientific, industrial and educational activities could be implemented on a platform of specialized schools. They are designed for intensive people training to work in a specific branch or in a particular company. The requirements of the dynamically developing business are so great that the external market is simply unable to provide the inflow of necessary specialists for each individual company.

Many organizations nowadays have reached a new level of training of qualified personnel and established their own educational institutions (departments) for staff development. International experience in the field of professional education suggests that one of the most effective ways to solve this problem is creating a company's corporate university.

Defining the concept of corporate university, the majority of experts tend to call corporate university as the existing in the company's forms of training, the in-house staff training system. At the same time, there is more than a narrow understanding of the corporate university, as a system of training young professionals in the specialized universities. They are trained by a specially designed training program which takes into account the specifics and the corporate culture of the company. Herewith the supporters of this concept do not exclude the university's function of in-house staff training at various levels.

The initiative to use "university" the term for the name of the department for personnel training and development is owned by US companies. In Europe, "university", the term is used with restraint, only in relation to higher education. Among the 30 corporate universities, performed in Europe, only 14 are known as "university", 5 are called the "center", 4 use the name "institute", 3 - "academy"

and one is called "business school". European companies using the term "university" explain it in their own way. For example, Daimler Chrysler (Germany) presents a corporate university as "the place for the exchange of knowledge and competence". Heineken (Netherlands) describes a corporate university as a "link between knowledge transfer and creation." The term "university" in this case is using quite carefully as it implies a certain institutional and functional addictiveness.

According to the Ukrainian legislation "University is a multidisciplinary higher education institution of the fourth accreditation level, which carries out educational activities related to obtaining certain higher education and wide range qualification in natural, human, technical, technology, culture art, economic and other areas of science. It carries out fundamental and applied researches, is the leading scientific and methodical center with a developed infrastructure of educational, scientific and industrial divisions, and appropriate level of staffing and logistical support, contributing to the spread of scientific knowledge and carrying out cultural and educational activities" [The Law of Ukraine "On Higher education" 2014]. According to the analysis of legislation, the existing legal framework does not provide such type of educational institution as a corporate university.

The experts pay attention to the specific characteristics of education in the corporate university. First of all, it refers to the fact that education (its content and form) aimed at a specific target group - employees of the company or the industry. Another essential feature is the presence of a single company's development strategy and the corresponding concept of staff development of the company.

A further feature is that the corporate university is a system that allows people to improve their skills constantly through training, coaching and traineeship. Thus, the corporate university provides continuous professional education in lifelong learning concept. Finally, the function of the corporate university is the intellectual component, which allows you to be engaged in strategic researches, to determine the company's strategy.

Therefore, despite some differences in the definition of the corporate university, almost all experts agree that the corporate university is a system of in-firm training, combined in single concept within the strategy of the organization's development and applied for all staff levels.

From the determined meaning of corporate university education there is an interesting consequence: the current system of professional higher education cannot and doesn't have to reproduce in full the corporate university functions. The higher professional education system should prepare graduates which are oriented to work in any corporation. On the other hand, the existence of competition leads to constant appearance of new forms and methods for solving practical problems, knowledge of which would be very useful for future graduates. Thus, there is a mutual influence of corporate education on the system

of higher education and vice versa. This effect manifests itself in the formation of professional and other requirements for graduates by employers (corporations).

Today, the real requirements for graduates will not be able to identify any corporation, as the goals and objectives of corporate entities will differ from each other by different organizations, even in the same industry. Thus, to entrust the formation of professional and other requirements for college graduates by companies, means to consider only private interests that will prevail over the general. It is necessary to develop employees' specific skills on the basis of private educational institutions or the company itself.

Corporate education is an integral part of the business, so it should make real direct/indirect economic effects. Corporate education should be cost-effective, and, therefore, use easily replicable educational technologies, with minimum disruption of staff from production responsibilities and minimizing the costs for the implementation of educational programs.

In the modern understanding, the corporate university (CU) is the system of staff training and development within the company, basing its principles on the strategy of the organization's development. Of course, each industry has its own specifics; however, the majority of learning centers and CU use similar forms and methods of training:

- thematic trainings, master classes, and workshops;
- professional development courses;
- projects, lectures, group work, case studies solution, etc.
- "gamification";
- "electronic learning» (e-learning), allowing to cover all levels of employees or wide geography.

The main reason that encourages companies to invest millions into the creation a corporate university is ensuring the sustainable development of employees at a single training standard.

A pioneer in corporate training center creation was McDonalds. Its famous Hamburgers University was opened in 1961, but it took six years more to realize the important thing: ensuring the same quality of service the city center, as well as on the outskirts of small towns, is possible only if all employees are trained at the same standard. For other countries it took another 30 years to come up to this conclusion. The "boom" of creating CU came in the 1990s [Hearn 2002; Meister 1998]. Such companies as General Electric, Motorola, Coca-Cola, Procter&Gamble still continue to set trends in the corporate training development.

Thus, creating an internal corporate university the company solves its needs to increase business efficiency and development of its employees. However, this is not the only option of functioning CU. It could have an open form and provide training services and expertise to external clients, companies and businesses.

The economic crises of the mid-1990s forced experts of corporate training centers to search the ways to survive. One of the most fruitful ideas turned out to be a transition to self-sufficiency. One of the first companies gave their CU a

status of separate business unit was Motorola company. Moreover, Motorola U (university) began to teach not only the internal customers (employees) but external individuals as well.

Eventually leaders in the commercialization of corporate training were IT companies. Providing customers with IT products, they offered to train their employees, so that corporate users in future would be able to self-serve and modify complex IT products.

Transformation CU in open mode of training and consulting center is a serious project that requires significant investment at the initial stage. Such an important decision requires a balanced risk analysis and calculation of remote consequences.

Today the market offers a very different CU models range: based on the objectives, directions, budgets and organizational forms (non-profit educational institution and its subsidiaries, company's branches or its structural subdivisions, department or division and so on).

Creating an effective learning center is a costly project, which may account 15-60% of staff budget. Therefore, it is necessary to assess whether CU is required at this stage of the company's development. In addition, proceeding with such project, you need to understand that the return of investments will start with considerable delay of about one year after the CU launching.

The first step in creating a corporate university is conducting an audit of system of existing personnel training. Auditing can be performed using the following analytical procedures:

- training purposes evaluation;
- assessment of implemented learning concepts;
- assessment of the current organizational structure of training;
- teaching methods evaluation;
- evaluation of the quality control systems of learning;
- evaluation the effectiveness of training;
- evaluation of existing corporate training and development budget.

Carrying out such an audit is necessary to obtain a comprehensive understanding of the processes related to the training and development of staff implemented in the company.

Business objectives can change and therefore the CU activity should be able to change its direction. Therefore, the work of CU has to be mobile, flexible and responsive to business objectives. All this brings us to the necessity of the concept of Corporate Training and Development staff creation. The purpose of this step is the formation of relevant principles and elements of the corporate system of training and staff development.

At this stage it is important to develop not only target concepts of goal but also the stages, principles of the learning system reorganization in the path of the current format to the format defined in the concept. It is important to identify the

resources needed for carrying out the changes, namely the budget of the project and the project team.

The next step in creating a corporate training center is to develop competency profiles of key positions and levels. It is very important to integrate the competence assessment procedure to the staff development program. Only then the company can form and choose teaching methods that would satisfy the need for the development of key competencies.

There are many formats of training and development. To improve the efficiency of the CU there should be used the entire arsenal of existing formats of learning. Selection of the teaching format has to be applied to a particular module and goals. It is needed to create and approve the schedule of the training activities implementation.

Finally, one of the most important stages for the success CU creation is the development of methodology for assessing its effectiveness. The evaluation criteria may, for example, be the following:

- an increase in sales and revenue;
- reducing costs by unifying management processes (management of knowledge, staff, changes, etc.);
- improved customer satisfaction;
- improving the quality of products and services;
- optimization of the cycle of order execution;
- reduction of waste;
- improved safety performance;
- increasing employee satisfaction;
- reducing staff turnover, etc.

The implementation of the above analysis of indicators will help to understand what positive effect brings corporate training: what kind of results for any money and how the company will soon receive.

Typically, the steps for creating a CU are similar to each other (Table 1).

Table 1 – The process of creating a corporate university

Steps	Tasks
1	2
Assessment of existing training and development system	To understand: - whether the need for training staff cannot be satisfied by the existing educational institutions; - do employees need specific skills that require regular training.
Development of the concept and the corporate university strategy	to create a mission, vision of the future knowledge center (based on analysis of the information obtained in the first stage) to form a project team to develop and justify the business plan for the CU

1	2
Development of the methodology of training, trainers education	to create training programs (in line with the company's strategy, key positions profiles and competencies) to standardize learning processes
Development and implementation of performance criteria	to define the success criteria, key performance indicators to provide the continuous monitoring of performance and effectiveness of CU

Source: compiled by authors grounded on [Allen 2002; Heckscher, Adler 2006; Udovichenko 2006]

The delivery of CU on the external market as an independent educational services provider requires a lot of effort. It is necessary to consider all pros and cons carefully. It is advisable to launch training for external clients when:

1. The main goal of CU is achieved (staff training and development at all levels is established, unified and standardized).
2. All processes are digitized, KPI's are set.
3. The effectiveness of the staff training is proved in practice.
4. Corporate training programs provide the necessary knowledge and skills relevant to the needs of individual departments and the whole company.

To summarize everything that has been already mentioned, as well as highlight the feasibility of operation of a CU, it is reasonable to combine and compare benefits of the country, regions, company (which open a CU), as well as a specific individual who is potentially trained in the corporate university (Table 2).

Table 2 – The benefits of creating corporate universities in the region/country

Opening a private CU unit		
Region/country interests	Company's interests	Individual interests
<ul style="list-style-type: none"> - development of scientific and technical progress; - improving the quality of educational services; - private investments in social infrastructure. 	<ul style="list-style-type: none"> - solution of the conflict between quality of education and business requirements; - targeted training of employees at the same standards; - increasing the efficiency of employees, and the business efficiency therefore. 	<ul style="list-style-type: none"> - satisfying the needs in education and spiritual development; - the possibility of sustainable development; - socialization in a possible new circles; - an opportunity to show yourself as a trainer.

Source: compiled by authors grounded on [Blass 2001; Walton, Martin 2004]

It is worth to emphasize the trends in corporate education development within the social infrastructure of regions and country. The main trend in the corporate universities performance nowadays is there quantity growth and going

mass. On the day, there are more than 3000 corporate universities and their rapid growth continues.

Through cooperation of CU with leading universities in the region/country, a system of staff creating appears. The forms of such cooperation may be different from the participation of students in the internships at companies to establishment the specialized educational and research departments at universities, financed by corporations. At the same time it is possible for CU to select talented students by corporate grants, attraction to interesting and promising work etc.

The next trend in cooperation of educational institutions of the social infrastructure is the participation of CU in development of the professional and educational standards for different specialties. Leading companies are already involved in this process, working with the government to develop such standards.

Another trend is related to the need for more dynamic content update of educational programs. Experience shows that the dynamics of corporate universities renovation of teaching materials is much higher than in traditional universities. It should be noted that this trend sharply tightens the requirements for teaching staff of CU and traditional educational institutions.

It should be counted another feature of the development of corporate universities, namely the development both professional and “soft” skills. The range could be presented by trainings of personal growth, self-development, leadership and team building, performance and organization, systematization, creativity and skill of public speaking etc. It is necessary to build enterprise knowledge accumulation system.

Finally, the latest trend is cooperation between CU in questions of educational methods development. This is especially important for the leading industries of regions and country. Today it is important for CU’s to express a united opinion on the teaching and staff development. This cooperation will enable to improve the system of training in companies, to solve common systemic issues, to create conditions for the free experience exchange.

A higher level of economic development could be achieved through the development of social infrastructure. On the other hand, this requires a significant investment in the development of education of regions and country. Stimulation the creation of private corporate universities is one of the possible ways to get continuing education for people. This satisfies two important needs: skilled workers for the enterprises and companies, as well as the spiritual and cultural development for individuals. This means that the establishment of corporate universities contributes to the solution of the main task of social infrastructure.

References

1. Allen, M. (2002). The corporate university handbook. Designing, managing, and growing a successful program AMACOM.

2. Blass, E. (2001). What's in a Name? A comparative study of the traditional public university and the corporate university. *Human Resource Development International*, 4 (2), 153-173.
3. Drucker, P. (1997). The Future That Has Already Happened. *Harvard Business Review* (September-October), p. 20.
4. Golyakov, M. S., Ganina, E. A., (2012). Nature and significance of social infrastructure. *Kama State Engineer – Economic Academy*, Chistopol, Russia. Retrieved from <http://www.rae.ru/forum2012/pdf/2261.pdf>.
5. Hall, R. E., Jones, C. I. (1999). Why Do Some Countries Produce So Much More Per Worker Than Others? *Quarterly Journal of Economics*, 114, 83-116.
6. Hearn, D. R. (2001). *Education in the Workplace: An Examination of Corporate University Models*. Retrieved from www.newfoundations.com/OrgTheory/Hearn721.html.
7. Heckscher, C., Adler, P. S. (2006). *The Firm as a Collaborative Community: Reconstructing Trust in the Knowledge Economy*. New York, NY: Oxford University Press. Retrieved from <http://www-bcf.usc.edu/~padler/research.html>.
8. Huitt, W.G., (2007). Maslow's Hierarchy of Needs. Educational Psychology Interactive. *Valdosta, GA: Valdosta State University*. Retrieved from www.edpsycinteractive.org/topics/regsys/maslow.html.
9. Johnson, S., Daron, A. (2005). Unbundling Institutions. *Journal of Political Economy*, 113 (5), 949-995.
10. Kazakov, V. (2011). Social services and social infrastructure in the modern society. *Social and legal problems of economic development: Interdepartmental collection of scientific papers, Book 1*, 32-42.
11. Kazakov, V., Pankratov, V. (2011). Infrastructure Software Research and innovation. *Innovation development of the Russian economy. Book 1*, pp.309-315.
12. Kharazishvili, Y., Liashenko, V., Zaloznova, Y., Kvilinskyi, O. (2016). Impact of infrastructure component on socioeconomic approach to modernization of the region. *Współpraca Europejska / European Cooperation*, 8 (15), 108-119.
13. Knack, S., Keefer, P. (1995). Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures. *Economics and Politics*, 7, 207-227.
14. Kvilinskyi, O., Kravchenko, S. (2016). Optimization of innovative project realization conditions. *Zeszyty Naukowe Politechniki Poznańskiej. Seria: Organizacja i Zarządzanie*, 70, 101-112.
15. Meister, Jeanne C. (1998). *Corporate Universities: Lessons in Building a World-class Work Force*. New York: McGraw-Hill.
16. Materials and analytical surveys of Managers Association Researches. Retrieved from www.amr.ru.

17. Patterson, T. (1998). Corporate Education and Training for Adult Learners: A comparative study of two corporate education models. University of California, Davis.
18. Pietrykowski, B. (2001). Information Technology and Commercialization of Knowledge: Corporate universities and class dynamics in an era of technological restructuring. *Journal of Economic Issues*, 35 (2), 299-306.
19. The Law of Ukraine "On higher education" № 1556-VII. Retrieved from http://search.ligazakon.ua/l_doc2.nsf/link1/T141556.html.
20. Sanderatne, N. (2011). Investing in social infrastructure: Education and technical skill. Imperatives of economic development. *The Sunday Times Economic Analysis* Retrieved from <http://www.sundaytimes.lk/110327/Columns/eco.html>.
21. Udovichenko, M. (2006). From organization of education to educational organization. *Corporate University*, 1, 9-13.
22. Udovichenko, M. (2007). Building the system of learning efficiency management. *Corporate University*, 6, 14-18.
23. Walton, J.S., & Martin, M.C. (2000). The impact of the corporate university - case study analysis of developments in the UK. *Academy of Human Resource Development Conference Proceedings*, pp. 36-40.
24. Walton, J. S., Martin, M. C. (2004). *Corporate Universities vs Traditional Universities: Comparison through Published Organisation Documentation*. Retrieved from <http://files.eric.ed.gov/fulltext/ED491482.pdf>.
25. Wang Y., (2007). *A Theory of Social Infrastructure and Economic Development*. Department of Economics, University of Chicago.

**ENERGY EFFICENCY IN THE CONTEXT OF
COUNTERCYCLICAL REGULATION AT THE GLOBAL AND
NATIONAL LEVELS**

Introduction. The beginning of the second millennium was marked with the growth of the processes of economic and geopolitical instability in the world, deepening of imbalances at global and national markets. Strengthening of these imbalances will cause permanent crisis phenomena that occur in the economic, political, environmental and other areas of social development and lead to deepening of irregularity of social and economic development around the world, increase social tensions and political instability in the world. The prove of the above mentioned is uttered global economic crisis of years 2007 – 2009, the effects of which have long gone beyond simply economic boundaries and intensified international competition for the right to development, prosperity and a decent level of self-affirmation.

These tendencies objectively actualize scientific researches of the countercyclical regulation mechanisms to meet modern achievements of economic science, as well as the manifestations of the crisis at the global and national levels, which at present are largely determined by the aggravation of imbalances in global resource markets, particularly in the energy market. Furthermore, the results of prediction of global energy development indicate the presence of strengthening of existing imbalances while preserving the existing trends in energy consumption.

The relevance of the study of scientific and practical problems of implementation of energy saving measures that should be seen in the system of countercyclical regulation and post-crisis recovery of global and national economies is explained with these circumstances.

Development of scientific approaches to mechanisms of contrercyclical regulation on national and global levels. The study of the causes of the crisis occurrence as well as mechanisms for countercyclical regulation of economic processes became quite popular in the second half of the nineteenth century, when the crisis became immanent processes for market economy. Thus, the outstanding Ukrainian scientist, Tugan-Baranovsky is reasonably called in economics the "father" of the theory of economic cycles, who in his famous work "Periodic Industrial Crises. History of British Crises. The General Theory of Crises" [Tugan-Baranovsky, 1894] formulated the law of the investment cycle theory, according to which the phases of industrial cycle are defined by investment process that provides long-term rise of basic sectors (according to Tugan-Baranovsky these sectors are those creating the means of production). The studies of Ukrainian scientist became the foundation for further research in the field of causes for economic advancement cyclicality, namely, the theory of "long waves"

(50-60 year) by M. Kondratyev, according to which the pattern of large cycles conditions is due to evolutionary development of the productive forces on the basis of production technologies change [Kondratyev, 1922]; theory of business cycles and economic dynamics by J. Schumpeter, in which a cyclicity is regarded as a pattern of economic growth based on massive investment in fixed assets and innovations implementation [Schumpeter J., 1939]; cycles of W. Mitchell are manifested though disparities between costs and prices, which undermine incentives to investment, leading to production shortage and unemployment [Mitchel W., 1951]; theory of business cycles and economic growth by S. Kuznets, according to which the investments into industrial sector of interlinked industries are made with clear intervals ensuring the development of primary (basic) economic sectors (extractive industries, agriculture) and thus stipulating the economic growth [Kuznets S., 1971], etc.

The Keynesian theory of cycles which occurred during the Great Depression became a kind of generalization for cyclical theories of economic development and according to it, cyclicity is caused by the dynamics of effective demand that is defined by consumption and investment functions [Keynes J. M., 1936]. On this basis, John M. Keynes set up the basic recipes for countercyclical regulation in practice and the use of discretionary monetary and fiscal policy (development of Keynesian theory of cycles was expanded in the works of E. Hansen, J. Hicks, P. Samuelson, who in their works substantiated the directions of state regulatory measures to influence aggregate demand). However, the aggravation of the crisis in 1970 led to the emergence of opposed to Keynesian theory monetary theory of the cycle by M. Friedman [Friedman M., 1963], which proved a decisive influence of monetary factors on cyclical economic development and justify critical state of monetary policy as the main mechanism for countercyclical regulation. So in the last decade Keynesian and monetarist's recipes were actively used in practice of countercyclical regulation at national level.

However, the rise of globalization has strengthened the issue of the crisis not only at national but also at global level and thus it has caused the spread of global economic crisis. This, in turns, objectively necessitates the modification of countercyclical regulation measures with regard to the fact that recent global economic crisis, including the crisis of 2008 – 2009, were accompanied by significant imbalances in global markets. As it was reasonably outlined by G. Bagratyan and I. Kravchenko [Bagratyan G., Kravchenko I., 2012], the global economic environment, which in the last decade is in the process of formation on the basis of unprecedented reduction of tariffs and liberalization of all spheres of international economic cooperation, would have to promote global economic balance. However, in reality everything is vice versa, global markets (labor resources, mineral resources, capital, etc.) are facing significant imbalances. Moreover, the important factor which increases global imbalances is the lack of resources (especially raw materials), caused by a mismatch global scope of labor

resources growth (the population of the world is constantly growing) and the world's reserves of raw materials (raw material reserves decrease or their production becomes more expensive). Therefore, in the situation that has developed, according to scientists, raw materials deficiency can be compensated either through a rapid growth of population (in this case the mineral resources deficiency will be partially compensated by the energy of living labor) or by deploying innovative wave of economic development.

In our view, the optimal way to overcome global imbalances in resource markets and to reduce national economies dependence from significant price volatility in global commodity markets is the development of innovative energy-saving technologies.

The aim of the article is a rationale for development of innovative energy-saving technologies in the system of countercyclical regulation at the global and national levels.

Analysis of global energy market and its impact on the formation of global economic imbalances. The initial aspect for the feasibility of energy-saving technologies broad development in the context of overcoming global imbalances of the world economy and its post-crisis recovery is to study the peculiarities of the global energy market, the relationship of global energy consumption and the global economy. In this connection, it is obviously advisable to analyze the mutual influence of the world GDP dynamics and world energy consumption (Figure 1).

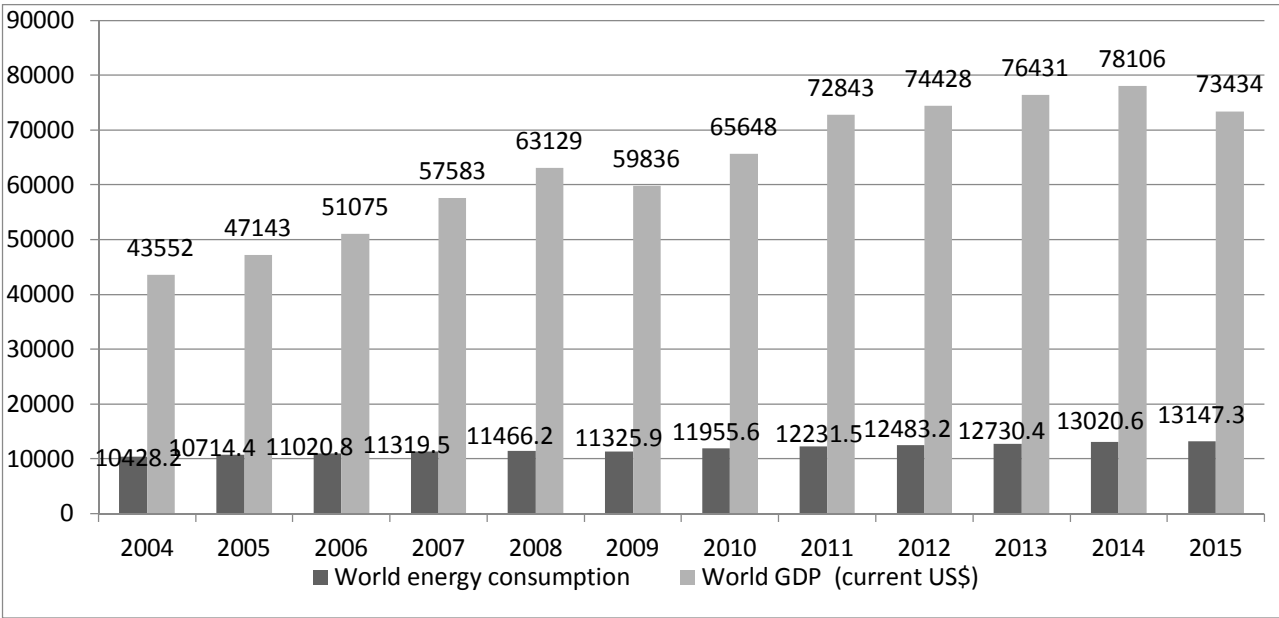


Figure 1 – Dynamics of world energy consumption over 2003 - 2013
 Source: author’s calculations according to the BP Statistical review of World Energy, June 2016 [3]

In Fig. 1 it is clearly shown that in the last decade the global GDP and global energy consumption have been rapidly growing. But the growth rate of world GDP and world energy consumption vary considerably. So, for the last decade (2004 - 2015) the world GDP grew by 69%, but the global energy consumption - only by 26%. In our opinion, this situation is primarily caused by changes in the sectoral structure of the world economy towards the growth of less energy-intensive non-productive sector in the world GDP (the service sector in global GDP is - 64% (2/3), manufacturing - 32%, agriculture - 4%), as well as a decrease in energy consumption of GDP generally through the use of innovative energy-saving technologies.

So, at first glance it seems that current trends reduce the energy dependence of the world economy. However, the slow recovery from prolonged recession of the world economy requires more thorough analysis of the processes taking place in the global energy market. Thus, the countries, being at present time the locomotives of the world economy (the highest GDP levels in the world), have the highest rates of energy consumption, namely the highest level of oil consumption occurs in the United States - 18.5 million barrels per day; China - 10 million barrels per day; Brazil - 2.9; Canada - 2.4; Germany - 2.4; India - 3.5; South Korea - 2.3; France - 1.8; UK - 1.5, etc. Moreover, most of these countries are net importers of energy [10]. In particular, the ten largest energy importers in the world, accumulating 40% of world production and 58% of energy consumption include the following countries: China, the USA, Japan, Germany, France, Italy, India, South Korea, Singapore (US dependence of energy import is permanently reducing through new exploration and production of its own primary energy sources as well as through the development of innovative technologies for renewable energy production) [Sentence A., 2014].

That is why the post-crisis recovery of the world economy, which depends largely on the economic development of the above mentioned leading countries, is primary determined by global energy market functioning. Therefore, we will provide a more detailed analysis of current trends in the global energy market development from the perspective of their impact on global economic conditions and the global economy advancement.

While analyzing the processes taking place in the global energy market, firstly it should be noted that its operation mainly depends on the demand and supply of energy, which in its turn are determined by the volume of global energy consumption and the provision of world primary energy sources, as well as development of renewable energy sources. In this regard, we will analyze the structure of world energy consumption and energy distribution while ensuring the world with energy sources (Fig. 2).

In Fig. 2 we see that at present stage the non-renewable energy sources remain dominating among the world's energy resources, as they constitute 86% of total world energy consumption, the largest share of which - 33% is an oil consumption, 29% - coal and 24% - natural gas. At the same time the nuclear

power and renewable energy sources make only 13% of energy consumption, 4% of which goes for nuclear energy and 9% means a hydropower and other renewable energy sources.

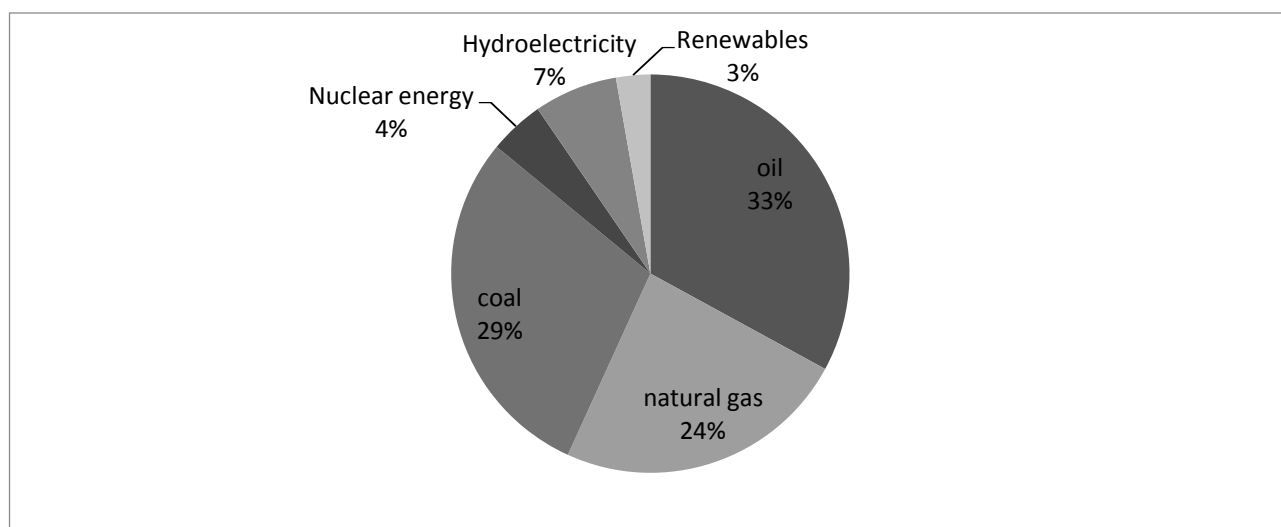


Figure 2 – The global energy consumption by type of energy in 2015

Source: author's calculations according to the BP Statistical review of World Energy, June 2016 [3]

Thus, despite the significant technological advances of the twentieth and twenty-first centuries, the world remains dependent on natural reserves of mineral energy resources, provision of which in the world is distributed unevenly (Table 1).

Table 1 - World reserves of natural energy resources at the end of 2015

Regions and some countries	Oil		Natural gas		Coal	
	Billion. barrels	% of total	Trillion. cubic meters	% of total	Million . tons	% of total
1	2	3	4	5	6	7
North America, including	238,0	14,0	12,8	6,8	245088	27,5
USA	55.0	2,6	10.4	5,6	237295	26,6
Canada	172.2	10,3	2,0	1,1	6582	0,7
Central America, including	329,2	19,4	7,6	4,1	14641	1,6
Venezuela	300.9	17,7	5,6	3,0	479	0,1
Europe and Eurasia, including	155.2	9.1	56,8	30,4	310538	34,8
Germany	i/a	i/a	i/a	i/a	40548	4,5
Russian Federation	102.4	6.0	32,3	17,3	157010	17,6
Kazakhstan	30,0	1,8	1,5	0,8	33600	3,8
Azerbaijan	7,0	0,4	0,9	0,5	i/a	i/a

1	2	3	4	5	6	7
Turkmenistan	0,6	0,04	17,5	9,4	i/a	i/a
Ukraine			0,6	0,3	33873	3,8
The Middle East, including	803,5	47,3	80,0	42,8	1122	0,1
Iran	157,8	9,3	34,0	18,2	i/a	i/a
Iraq	143,1	8,4	3,7	2,0	i/a	i/a
Qatar	25,7	1,5	24,5	13,1	i/a	i/a
Kuwait	101,5	6,0	1,8	1,0	i/a	i/a
Saudi Arabia	266,6	15,7	8,3	4,5	i/a	i/a
United Arab Emirates	97,8	5,8	6,1	3,3	i/a	i/a
Africa, including	129,1	7,6	14,1	7,5	31814	3,6
Algeria	12,2	0,7	4,5	2,4	i/a	i/a
Libya	48,4	2,8	1,5	0,8	i/a	i/a
Nigeria	37,1	2,2	5,1	2,7	i/a	i/a
South Africa	i/a	i/a	i/a	i/a	30156	3,4
Asia Pacific, including	42,6	2,5	15,6	8,4	288328	32,3
Australia	4,0	0,2	3,5	1,9	76400	8,6
Indonesia	3,6	0,2	2,8	1,5	28017	3,1
China	18,5	1,1	3,8	2,1	114500	12,8
Worldwide	1697,6	100,0	186,9	100,0	891531	100,0

*i/a – information not available

Source: author's calculations according to the BP Statistical review of World Energy, June 2016 [3]

From Table. 1 we can conclude that significant reserves of mineral energy resources at present time are concentrated in the Middle East, including almost 50% of world oil reserves and 42.8% of natural gas. Among the countries in the said region that are mostly rich in oil there are the following: Saudi Arabia (15.7%), Iran (9.3%), Iraq (8.4%), Kuwait (6.0%) and the United Arab Emirates (5.8%), and among those that have natural gas resources - Iran (18.2%) and Qatar (13.1%). It should also be noted that significant oil reserves today are possessed by Venezuela (17.7%), Canada (10.3%) and Russia (6.0%), and significant gas reserves belong to Russia (17.3%) and the USA (5.6 %) (output of shale gas in the USA has been expanding). Furthermore, coal is also an important energy resource nowadays, the large reserves of which are concentrated in the United States (26.6%), Russia (17.6%), Australia (8.6%), South Africa (3.4%) and Ukraine (3.8%). Obviously, due to the high availability of natural resources the above mentioned countries are exporters of the global energy market. Thus sustainable economic development of the world is supported by an active world trade in energy resources, which provides vital overflows from resource-excessive to resource-deficient regions. However, the growing scope of the world economy objectively leads to an increase in consumption, which in its turn encourages the growth of energy production. Due to the fact that oil as versatile to use and relatively easily transportable energy source dominated in the present structure of

energy (Figure 2) (33% of world energy consumption) it is reasonable to pay more attention to the analysis of the global oil market.

It is obvious that the global oil market trends are primarily dependent on supply and demand for this energy resource, i.e. the volume of consumption and production (Fig. 3).

Fig. 3 clearly outlines the growing scale of consumption of oil, ahead of its production. Obviously, this situation is appropriately displayed on the pricing mechanism and the global oil market towards the general trend of price increasing dynamics for this type of energy (Fig. 4).

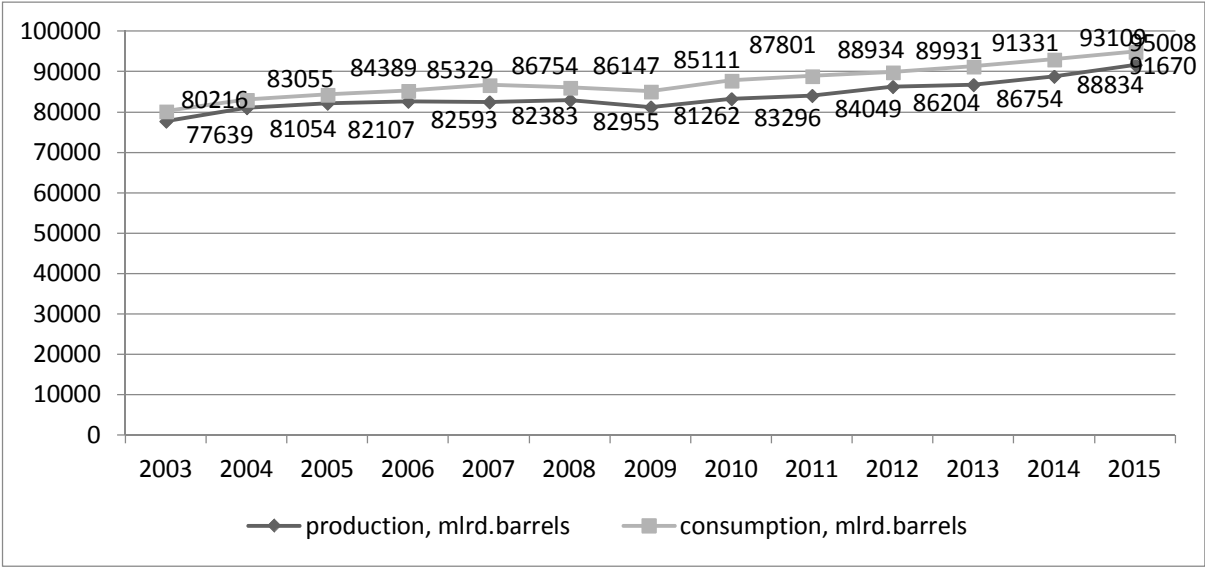


Figure 3 – Dynamics of world production and consumption of oil during 2003 – 2015

Source: author’s calculations according to the BP Statistical review of World Energy [3]

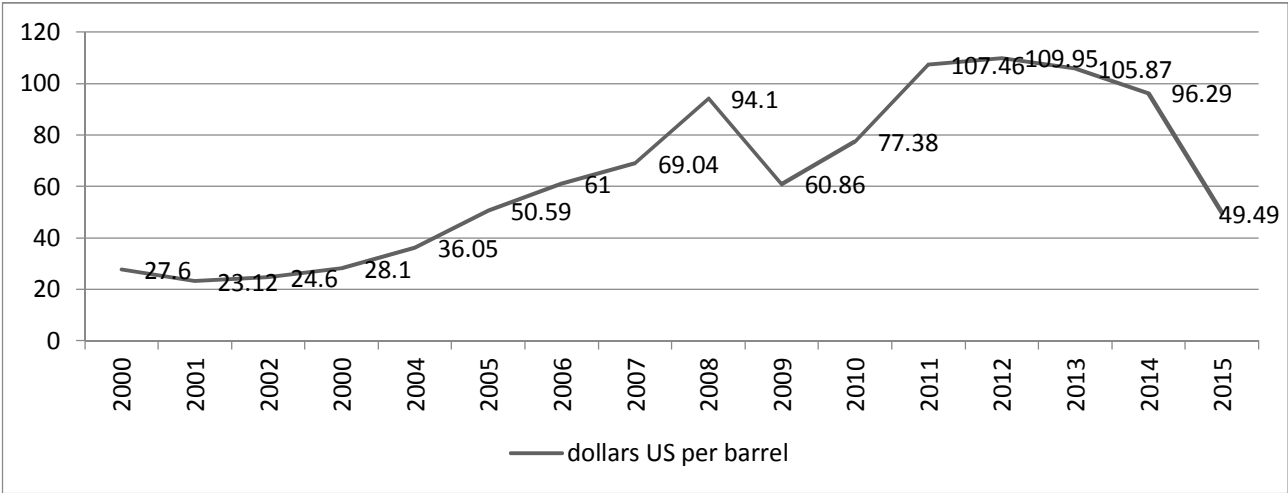


Figure 4 – Average annual OPEC crude oil price from 2000 to 2015 (in U.S. dollars per barrel)

Source: author’s calculations according to Average annual OPEC crude oil price [1]

As seen in Fig. 4, from 2000 to 2013 the price for oil increased by 78 USD per barrel, nearly 4 times. However, prices on the global oil market are characterized by high volatility on the one hand due to objectively unstable world situation (fall in prices during the global crisis), and on the other hand due to the specific oil market, the operation of which is influenced by subjective factors. In this regard, the Director-General of the WTO Pascal Lamy stressed that oil market is influenced by three main factors that affect prices: supply and demand (they are crucial), geopolitics, and oil producers attempt to generate a steady stream of financial resources from raw materials sales.

In our opinion, these three defining factors as described by general secretary of the WTO largely influenced the change in oil price dynamics during 2014 – 2015 years, demonstrating unprecedented for modern trend lower prices for the main energy resource in the world.

Obviously, this situation can be objectively caused by reduced demand of the largest oil importers (Europe, USA and Japan) on the background of a slow post-crisis recovery of their economies, as well as the expansion of oil production in the USA and Canada (Figure 5).

At the same time, we should not omit the fact that pricing policy in the global oil market is also under the impact of political factors, thus reflecting the efforts of certain countries to put pressure to global oil exporters in an economical way.

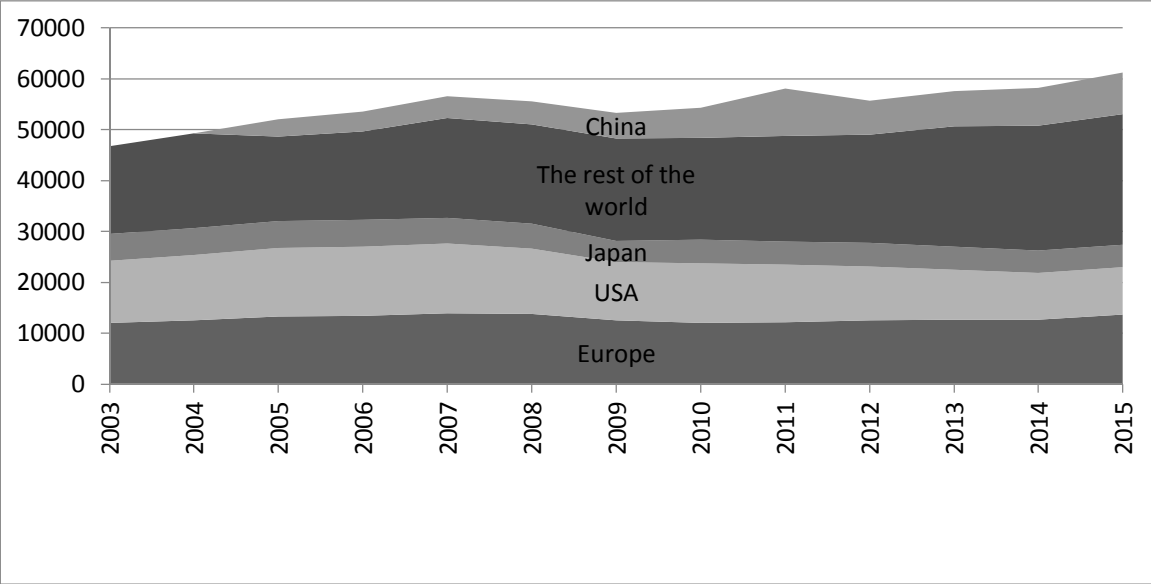


Figure 5 – Dynamics of world oil imports in the context of the main importers
 Source: author’s calculations according to the BP Statistical review of World Energy [3]

However, the well-known is that global oil exporters are the Middle East and the former Soviet Union countries, including Russia, whose economies are heavily dependent on export revenues from oil sales. In this situation, it is clear

that the significant drop in oil prices (during 2014-2016) will adversely affect their economic condition. So we know that these trends in the global oil market have already significantly affected Russia (and also by the global economic sanctions in connection with the annexation of Ukrainian territories), which during 2014-2015 was facing significant devaluation, inflation and recession in general.

Peculiarities of Ukrainian energy market and its impact to the energy security of Ukraine. The functioning of the Ukrainian economy, which is in present period in a deep economic crisis, largely depends on the development of energy sector and the provision of national economy by energy resources (Fig. 6).

In Fig. 6 we see that oil consumption in Ukraine in comparison with the world is low and is only 8.5%. In the structure of primary energy supply in Ukraine is dominated by coal and natural gas, constituting respectively 33.7% and 31.6% of the total primary energy supply. And if Ukraine has mainly its own coal and is even exporting it, but speaking about natural gas Ukraine lacks the sufficient amount and largely dependent on its imports (Table 2).

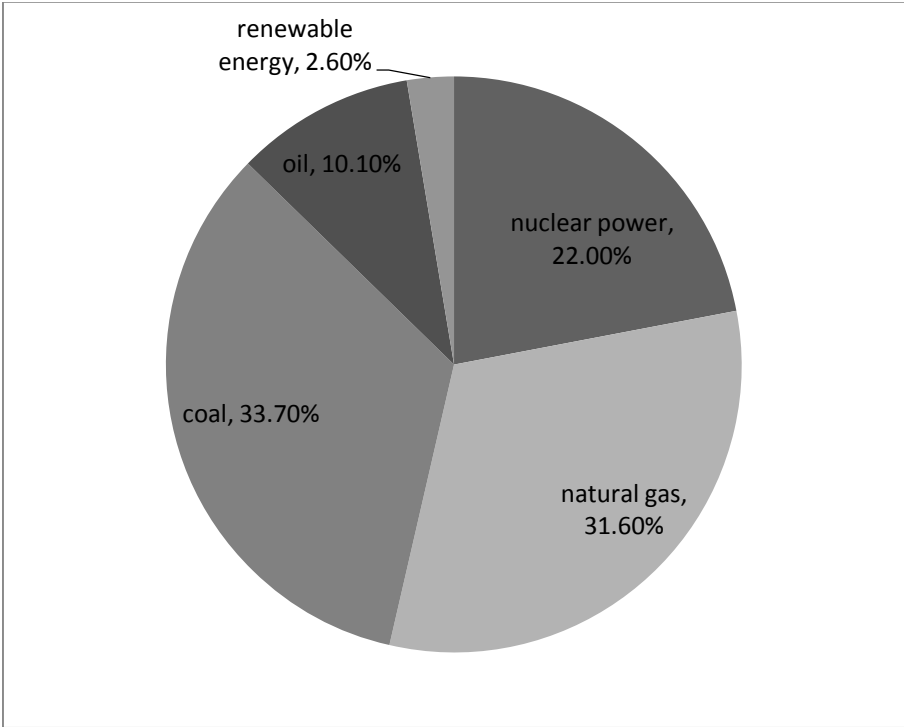


Figure 6 – The distribution of energy in total primary energy supply in Ukraine in 2014

Source: author’s calculations according to Energy balance of Ukraine [5]

Table 2 – Balance of primary energy supply in Ukraine in 2014

Supply and consumption	Coal and peat	Crude oil	Oil	Natural gas	Atomics	Hydropower	Wind Solar Energy	Biofuel	Electric Power	Heat	Total
1	2	3	4	5	6	7	8	9	10	11	12
Production	31891	2817	-	15022	23191	729	134	2399	-	745	76928

End of Table 2

1	2	3	4	5	6	7	8	9	10	11	12
Import	10374	193	8117	15720	-	-	-	15	8	-	34437
Export	-4915	-70	-747	-	-	-	-	-502	-733	-	-6967
International bunkering	-	-	-131	-	-	-	-	-	-	-	-131
Change in inventories	-1774	102	407	2671	-	-	-	11	-	-	1417
The total primary energy supply	35576	3043	7645	33412	23191	729	134	1934	-725	745	105683

Source: author's calculations according to Energy balance of Ukraine [5]

Table. 2 shows the considerable dependence of Ukraine on natural gas imports which makes 45.6% in the structure of energy imports (it should be noted that the share of gas imports to Ukraine in 2014 compared to 2013 decreased by 11.4%). Therefore, the situation in the global gas market has a significant value for Ukraine. Obviously, the situation on the global gas market reflects the objective trends of supply and demand for this energy resource, which is reflected in its global production and consumption (Fig. 7).

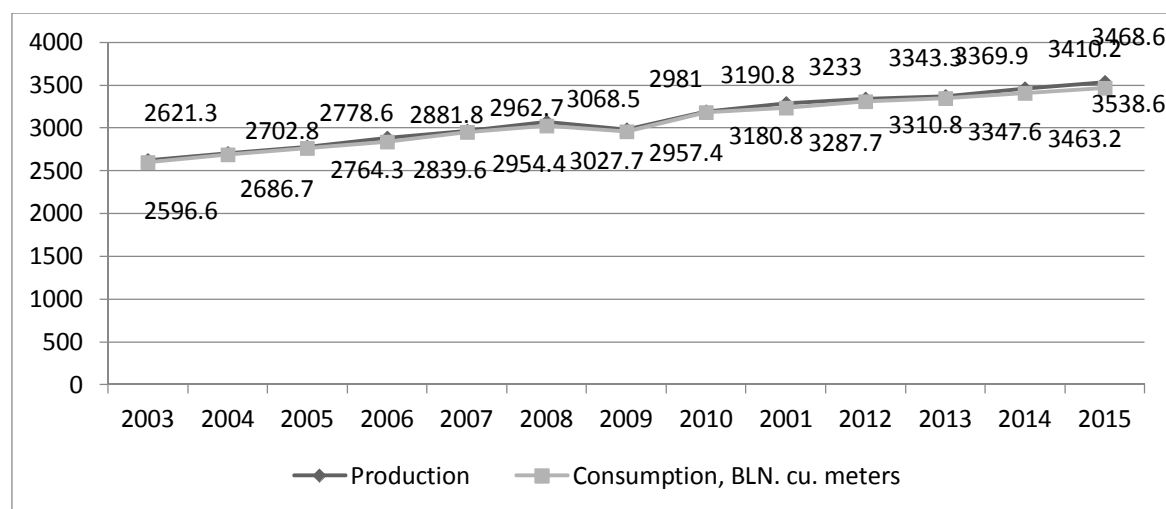


Figure 7 – Dynamics of world production and consumption of natural gas during 2003 – 2015

Source: author's calculations according to the BP Statistical review of World Energy [3]

From Fig. 7 we can judge on the of slow growth trends of world consumption and production of natural gas, which is largely dependent on the general global economic situation (a slight decline in consumption and production

during the global economic crisis) and appropriately reflected in the pricing of this energy resource (Fig. 8).

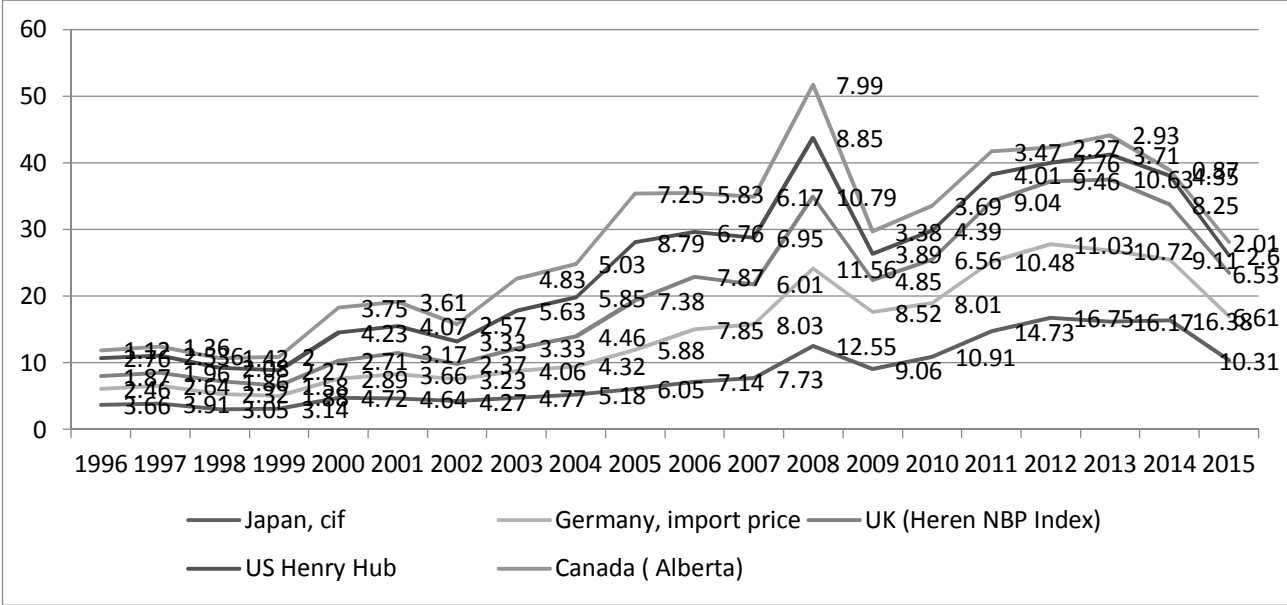


Figure 8 – Dynamics of world prices for natural gas for the leading regional markets during 1996 - 2013

Source: author’s calculations according to the BP Statistical review of World Energy [3]

Fig. 8. outlines that the background for natural gas specific pricing is the existence of exchange trade on regional markets of energy resources and relevant different prices. However, overall price dynamics reflects natural trends in supply and demand for this energy resource and general decline trend in prices for natural gas in the world, including Russian gas (fig. 9).

Current trends for Russian gas prices would accordingly effect on trade and cooperation between Ukraine and Russia, which has traditionally been a major exporter of natural gas to Ukraine. However, the economic cooperation between Ukraine and Russia contains important political component, so that Ukraine receives gas at inflated prices. Moreover, Ukraine, having its favorable geographical location and modern gas transit system, loses political reasons and positions of gas transit country due to construction of the Nord Stream gas pipeline by Russia, bypassing Ukraine. As a result, Ukraine is losing a significant portion of foreign exchange earnings, which adversely affects the balance of payments, and hence the value of the national currency.

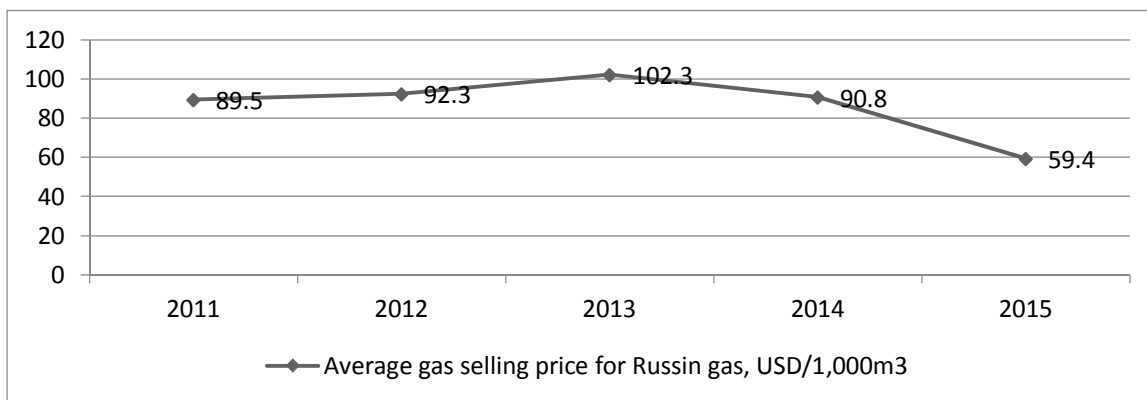


Figure 9 – Average gas selling price for Russian gas (net of VAT, excise tax and customs duties) during 2011 – 2015

Source: author's calculations according to Gazprom data [6]

In this challenging economic situation in Ukraine, due to the political and economic crisis, the value of its own sources of energy (which is coal) is growing (Table 1 and 2). But due to the military developments in the east, where the coal sources are mostly situated, it is almost impossible to use them and thus Ukraine is deprived from its significant proportion of the energy resources, that greatly impairs the country's energy security.

It should be noted that in the last decade (2004 - 2014) there have been seen growth trends in global production and consumption of coal and only in 2015 there is a negative trend (Fig. 10).

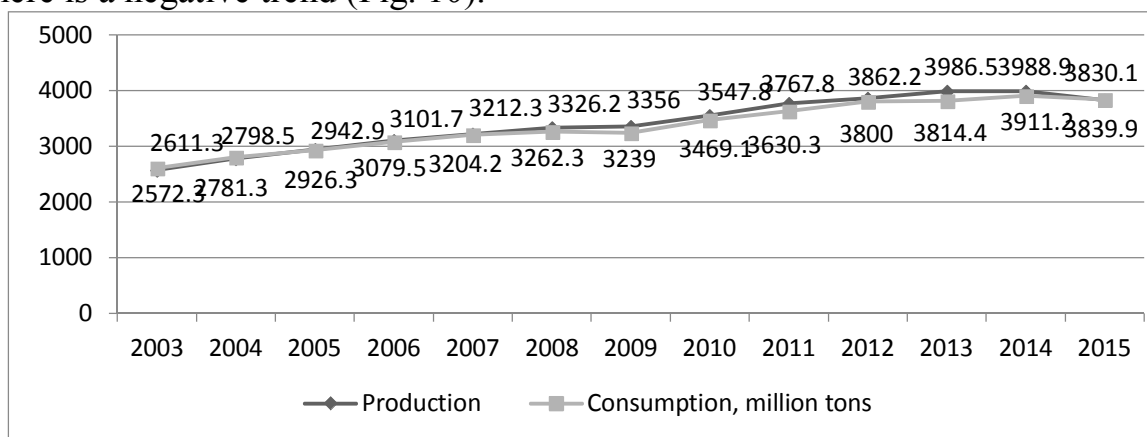


Figure 10 - Dynamics of world production and consumption of coal during 2003 – 2015

Source: author's calculations according to the BP Statistical review of World Energy [3]

In Fig. 10 it is clearly seen the increasing amount of world production and consumption of coal, mainly due to relatively uniform provision of the world with this energy source if compared to oil and natural gas (Table. 1). These trends appropriately influence the price dynamics for coal, which is also dependent on

the general economic and market conditions and regional inventories of raw materials (Fig. 11).

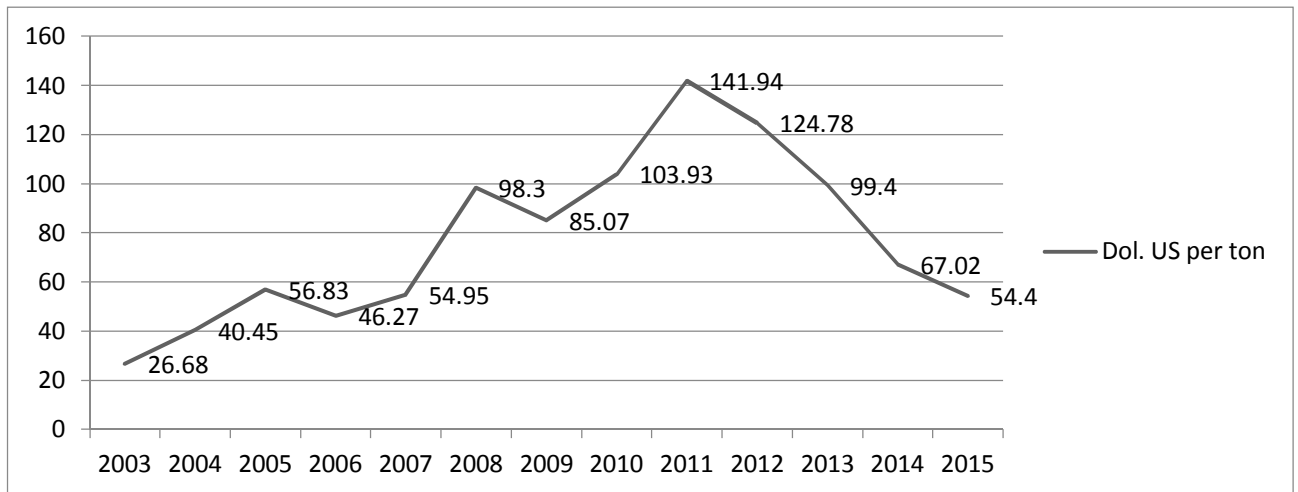


Figure 11 – Dynamics of world prices for coal (Australian) over 2003 - 2015
Source: author's calculations according to Statistics of Coal Prices [4]

Fig. 11 shows the existing since 2011 worldwide trends of coal prices reduction, which can be explained by the fact that many countries have their own coal reserves and are increasing its production as well as the obligations of industrial and developed countries (USA, EU and Japan) under the Kyoto Protocol to substantially reduce during 2008 – 2012 the emissions of carbon dioxide (a greenhouse gas) from the coal usage of as fuel.

For Ukraine, obviously, the global trends of coal prices reduction are beneficial, as it will have to import coal. However, the substitution of domestic coal with the imported one will be an additional economic burden for Ukraine in this very difficult economic situation.

In the situation that has developed, the support of Ukraine's energy security largely depend on another power resource of its own production - nuclear energy, which in 2014 accounted for 22.0% (Figure 6) and is likely to grow in the future. At the present stage in Ukraine there are operating four nuclear power plants (Zaporizka, Pivdennoukrainska, Rivnenska and Khmelnytska (Chernobyl was decommissioned in 2000)), which produce almost 50% of electricity in the country. Thus, Ukraine is among the ten countries with the highest consumption of nuclear energy (Fig. 12).

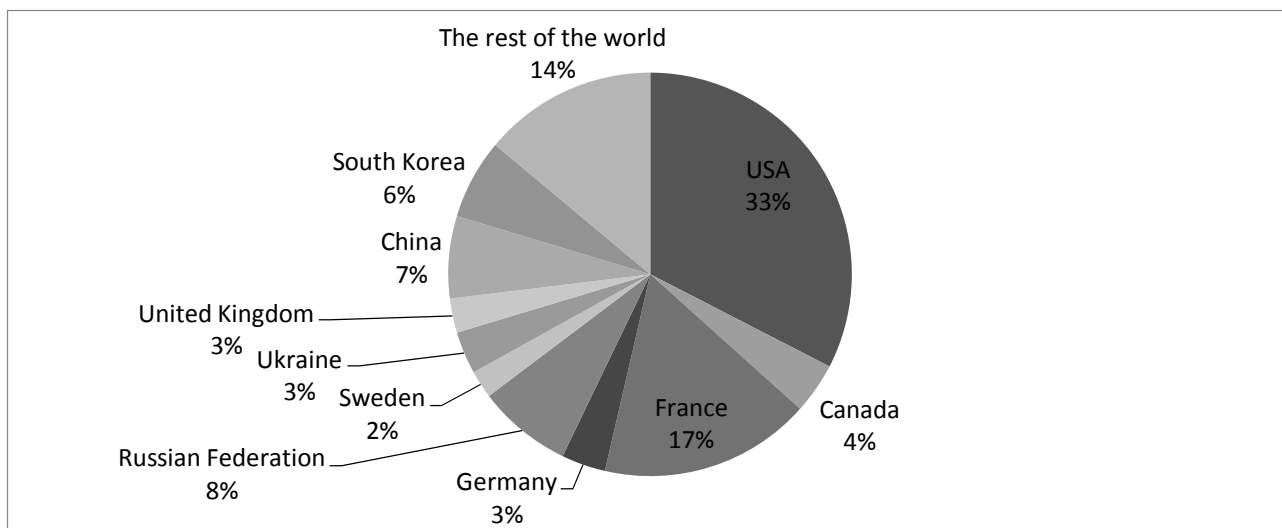


Figure 12 – World consumption of nuclear power in 2015 in the context of the world

Source: author's calculations according to the BP Statistical review of World Energy [3]

Fig. 12 shows that the world's largest consumers of nuclear power are the USA (33% of world consumption of nuclear energy), France (17%), Russia (8%) and South Korea (6%). Ukraine has also a high consumption of nuclear energy, which is 3% of world consumption. Consequently, as it was rightly noted by B. Paton, A. Baryakhtar, O. Bakay and I. Nekliudov [Paton B., Baryakhtar A., Bakay O. and Nekliudov I. 2006, p.3 - 13], this industry can certainly be the basis of energy security of our country, because Ukraine takes the sixth place in the world rate of countries with proven reserves of uranium; it has relevant technologies for nuclear separation reactions (nuclear power), but also due to the fact that the NPPs do not consume oxygen and emit no greenhouse gases.

However, in Ukraine has not created its own closed nuclear fuel cycle (required not only the availability of own fuel, but also facilities for processing spent nuclear fuel storage and facilities for its storage, etc.)), and there is strong opposition to the development of national nuclear energy by public opinion which was formed after the Chernobyl disaster.

The strengthening of global public opposition against the development of nuclear power was caused by accident at Japanese nuclear power plant "Fukushima", which was the result of a powerful tsunami. Thus, the wave of anti-nuclear confidence in the world led to the fact that Germany first refused from the nuclear power (until 2022 all nuclear power plants in Germany will be shut down), then Italians expressed against the construction of nuclear power plants, and also Japan plans to abandon nuclear power up to 2030, as well as Switzerland is going to do the same by 2034.

The development of renewable energy and saving energy technologies.
The development of renewable energy and savings energy technologies is a

modern tendency of the development of energy sector in developed countries (Fig. 13).

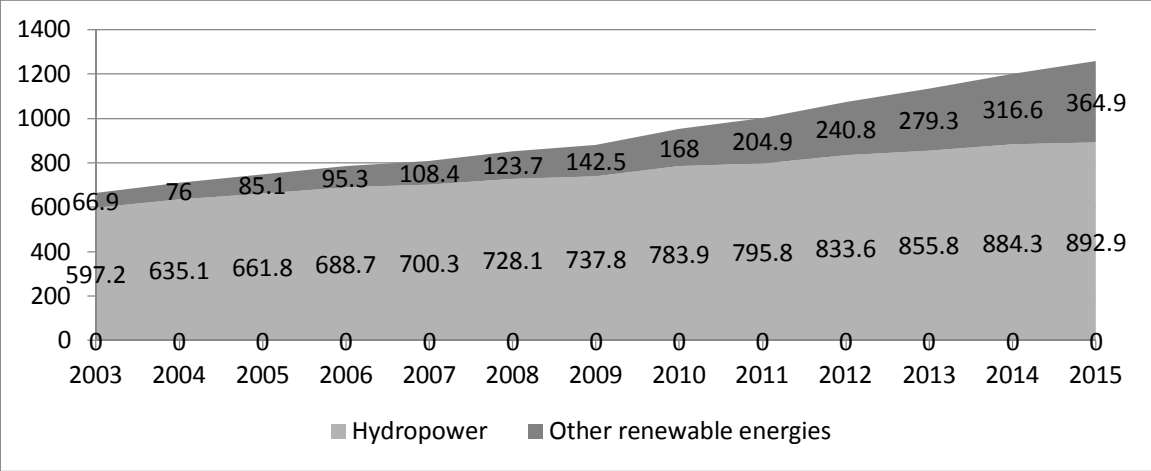


Figure 13 – Dynamics of world consumption of renewable energy during 2003 – 2013

Source: author’s calculations according to the BP Statistical review of World Energy [3]

The Fig. 13 clearly outlines the global trends in the development of renewable energy, which includes hydro, wind, solar and others energy sources. And, as you can see, energy of water is the most widely used in the global energy sector. However, the use of wind, solar power, geothermal and other renewable energy due to the high initial capital intensity provides at present less than 2% of commercial energy and is concentrated only in a small number of industrialized countries (Fig. 14).

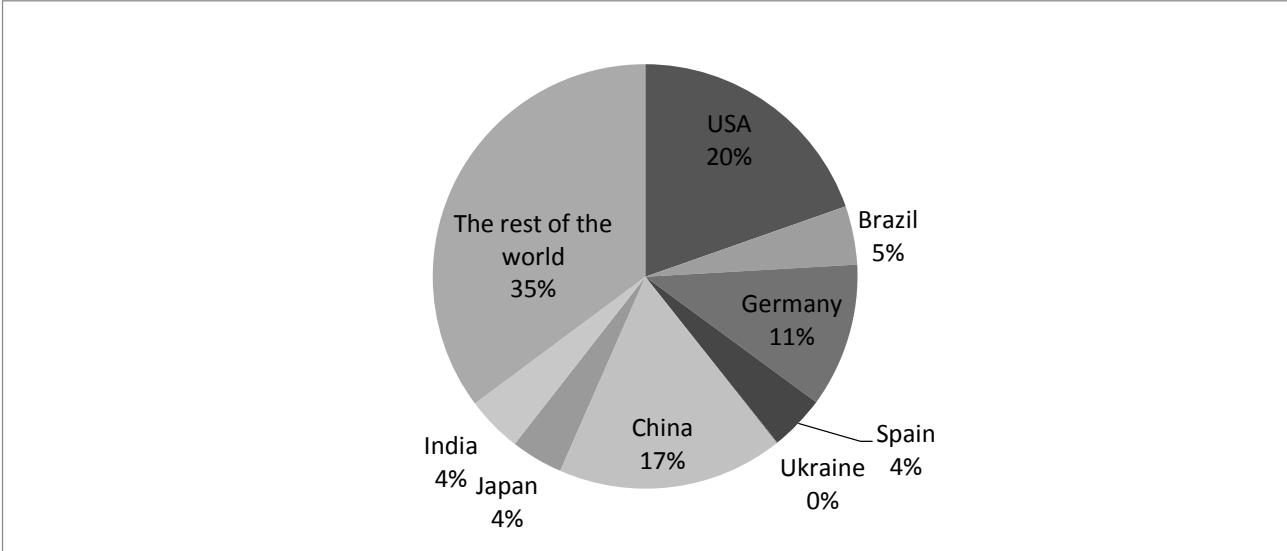


Figure 14 - World consumption of other types of renewable energy in 2015 in the context of the world

Source: author’s calculations according to the BP Statistical review of World Energy [3]

Fig. 14 shows that half of the world's renewable energy capacity is concentrated nowadays only in four countries, meaning the US, China, Germany and Spain. However, further expansion of renewable energy is an objective requirement of the modern world. Thus, from Fig. 15 we see the development of renewable energy in Brazil, Japan, India and other countries. Ukraine is significantly behind these global trends, because the renewable energy sources make only 2.7% in its energy consumption structure, while in the whole world it is 9% (Figure 2 and 6).

Conclusions. Thus, summarizing the analysis of modern trends of global and national energy sector and its influence on development of global and national economics, there should be separately distinguish its worldwide trends and national particular qualities. To worldwide trends there are assigned the following:

- firstly, the economic growth in global contexts, in the current stage, is to a large extent determined by development of energetic sector, which rightly can be called strategic sector of global and national economics;
- secondly, global trends of GDP energy consumption reduction as well as reduction of energy consumption manufacturing sectors does not help much to cut down the worldwide energy consumption amount;
- thirdly, in the structure of worldwide energy consumption the non-renewable energy sources (oil, natural gas and coal) traditionally dominate and their stocks are located irregularly in the world;
- fourthly, irregularity of supply of energy resources, which primarily depends on geologically-geographical location of the country and demand for energy resources, depending on the size of the economy and socio-economic development of countries, lead to significant imbalances in the energy market causing or deepening economic crisis developments;
- fifthly, price performance price dynamics in the global energy market characterized by significant volatility on renewable energy sources, especially on oil, which is determined by objective tendencies of changes of economic conjuncture as well as by subjective political and other factors;
- sixthly, post-crisis recovery of the worldwide economy in a growing dependence leading world countries (net importers) to ensure energy sources, strengthening the imbalances in the global energy market and growing ecological demands of society is impossible without the forced development of innovative energy-saving technologies and renewable sources of energy.

Particularity of national energetic sector is its significant dependence on import of primary energy sources, primarily natural gas. At the same time, non-diversified sources of energy imports, in particular natural gas, lead to the possibility of applying against Ukraine of economic and political pressure methods by its main energy supplier - Russia – through not market pricing mechanisms. Obviously, such situation represents a threat not only for energy security but also for political and economic sovereignty of Ukraine as a whole.

Thus, taking into account the above said development trends of global and national energy sector and permanent crisis that arise in the global and national economy systems and amplify imbalances in the energy market, we consider it necessary to complement traditional measures of countercyclical regulation extensive development of innovative technologies of energy saving. In our view, this will promote to not only reduction of the energy intensity of GDP and energy consumption in general, but also will stimulate the development of knowledge-intensive economic sectors, effective investment in their domestic and foreign investments, creation of additional highly skilled jobs and therefore it will stimulate post-crisis economic recovery and social and economic progress in general.

References

1. Average annual OPEC crude oil price from 1960 to 2016 (in U.S. dollars per barrel). [Data file]. Retrieved from <http://www.statista.com/statistics/262858/change-in-opec-crude-oil-prices-since-1960/>.
2. Багратян Г., Кравченко И. Введение в мегаэкономiku: теория, методология, практика: монография. К.: УБД НБУ, 2012.
3. BP Statistical review of World Energy, June 2016. – [Data file]. Retrieved from <https://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf>.
4. Coal Prices: Long Term Forecast to 2020. [Data file]. Retrieved from <http://knoema.ru/xfakeuc/coal-prices-long-term-forecast-to-2020-data-and-charts>.
5. Енергетичний баланс України за 2014 рік. Експрес випуск державної служби статистики України. [Data file]. Retrieved from <http://www.uabio.org/img/files/news/pdf/energy-balance-ukraine-2014.pdf>.
6. Gazprom. Europe. Retrieved from <http://www.gazprom.com/about/marketing/europe/>
7. Keynes J. M. The General Theory of Employment, Interest and Money, Macmillan Cambridge University Press, for Royal Economic Society, 1936.
8. Кондратьев Н.Д. Мировое хозяйство и его конъюнктуры во время и после войны. Вологда: Обл.отделение гос.издательства, 1922.
9. Kuznets S. Economic Growth of Nations: Total Output and Production Structure. Cambridge: Belknap Press of Harvard University Press, 1971.
10. List of countries by oil consumption. [Data file]. Retrieved from <http://en.m.wikipedia.org>
11. Mitchell W. What Happens During Business Cycles: A Progress Report. Pp, xxxi, 386. - New York: National Bureau of Economic Research, 1951.

12. Патон Б., Бар'яхтар Б., Бакай О. та Неклюдов І. Майбутнє атомної енергетики. Вісн. НАН України, № 4, 2006.
13. Schumpeter J. Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process. Volume I, Volume II. New York - London: McGraw-Hill, 1939.
14. Sentence A. Who will benefit from the oil surprise? Retrieved from http://pwc.blogs.com/economics_in_business/2014/12.
15. Туган-Барановский М. И. Периодические промышленные кризисы. История английских кризисов. Общая теория кризисов. Петроград, 1923.
16. Friedman, M. and Schwartz A. A Monetary History of the United States, 1867–1960. Princeton, NJ: Princeton University Press, 1963.

Sergii Ivanov
Vasyl Perebyynis
Valerii Havrysh
Yuliya Perebyynis

LOW-CARBON ECONOMY: MODERN VIEW ON ENERGY CONCEPT OF SERHIY PODOLYNSKY

The article focuses on expediency of transformation of humanity to the paradigm of the low-carbon economy as a result of restrictions or unavailability of carbohydrates, the ongoing global energy and environmental crisis. In this context, the energy concept of an outstanding thinker of the XIXth century Serhiy Podolynsky, a scientist who was ahead of his time, is relevant in modern times.

It has been established that S. Podolynsky focused his attention on four issues: nature of energy, its movement and transformation; consideration of fossil fuels and efficiency of their use in the conditions prevailing at that time; studying energy as a major factor in agriculture; essence of human labour as a means of energy storage.

In his fundamental work, S. Podolynsky draws attention to a need to increase efficiency of the basic fuels at that time - coal and wood, as for getting the later leads to deforestation resulting in environmental degradation. History has confirmed expediency of the major part of Serhiy Podolynsky's ideas, particularly, ecosafety and cost-effective energy production using solar energy, wind energy, hydro energy of small rivers, geothermal energy, plant and animal waste, biofuels, etc., which are the basis of modern concepts of low-carbon economy.

Introduction. Energy is usually called a queen of the world. Due to existence of the energy conservation law, the category of "energy" binds together all natural phenomena. Physical increasing of energy amounts used by mankind has been an important precondition for economic, scientific and technological progress for a long time.

Over the past two centuries, qualitative changes have taken place in various branches of energy production accompanied by alternating jumps and evolution: the steam engine - internal combustion engine – electric motor. This has determined the growth of rates of replacement of manual labour with machine one. Obviously, energy-saving of manual labour is directly dependent on the level of mechanical engineering development and rates of growth of energy availability per worker.

A universal historical trend is a relative decline in the use of directly available natural potential, particularly hydrocarbons. However, the type of scientific and technological progress focused on permanent increase in production of fossil energy resources is limited in volume, accessibility and quality of their reserves.

Restrictions or unavailability of natural resources, including hydrocarbons, permanent global energy and environmental crisis of the late XX - early XIX century have led to an objective need for reorientation of material production to an energy-saving type, transition to the low-carbon development paradigm.

Review of researches. Numerous scientific publications of researchers released recently have been devoted to the problems of the low-carbon economy. In particular, development of the low-carbon economy in G20 countries has been highlighted in the article by He Ge [He 2012], prospects and opportunities for further spread of the low-carbon economy in the regions of Ukraine have been considered in details in the scientific paper [Shevtsov, Barannik, Zemlianyi, Riauzova 2013].

The monograph by I. Haidutsky [Haidutsky 2014] has been devoted to theoretical, methodological and practical aspects of investing in the low-carbon economy, the article by N. Karaieva and N. Bereznytska [Karaieva, Bereznytska 2014] has been devoted to use of expert methods to support the low-carbon strategy for economic development. The above-mentioned set of problems has been studied in numerous books and articles by scientists from leading universities of Poland [Lis, Mazurkiewicz, Pająk 2015, pp. 181-202; Pająk, Dahlke, Kvilinskyi 2016, pp. 109-122; Pająk, Mazurkiewicz 2015], other European countries, discussed at scientific conferences.

In this context, the energy concept of an outstanding thinker of the XIXth century Serhiy Podolynsky (1850-1891) attracts our attention. The French scientist Debirre named Serhiy Podolynsky an author of one of the newest theories of thermodynamics. A famous Belgian explorer and Nobel laureate Illia Prigozhin pointed out that his discovery had been prompted by this precisely concept by Serhiy Podolynsky. Developing his ideas, Volodymyr Vernadsky, Konstantyn Tsiolkovsky and others created the theory of the noosphere. In particular, V. Vernadsky called S. Podolynsky a scientist who was ahead of his time: "we find short but absolutely clear instructions, opinions and facts about energy difference between of the living from the dead - already in the writings of the founders of thermodynamics - R. Mayer, W. Thomson (Lord Kelvin), H. Helmholtz. These instructions had been neither understood nor appreciated. Later and independently, the predeceased S. Podolynsky understood all the importance of these ideas and tried to adapt them to study economic phenomena" [Vernadsky 1954; Vernadsky 1991].

According to V. Shevchuk, S. Podolynsky formed principles of the essential economic paradigm, the fundamental nature of which is to open sources of economic life and social progress. He demonstrated that solar energy is such a source [Shevchuk 2002].

Podolynsky S. is considered a founder of the school of physical economy, promoter of the energy approach to human capital [Zlupko 2000; Maksymenko 1995; Rudenko 1998; Shevchuk 2005].

As L. Vorobyova points out [Vorobyova, 2008]:

1) S. Podolynsky created an original doctrine which surpassed the previous achievements of economics and laid the foundation for a new school - physical economics. If physiocrats borrowed from William Petty one part of his definition of value (i.e. land) and Adam Smith and David Ricardo – the other (i.e. labour), S. Podolynsky combined them. He stated that not only land and labour but also solar energy, which is largely accumulated on the Earth through human labour, are a source of value;

2) S. Podolynsky developed a new paradigm of civilizational development. He relates the progress of society with increasing energy budget of every person and mankind as a whole, with energy saving and accumulation. Energy saving and accumulation occur due to conscious, creative human labour;

3) S. Podolynsky gave a new natural scientific definition of labour. He was the first in the world of science who linked the concept of "labour" and "development" with an increase of free energy flows. The scientist first proved that with his labour, a human being is able to increase accumulation of solar energy on the Earth and reduce its dissipation in the universe;

4) S. Podolynsky laid the foundation of an integrated system of "nature - society - human being".

Modern scientists think that S. Podolynsky's discoveries are outstanding discoveries for all the mankind's science and call them "Podolynsky's law" [Kuznetsov 2003]. The study guide prepared and published by O. Kuznetsov and B. Bolshakov [Kuznetsov, Bolshakov 2002] has been based on the thinker's ideas.

Serhiy Podolynsky was born in Kyiv province of what was then the Russian Empire (now Cherkasy region, Ukraine) in a noble family: his father Andrii Ivanovych was a civil servant, famous poet; his mother Mariia Serhiiivna had Polish and French roots (she was Count Octaviy Choiseul-Hufye's granddaughter and Count Stanisław Szczęśny Potocki's great-granddaughter).

Podolynsky S. graduated from the Natural Department of the Physics and Mathematics School of St. Volodymyr Imperial University (the city of Kyiv) with honours (a gold medal), continued his studies at medical departments in Paris and Zurich. In Breslau (now Wroclaw), he worked at Rudolf Heidenhain's laboratory where in 1876, he presented his doctoral thesis in medicine. After that, he passed an appropriate examination at the Medical Department of the University in Kyiv (because foreign diplomas were not recognized in Russia according to the decree of 1873) and got "a doctor degree".

Podolynsky S. started publishing his works at 23. Articles about development of the labour movement, an issue of health of the rural population, philosophical and economic works were issued from his pen. In 1877, he emigrated to France and settled in Montpellier and in 1880, he published his work "Human Labour and Saving Energy" in the journal "Slovo" (Word) [Podolynsky 1880], which was also published in France, Italy and Germany.

Nowadays, this most important Podolynsky's work has been reprinted in Montreal [Podolynsky 1990], Moscow [Podolynsky, 1991], Kyiv [Podolynsky, 2000]. He was elected a member of the French Society of Science Development.

Setting objectives. In our opinion, nowadays, considering a number of environmental issues of power engineering, researches related to ecologization of energy production are important because we do not have scientists' well-established views on the energy strategy, in particular expediency of nuclear power plants, development of alternative ecological safe energy sources. Studying S. Podolynsky's scientific heritage allows to take into consideration his methods of approach to the energy concept based on the paradigm of low-carbon economy. Considering the mentioned above, we have attempted to analyze Serhiy Podolynsky's views on four issues (energy, its motion and transformation; fossil fuels and efficiency of their use; energy as a main factor in crop and livestock production; human labour as a means of energy accumulation), their relevance to modern conditions of global development.

Results of the research. Energy, its motion and transformation. In their time, scientists believed that energy was the sum of all natural forces contained in the system of bodies and could be in the form of seven different physical forces: heat, light, electricity, magnetism, chemical affinity, partial forces and universal gravitation. Guided by the scientific researches of that time, Serhiy Podolynsky drew his attention to the fact that the total energy of a system, including the universe, has a completely unchanged value, and the energy conservation law is, in fact, no more than a generalization of the long-known law of mechanics.

The researcher divides energy into kinetic and potential: in cases when we have kinetic energy, motion is directly available to our senses (e.g., flowing water, a falling avalanche, working steam engine, shell fired from a cannon, motion of the Moon around the Earth, etc.). Conversely, even though motion of a matter exists in its potential energy, it has not entered into forms accessible to our sense yet, although it can get it under certain circumstances. An avalanche hanging over a cliff, a heated but still not working steam engine, a loaded cannon, human food that has not been converted into a muscle contraction at work yet are examples of potential energy.

He writes that planets and satellites derive energy from stars (the Sun) and this will eventually lead to widespread energy levelling. Transfer of energy is accompanied with transformation of one kind of energy into another. But not all the forms of energy can be equally easily transformed into others. And every time such a transformation takes place, there is a tendency of energy to move, at least, partially, from easy convertible forms (e.g., movement) to a form modified with great difficulties, (e.g., heat). Thus, energy of the Universe is constantly moving from easily convertible forms to more stable ones, therefore its opportunity to transform is constantly decreasing.

Referring to W. Thomson, the scientist concludes: in a long lapse of centuries, all the energy will take a form incapable to transform which will consist

of heat evenly distributed throughout the Universe. In this case, every life and every movement that we feel, obviously, have to stop because we know that it is necessary to have bodies with different temperatures to transform heat into another form of energy. Trend of energy of the Universe to its general balance is called by S. Podolynsky dissipation of energy (entropy) and the energy distribution law is as proven as the energy conservation law.

The researcher points out that energy of the Sun and own energy of the Earth, which gradually decreases, are energy sources on our planet. He analyzes how people use energy produced in the result of rotation of the Earth around the Sun and around its axis by applying it for mills using tidal energy. People also use internal heat of the Earth (hot water sources) for heating homes, cooking. According to S. Podolynsky, economic use of wind, which in fact is nothing more than a result of striving to balance temperatures, is important.

Force of water currents is not disregarded by him. He notes that water falling, for example, to a mill wheel from height provides the percentage of useful work which is not made by a steam or electromagnetic machine, or even a more favorably arranged working animal or human body. That is why it is no accident that the researcher saw the wind and water engines as the best ones, as they are notable for extremely high percentage of provided work because their energy is already in the stage of higher, convertible energy.

The scientist's attention is attracted by invention of the "solar car" - a device that heats water and turns it into steam with special mirrors using sunlight. He believes that in terms of energy conservation, the solar car may be the best machine invented at that time. Any work done by this machine is including an excessive amount of solar energy into mankind's budget without simultaneous dissipation of saved energy as it often happens when a steam engine or domestic animals work. His estimations show that whatever a number of people was on the Earth, all energy needs would be fully met, as not less than one half of horsepower from the accumulated solar energy would be accounted for each person.

The researcher concludes: solar energy obtained by the Earth gradually decreases. Obviously, in order to accumulate convertible energy in conditions of its decrease on the Earth surface and the closest layers beneath it, a process of energy-saving should take place, a process that is opposite to dissipation. It should even be a process of converting sustainable energy (heat) into its highest form, more convertible into mechanical motion, potential or kinetic.

The scientist points out that on the Earth, we receive solar energy that is not too much convertible but its form is not stable too much. High temperature, light, chemical rays are all such forms of energy, which, however, with a great loss to dissipation, are still partially transformed on the Earth's surface into more convertible, higher kinds of energy such as mechanical work of a machine, muscle contraction, and, probably, mental activity.

The scientist notes considerable difficulties of transition of lower forms of energy into higher ones. He indicates that known methods by which solar energy

can be converted into mechanical motion are very few, and reserves of convertible energy are not accumulated in the air. This is due to the fact that nature does not have tanks that could be filled by themselves with "condensed" air, energy of which could be consumed to the necessary extent.

According to the scientist, although the total amount of energy received by the Earth surface from the inside and from the Sun gradually decreases, at the same time the total amount of energy accumulated on the Earth surface and available to mankind is gradually increasing. This increase is influenced by human labour and that of workstock.

Organic fuel and efficiency of its use. Serhiy Podolynsky notes that the source for fossil fuels formation (coal, oil, peat) are plants that covered the Earth surface in different periods by means of energy delivered by the Sun. In fact, the energy stored in coal is only saved solar heat.

Considering extraction of coal and peat, the scientist points out that energy contained in coal exceeds energy spent on its extraction in both heat and work in 20 times. But he doubts whether coal extraction and consumption is useful work or whether it is dissipation of energy in space. The researcher is concerned about the fact that deposits of coal and peat being ready stockpiles of solar energy have both been extracted uneconomically and consumed wastefully without returning all the saving of energy that they could give either while heating or machine working.

The scientist is worried with some incorrectness of existing at that time methods of calculating energy efficiency because coal is a deposit of solar energy collected over a long period of time. Utilizing coal in large quantities, we introduce accidentally collected profits of previous years to our budget and conduct a calculation as if we really make ends meet. He believes that use of this kind of fuel would only be effective ("useful labour") if annually we could fix such an amount of solar energy on the Earth surface which is equal to the energy of the extracted coal by means of all the work spent to extract it. The researcher notices that humans look with fair fear at the use of combustible material done on such principles.

The scientist examines effectiveness of technology use, believing that it is not a mechanical tool (working machine) that is it's the main component but an engine. Considering the work of steam engines and other thermal machines, the researcher suggests the following data. First of all, the economic equivalent of almost all the thermal machines is much lower than the economic equivalent of driving force of water and air (no more than $1/6 - 1/5$). Secondly, their real industrial equivalent is even less than the theoretical economic equivalent as mostly a part of the heat derived from fuel combustion is absorbed by a steam engine. The scientist believes that the main reason for inefficiency of steam engines is the fact that when we consume coal, loss of energy is always similar to saving, and this makes us fear as we watch the spread of steam engines.

He notes a destructive effect of steam engines in areas with no coal and routes for its transportation (as it was in the areas of sugar industry). And he asks his contemporaries a sharp questions: whether sugar production provided deforestation is energy-saving, i.e. is useful labour, or it is rather dissipation of energy in space, that is ridiculous predation.

Therefore, S. Podolynsky's conclusion is not accidental: if the steam engine is not quite profitable even now, its activities will be not effective at all in some distant future. The scientist realizes that people cannot abandon it now because their needs are growing so fast that they cannot be removed from their satisfaction to save for the future. In addition, consciously or unconsciously, deep down, everybody has a hope that in case of an extreme hardship, there will be a new invention that will save everything or, at least, delay a trouble for an indefinite term.

The researcher believed that until humans find such an engine for their machines which will provide them with energy for a longer time without confusion of rapid depletion, all calculations of an amount of technical work, which are at the disposal of mankind, should be considered erroneous because an amount of energy that supports this work may eventually cease to exist. At the same time, to some extent, he justifies the situation noting that a need for coal is so inevitable and its reserves are so big and an opportunity to have new inventions before their exhaustion is so probable that humans cannot behave differently as did previously, i.e. trying to increase their reserve of unconvertible energy with coal mining whenever possible.

Energy as a main factor in crop and livestock operation. Serhiy Podolynsky concludes that under present conditions, all the people who eat products of plant growing and animal husbandry satisfy their need for food almost exclusively with solar energy introduced in exchange of human labour on the Earth surface because plants mostly keep only solar energy.

So far, as plants have increased and continue to increase a reserve of converted energy on the Earth surface, the scientist believes that plants are the worst enemies of world energy dissipation. In fact, functioning of the mechanism of raising the solar energy from the lower level to the highest one takes place in plants. However, the energy, stored by plants and accumulated inside the Earth, does not result by itself in production of new higher energy.

The researcher notes that since the emergence of mankind, productivity of nutrient material containing a reserve of converted energy on the Earth surface has been increasing. Thus, according to his estimations, in France, each thermal unit applied as human or horse labour to cultivate an artificial meadow produces an excess accumulation of solar heat which equals to 41 thermal units, and cultivation of wheat equals to 22 thermal units. He explains that this excess of energy is derived from labour of humans and workstock.

Considering agriculture as a scope of human labour, the scientist notes that productivity of an acre of land is increased by ten, twenty or more times when a

human being makes it their work. Efficient agriculture is the best use of useful labour, i.e. labour that increases saving of solar energy on the Earth surface.

The researcher describes functioning of agriculture from energy point of view. In particular, he considers a ready energy reserve in the form of seeds and an energy reserve in the form of fertilizer as a precondition that plant life is able to make that significant saving of solar energy which is the immediate goal of agriculture.

But, it is the scientist's opinion that all of the following agricultural works as well as plant products processing do not only retain the converted energy, increase its quantity, which is in exchange on the Earth surface, but rather dissipate energy accumulated in the human body. However, all these expenses are compensated by consumption of the convertible energy reserve accumulated in crop production.

The researcher calculates that to return to humans all the energy spent on plant growing in full, solar energy saving in crop production should not exceed 20 times an amount of human mechanical work spent on plant growing. To the scholar's mind, in plant growing, as in some other fields of material production, the energy conservation law is quite obviously applied.

Considering animal husbandry, the scientist notes that the work on breeding domestic animals facilitates transition of energy saved by plants to the highest form. Despite the fact that this agricultural sector is not accompanied with saving of a new, excessive amount of solar energy, the role of nomadic life and animal husbandry is extremely beneficial in the development of labour. He motivates this with improving human food supply and saving time for leisure and observations. We know that partly energy goes to animal food. More or less, all animals turn a part of saved energy to its highest form, mechanical work; and completing that, animals, though, dissipate the energy stored by plants again.

Studying animal husbandry, the researcher notes that the main purpose of keeping livestock is to use working domestic animals as a means of increasing human capabilities. The scientist points out that livestock should be used as draft power for three reasons. First of all, livestock eats plant food that mostly does not need any special cooking. Secondly, the economic equivalent of most workstock is higher than the economic equivalent of humans. Thirdly, because of its small size, mechanical work done by humans is simply insufficient to do all the necessary actions.

However, according to the researcher, in energy distribution benefits obtained with working domestic animals cannot be very big because the economic equivalent of working livestock is not big. To support this thesis, he cites the data that when a steam engine works, one hour of steam horsepower costs 3 pence but when horses work, it is 5½ pence, that is almost twice as much. Besides, domestic animals eat the same food that humans do, i.e. land under meadows (grassland) could provide food for humans as well.

Further, the researcher says it is obvious that if the purpose of animal husbandry was only desire to get more mechanical work, a huge amount of work done by animals would be subsequently modified with machines. But since keeping domestic animals is for another purpose (to produce meat, leather, wool, manure, etc.), the matter cannot be resolved with such simplicity. The scientist notes that consuming meat, we cannot avoid losses inevitable in transition of solar energy saved by plants into animal meat used as human food and losses related to cooking.

Speaking of energy stored by plants and animals in the materials used as food and for making clothes, the researcher says that an amount of energy is limited and directly dependent on quality characteristics of plants, it stands on an amount of human labour applied in agriculture. And he concludes: if a volume of mechanical work constantly grows, crop volumes can constantly increase.

The scientist draws attention to another means of increasing nutrients in proportional ratio to applied mechanical work: it is direct synthesis of substances used as human food from inorganic elements that constitute them. His calculations show that synthetic production of nutrients using solar energy can save half horsepower of engine power for capita. The scientist concludes that use of solar energy as a direct engine and production of nutrients from inorganic materials are the main issues standing in line to continue the most favorable energy saving on the Earth surface.

Human labour as a means of energy-saving. Analyzing F. Quesnay's, A. Smith's, J. Sismondi's, J. Stuart Mill's views, Serhiy Podolynsky indicates that the purpose of labour is to meet needs. He understands needs as awareness of desire for energy exchange between a human body and external nature. The researcher concludes: labour is manifestation of energy of a human body through which a human being produces the amount of energy which, without his intervention, lacks in nature for exchanges necessary for a human being.

According to S. Podolynsky, labour is such a use of mechanical and mental work accumulated in a body which results in increase of an amount of convertible energy on the Earth surface. He points out that its increase can occur in two ways: directly - through transformation of a new amount of solar energy into a more convertible form, or indirectly – through keeping from dissipation which is inevitable without intervention of labour, a certain amount of convertible energy that has already existed on the Earth surface.

The researcher proves that the instances of mechanical work manifestation in the inorganic world given by him (i.e. wind, water currents, tides) will never transform solar energy into a more convertible form and never prevent dissipation of higher forms of energy without intervention of humans consuming their mechanical work. Energy accumulated by plants goes to raise a new amount of energy to a higher level only if this reserve is a part of human food or that of a working animal, or serves as fuel for machines.

The scientist believes that physical work should not be confused with useful labour. To his mind, a savage worked a lot but his work was almost not useful labour because a savage increased a reserve of convertible energy on the Earth surface in a very limited way. On the contrary, a worker running a plough or reaping machine strains his muscles very little compared to usefulness of his labour in the sense of increasing a total energy reserve.

The scientist indicates that human labour productivity increases with decreasing its economic equivalent; with development of human needs, majority of them is met with labour. Human labour productivity significantly increases with use of work to transform lower forms of energy into higher ones, for example, using workstock, machines and others.

Considering a human body presented as a thermal machine, Serhiy Podolynsky estimates that the economic equivalent of a human machine (i.e. a quantity of heat per cent converted into mechanical work) is 1/5. Given the fact that on average, humans spend on food about half of their profits, housing, clothing, meeting mental needs make up the other half of their expenses.

The researcher concludes: if the economic equivalent of a human body calculated by an amount of eaten food or inhaled oxygen is 1/5, this equivalent should be reduced to 1/10, as a part of human life is spent inefficiently, e.g., in childhood, old age or diseases and so on. To summarize this, the scientist states that a human being has a certain economic equivalent which decreases as human needs increase.

Analyzing various human needs, the scientist concludes that an amount of labour and increase of energy exchange on the Earth surface caused by it must constantly grow not only because a number of people increases, but also because each person's energy budget grows. The modern human being must save 10 times more, and possibly in the future, they will have to save 12-15 times more.

Serhiy Podolynsky uses the term as "energy misappropriation" which is understood as phenomena, opposite to labour, all human acts leading to a reduction of the budget, an increase of energy dissipation with certain human acts. Thus, according to the researcher, the war with all its attributes, i.e. regular troops, navies, arsenals, etc., is nothing else than energy misappropriation available to mankind. To his mind, a special kind of energy misappropriation is production of luxury goods and unproductive consumption.

The scientist claims that improvement of human life should mainly consist of quantitative increase of everyone's energy budget, not just qualitative transformation of lower energy into higher one. So, only the society longing for quick energy accumulation can quickly move forward. In this case, stagnation is almost an equivalent to dissipation of energy savings because without development, public life loses any value and any meaning of existence. Therefore, the scientist believes that the main goal of mankind in labour should be an absolute increase in energy budget.

Conclusions. In his fundamental work, S. Podolynsky draws attention to the need to increase efficiency of the basic fuels at that time – coal and wood, as for getting the later leads to deforestation resulting in environmental degradation. History has confirmed expediency of the major part of Serhiy Podolynsky's ideas, particularly, ecosafety and cost-effective energy production using solar energy, wind energy, hydro energy of small rivers, geothermal energy, plant and animal waste, biofuels, etc., which is the basis of modern concepts of low-carbon economy.

References

1. Haidutsky, I. (2014). *Investuvannia nyzkovuhletsevoii ekonomiky: teoria, praktyka: monohrafiia*. Kyiv: Informatiini systemu.
2. He, Ge (2012) Benchmarking Low-carbon Management Performance: an Empirical Study of G20 countries. *Aktualni problemy ekonomiky*, 11, 484-492.
3. Karaieva, N., Bereznystka M. (2014). *Formuvannia stratehichnyh napriamkiv perehodu do nyzkovuhletsevoho rozvytku Ukrainu na osnovi ekspertnoii otsinky*. *Ekonomichnui visnyk of NTTU "KPI"*, 11, 39-46.
4. Kuznetsov, O., Bolshakov, O. (2002). *Ustoichevoie razvitiie: nauchnyie osnovu proektirovaniia v sisteme priroda– obshchestvo – chelovel*. Saint-Petersburg – Moscow – Dubna.
5. Kuznetsov, P. (2003). *Yego deistvitelnoie otkrytie (Predisloviie k rabote S. Podolynskoho "Trud cheloveka i yego otnosheniie k raspredeleniiu energii")*. *Vostok*, 11/12. Available at: http://www.situation.ru/app/j_art_240.htm.
6. Lis, P., Mazurkiewicz, J., Pająk, K. (2015). Droga Chin do gospodarki niskoemisyjnej, w: Marszałek-Kawa, J., Pająk, K., (red.), *Polityka energetyczna państw Azji i Pacyfiku*, Wydawnictwo Adam Marszałek, Toruń, s. 181-202.
7. Maskymenko, S. (1995). *Liuduna, yaka zahlianula v nauku XXI st*. *Filosofska ta sotsiolohichna dumka*, 3-4, 3-15.
8. Pająk, K., Dahlke, P., Kvilinskyi, O. (2016). Determinanty rozwoju regionalnego - współczesne odniesienie. *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy*, 9, 109-122.
9. Pająk, K., Mazurkiewicz, J. (2015). *Low-carbon economy*, Toruń.
10. Podolynsky S. (1990) *Vybrani tvory / Compiler Roman Serbyn*. Montreal: *Ukraiinske istorychne tovarystvo*.
11. Podolynsky S. (2000) *Vybrani tvory / Compiler L. Korniiichuk*. Kyiv: KNEU.
12. Podolynsky S. (1880) *Trud cheloveka i yego otnosheniie k raspredeleniiu energii*. *Slovo*, 4-5, 135-211.
13. Podolynsky S. (1991) *Trud cheloveka i yego otnosheniie k raspredeleniiu energii / Preface by P. Kuznetsov*. Moscow: Noosfera.
14. Rudenko, M. (1998). *Enerhiia prohresu (narysy z fizychnoi ekonomii)*. Kyiv: Molod.

15. Shevchuk, V. (2002). *Ukraiinska naukova shkola fizychnoi ekonomii. Ekonomichna entsyklopediia: v trioh tomah. V.3.* Kyiv: Vudavnychi tsestr "Academia".
16. Shevchuk, V. (2005). *Serhiy Podolynsky i tsyvilizatsiina perspektyva.* Ekonomist, 5, 13-16.
17. Shevtsov, A., Barannik, V., Zemliany, M., Riauzova, T. (2013). *Nyzkovuhletseva ekonomika v rehionah Ukrainu – perspektyvy ta mozhlyvosti podalshoho rozvytku: Scientific paper.* Dnipropetrovsk: Rehionalnyi filial stratehichnuh doslidzhen in m. Dnipropetrovsku.
18. Vernadsky, V. (1954). *Izbrannyye sochineniia. V. 1.* Moscow: Izdatelstvo AN SSSR.
19. Vernadsky, V. (1991). *Nauchnaia mysl kak planetarnoie yavlenie /* Editor-in-chief Yanshin, A. Moscow: Nauka.
20. Vorobyova, L. (2008). *Formuvannia naukovykh shkil. Ukraiinska shkola fizychnoi ekonomii.* Ekonomika Ukrainy, 5, 66-76.
21. Zlupko, S. (2000). *Zasnovnyk teorii enerhetuchnoi ekonomiku (Do 150-ricchia vid dnia narodzhennia S.A. Podolynskoho).* Ukraiinskyi almanah. Warsaw.

Dmitry Lazarenko

ECONOMIC APPROACH TO GLOBAL ENERGY TRENDS

Global trends of human development show that we are entering a new phase in the evolution of energy. Changes occur in the areas of energy and in energy consumption. Among the many social and economic problems are the most global energy efficiency and energy saving. This problem is multifaceted, depends on many factors. It is the cause of global change: environmental, economic, social and technological. Currently, power generation problem escalates and requires complex scientific and technical approach.

For many countries that have the high degree of the dependence from the imported energy resources this problem appears between the strategies of the national security and is the obligatory requirement of the socio-economic development, modernization of the economy and clean environment.

Problems efficiency of wind, geothermal and solar energy for socio-ecological-economic development in the regions studied M. Afanas'yev [Afanas'yev, 2008], O. Lapko [Lapko 2009], O. Malyarenko [Malyarenko 2011], M. Kulik [Kulik 2007], O. Dyachuk, A. Meshkov, I. Bondaryeva, O. Kvilinskyi, V. Lyashenko, A. Tolmachova, K. Pająk, P. Dahlke, Y. Kharazishvili, Y. Zaloznova [Meshkov, Bondaryeva, Kvilinskyi 2016; Lyashenko, Tolmachova, Kvilinskyi 2016; Pająk, Dahlke, Kvilinskyi 2016, pp. 109-122; Kharazishvili, Liashenko, Zaloznova, Kvilinskyi 2016, pp. 108-119].

International experience with key program elements of industrial energy efficiency of greenhouse gas and emissions reduction target-setting programs studied L. Price [Price 2010], C. Forbes [Forbes 2011], N. Stern [Stern 2007].

a trend clearly emerged in the last 5 years, enhancing the role of energy in the world of alternative energy sources and unconventional gas.

Will we have enough affordable energy in the near future? What will we do for the long term?

Today's energy industry is characterized by the creation of conditions for renewable energy development.

We single out the main global trends that induce rapid growth in electricity demand:

- an increase in the world population,
- increase in the number of electrical appliances,
- an increase in electricity demand in the industry.

Any of these factors can be changed in a very short period of time. Anyway, the last two factors necessarily affect the increase in the cost of electricity. In such circumstances the main task of the economy is to find ways to reduce the cost of electricity. The search for solutions should be based on the achievements in the field of energy production technologies.

Till 2025 the urban population worldwide will increase by 2.5 billion people, the number of devices connected to the network over the next five years

will increase by 50 billion, while the demand for electricity in industry will increase by at least 50% over the next 35 years. Production of electricity from fossil fuels causes the release of carbon dioxide and the production of large amounts of heat.

Under the energy efficient development of the region, let us understand the development of the measures concerning the change of the qualitative economic, social and environmental characteristics of the region, where the most important elements are the search for the technological innovations and improving the management of the energy provision of the region.

In the EU countries, the socioeconomic indicators are the necessary components of the governmental programs and the norm acts, such as the EU Directives. The developed by the International energy agency system comprises 24 indicators for the different spheres of the economy. This methodology of the calculation of the energy consumption for the sectors of the economy has been taken as a base to create the base of the data of the indicators of ODDYSEE – the common European project where there are the participants 28 countries of the EU and Norway [Dodonov B. 2015, c. 5]. In accordance with the Directive of the EU [2012/27/EU] the consumption of the indicators of the energy efficiency in the regions there are foreseen the following steps:

- The countries are to present the annual reports on the fulfillment of the given objectives of the Directive.
- Starting from 2014, every country is a time during 3 years to report concerning the fulfillment of the National plan of the actions as to the energy efficiency.
- The indicators of the energy efficiency are to be quantitative and to be expressed in the form of the primary provision of the energy resources and the finishing energy consumption.

The construction of the system of the indicators has to give a holistic view of the quantitative and qualitative characteristics of the sources of the energy provision and the level of the energy consumption of the region, their structure and the degree of the balance (Figure 1).

Of great importance is the use of renewable energy sources. By 2030, solar generators and batteries make up 50% of new installations to increase the amount of available power. Already, 57% of consumers are considering the possibility of self-sufficiency of electricity that will cause growth in demand for electricity mikroustanovki.

Recently it published a report «The potential of energy citizens in the European Union». It was produced by the Dutch consultancy CE Deft commissioned by Greenpeace Friends of the Earth Europe, European Renewable Energy Federation (EREF), and REScorp. Its authors had the opportunity to define European energy production by households, non-governmental organizations (administrative buildings, schools, hospitals), small companies (with less than 50 employees), and the Energy Community.

In Europe, there are about 216 million households and 20 million small companies, that creates a huge potential for the development of dispersed energy.

The essence of the implementation of the socioeconomic indicators is in the following [Sokha 2011]:

- Creating the conditions for the unified assessment of the energy efficiency of the industries of the region;
- Defining the level of the dependence of the region on the energy resources;
- Determining the specific proportion of the consumption of the renewable energy;
- Determining the specific proportion of the non-productive energy (losses energy);
- Possibility of the monitoring of the macroeconomic indicators of the energy efficiency;
- Loading of the energy sector on the environment and ecological safety;
- Measuring the economic impact from the introduction of the energy saving measures.

In accordance with the expediency (productivity) the final consumption of energy can be logically divided into:

- 1) *non-productive energy* (losses energy), lost in the conversions of thermal power stations, engines, etc.;
- 2) *useful energy* (consumption energy), which directly fulfills work.

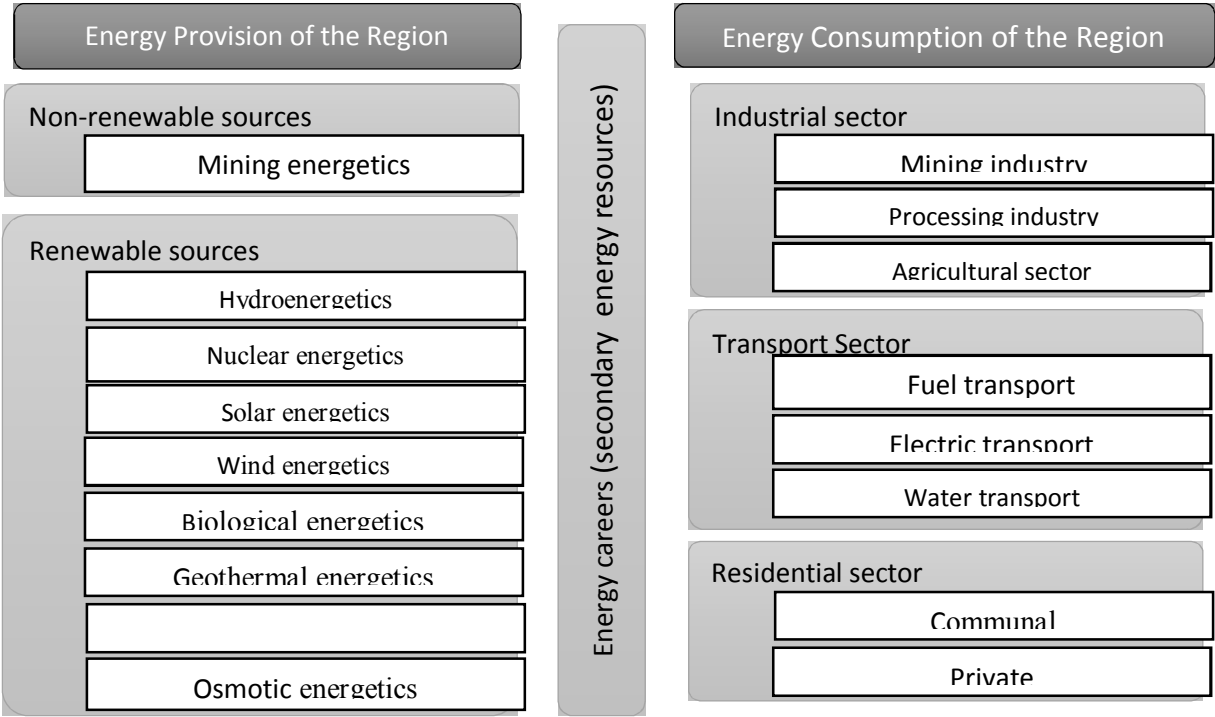


Figure 1 – Innovational Energy Balance of the Energy Provision and the Energy Consumption of the Region

Source: compiled by author

In Europe, the problem of the non-productive energy losses occurs at all the stages of the energy conversion and reaches the emergency proportions. The specific proportion of the non-productive losses exceeds 62% (Figure 2). This is according to the data of the International Energy Agency [International Energy Agency 2016].

Up to 90% of these losses are typical only of traditional energetics. The economic indicators characterizing the efficiency of the energy systems depend on many technical specifications. With decreasing the efficiency the amount of the useful energy decreases, so the decrease of the progressive indicators of productivity (from 1 to 0).

At the same time, the increase of the level of hydrocarbon emissions into the ecosystem, characterizes the shortfall of the useful energy, i. e. reduces the social significance of this energy and this negatively affects the environmental safety (from 1 to 0).

If absolutely productive energy systems (CRC - 100%) have zero emissions, that means that all the energy from its generation to the consumption is transmitted without any losses. In this case the socioeconomic indicators will be maximum:

- productivity of the energy generation – 1;
- productivity of the energy transformation – 1;
- productivity of the energy consumption – 1;
- ecological security – 1.

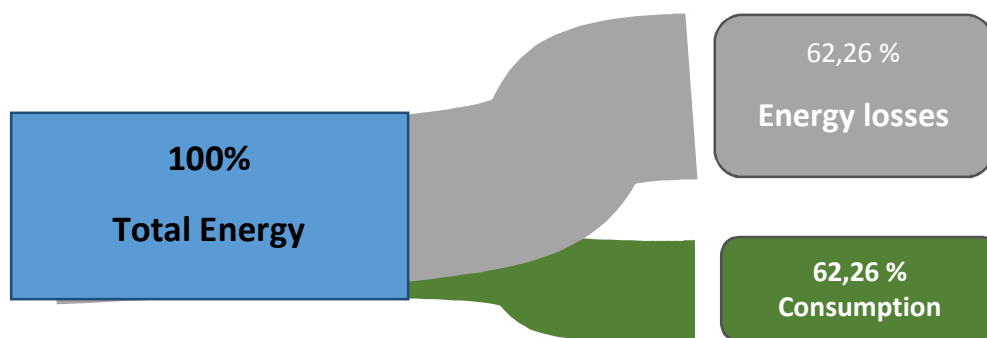


Figure 2 – Energy Distribution According to Productivity

Source: compiled by author

In September, 2015. the 70th session of the UN adopted a new concept "Transforming our world: the 2030 Agenda for Sustainable Development – UN", which provides for the acceleration of growth in energy efficiency and doubling the share of renewables in the global energy balance.

Despite the decline in the price of fossil fuels and other problems, 2 consecutive years, the largest increase occurred in the power of wind and solar energy - about 77% of all new renewable energy capacity (Table 1.).

Table 1 – Power in renewable energy in 2014-2015

Power in renewable energy in 2014-2015, GW		
	2014	2015
Renewables (including hydropower), including:	1 701,0	1 849,0
Hydropower	1 036,0	1 064,0
Bioenergy	101,0	106,0
Geothermal energy	12,9	13,2
Photovoltaic solar energy	177,0	227,0
Concentrated solar power	4,3	4,8
Wind energy	370,0	433,0

Source: compiled by author

The most notable growth rate of energy production from renewable observed in the UK - + 31.0%, Germany - 23.5 +%, Brazil - + 23% and China - + 20.9%.

Solar power generation in 2015. Compared to 2014., Increased by 25% - a record high of 50 GW, increasing total capacity to 227 GW. China, Japan and the United States established the largest number of facilities, but each year the number of countries that contribute significantly to the growth of global solar generating capacity increases. At the end of 2015 in 22 countries at least 1% of electricity demand covered by solar energy, but there are countries where this share is significantly higher - Italy (7.8%), Greece (6.5%), Germany (6.4%).

Energetics based on the renewable sources provides the minimum emissions, so replacing the traditional energetics to an alternative generation will enhance the socio-economic indicators.

The energy generation of the future will be determined whether by the fully restored or virtually renewable sources.

For example, the volume of electricity produced in Poland from renewable energy sources, increased from 3% in 2008 to 14% in 2014. The level of CO² emissions reduced in comparison with 1988 levels by 30%. Currently, this indicator Poland is in fifth place in the European Union (400 mln. tons per year).

A new source of clean energy the scientists of the Laboratory of Nanobiology of the Polytechnic School of Lausanne have discovered - osmotic. The energy is generated by the contact of the fresh water with the salt one through the membrane of the thickness of three atoms, in which it is the main innovation. The potential of such a system is huge. According to the calculations, the membrane with area of 1 m², 30% of which is covered with the nanopores will be able to produce 1 MW of electricity. And as molybdenum disulfide is common in nature, the whole system is easy to increase to industrial scales. The non-productive emissions from this generation are completely absent [EcoTown 2016].

The next level of the indicators characterizes the dependence / independence of the region on the energy resources. In order to avoid the dependence of the region on the energy resources it is necessary to analyze the energy sources and to determine the specific proportion of those ones that are of the renewable character (Figure 3).

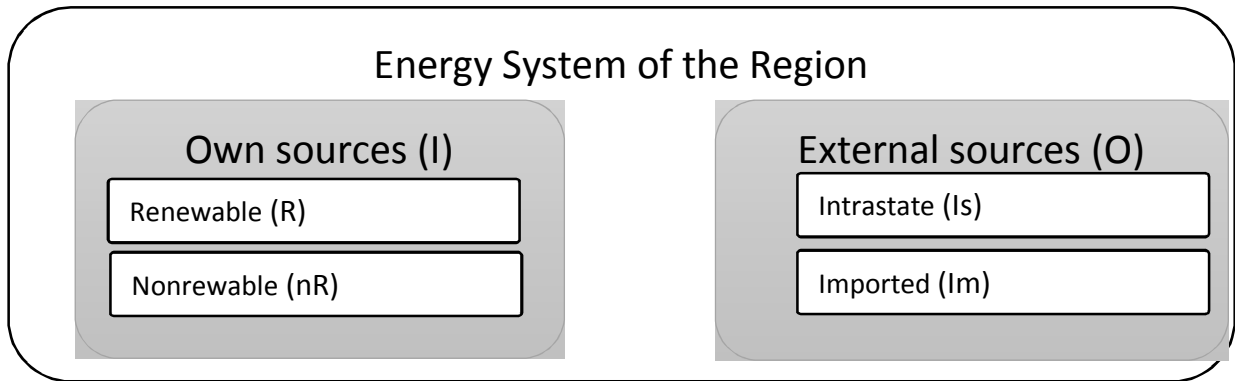


Figure 3 – Dependence of the Energy Generation of the Region on the Energy Resources

Source: compiled by author

Coefficient of renewing of the own sources of the region k_R is the relative indicator characterizing the specific proportion of the renewable resources in the energy generation (from 0 to 1).

$$k_R = \frac{R}{R+nR} \quad (1)$$

Coefficient of the energy dependence of the generation of the region k_O is the relative indicator characterizing the dependence of the region on the external sources of energy (from 0 to 1).

$$k_O = \frac{I}{I+O} \quad (2)$$

The indicator of the dependence of the energy generation (I_G) of the region on the energy resources is calculated according to the formula:

$$I_G = k_R + k_O, \quad (3)$$

where k_R – coefficient of the renewing of the own sources of the region;
 k_O – coefficient of the energy dependence of the generation of the region.

The transport sector is one of the most power-consuming, and now it is in the state of advanced modernization. The progressive development of the automobile industry promotes the increase of profitability of passenger traffic on the wireless electric transport. The use of electric motors is quite successful in

public transport (taxis, electrobuses) in Norway, Denmark and Sweden. The Ukrainian concern “Electron” specially for Lviv region has begun the production of the electrobuses of Model E19101 with the ability to carry up to 100 passengers at a time. It is a completely ecological means of transport with the increased comfort for passengers. By 2025, in Lviv it is planned to replace 75% of the vehicle fleet.

The transition of the regional public transport to electric cars increases the socio-economic indicators.

The search for alternative fuels continues worldwide. The Japanese car manufacturer Toyota has started the mass production of the world’s first car with a hydrogen engine „Mirai”. The vehicle only runs on hydrogen, and instead of harmful emissions, it produces clean water. To motivate consumers to buy environmental cars the program the government provided program subsidies of \$ 17 thousand at every purchase [Toyota, 2016]. In the near future the market of hydrogen cars other manufacturers are planning to enter.

Conclusions. Compound with the traditional model of renewable solutions with the support of IT will significantly change the energy market and will allow to reach a new stage of development similar to the one that operates in telecommunications. As a result, it will help to significantly increase energy efficiency and to solve the dilemma - the climate or energy.

References

1. Afanas'yev, M., & Salashenko, T. (2008). Otsinka enerhoefektyvnosti z pozytsiyi kontseptsiyi stiykoho rozvytku. *Ekonomika i menedzhment 2010. Materialy I Mizhnarodnoyi konferentsiyi molodykh vchenykh*, p. 198 — 199.
2. Bal'tserovich, L. (2014). *800 dney: kratkaya istoriya velikikh peremen, 1989-1991*. Khar'kov: Zolotyie stranitsy, 201 s.
3. Barannik, V. (2010). *Efektyvnist' enerhospozhyvannya v derzhavi yak indyikator konkurentospromozhnosti. Mizhderzhavi spivstavlennya*. Retrieved from http://economy.kpi.ua/files/files/3_kpi_2010_7.pdf.
4. Bondar-Pidhurs'ka, O. (2016). *Naukovo-metodolohichni zasady staloho innovatsiynoho sotsial'no oriyentovanoho rozvytku ekonomiky*. Poltava: PUET, 531 s.
5. Borshchuk, Ye. (2007). *Osnovy teorii stiykoho rozvytku ekoloho-ekonomichnykh system*. L'viv: Rastr-7, 436 s.
6. Dodonov, B. (2015). *Reytynh enerhoefektyvnosti teplozabezpechennya 2015*. Retrieved from <http://www.ua.undp.org/content/dam/ukraine/docs/EE>.
7. Dolins'kyi, A. (2006). *Enerhetychna stratehiya Ukrayiny na period do 2030 roku*. Retrieved from <http://mpe.kmu.gov.ua/>
8. Dolins'kyi, A., Karp, I., & Korchevoy, Yu. (2006). *Stratehiya enerhozberezhennya v Ukrayini: analitychno-dovidkovi materialy. Tom 1: Zahal'ni zasady enerhozberezhennya*. Kyiv: Akadempriodyka, 508 s.

9. Forbes, C. (2011). Summary of Country Reports Submitted to the Energy Efficiency Working Party. Period from March 2011 to September. IEA/OECD, P.12
10. Geletukha G. Prakhovnik A. *Analysis of the energy strategies of the EU and the countries of the world and the role of renewable energy sources. - Policy Brief BAU №13, Bioenergy Association of Ukraine*, 1 December 2015. 36 p.
11. *International Energy Agency*. (2016). Retrieved from: <https://www.iea.org/training/ieaonlinesummerschool2016/#d.en.156514>.
12. Kharazishvili, Y., Liashenko, V., Zaloznova, Y., Kvilinskyi, O. (2016). Impact of infrastructure component on socioeconomic approach to modernization of the region. *Współpraca Europejska / European Cooperation*, 8 (15), 108-119.
13. Kulyk, M., Hnidy, M., & Bilodid, V. (2007). Osnovy polityky pidvyshchennya enerhetychnoyi efektyvnosti ta holovni zakhody z enerhozberezhennya v ekonomitsi Ukrayiny. *Problemy zahal'noyi enerhetyky*, 15, 7 – 16.
14. Lapko, O. (2009). Zabezpechennya efektyvnosti rynkiv enerhoresursiv // *Rynky real'noho sektora ekonomiky Ukrayiny: strukturno-instytutsional'nyy analiz: kolektyvna monohrafiya*, Kyiv: Instytut ekonomiky ta prognozuvannya NAN Ukrainy, s. 497 — 518.
15. Lazarenko, D., & Spivak, Ya. (2014). Enerhozberezhennya yak odyn iz napryamkiv ekolohichnoyi stratehii Ukrayiny. *Naukovyy visnyk Khersons'koho derzhavnoho universytetu. Seriya „Ekonomichni nauky”*, 9(2), 138 – 142.
16. Lyashenko, V., Tolmachova, A., Kvilinskyi, O., (2016). Państwowa polityka rozwoju przedsiębiorczości w kontekście stabilności społecznoekonomicznej (na przykładzie Ukrainy). *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze*, 4, 155-164.
17. Malyarenko, O. (2011). Enerho-ekolohichni aspekty otsinky efektyvnosti enerhospozhyvannya rehionu (na prykladi Chernihivs'koyi oblasti). *Problemy zahal'noyi enerhetyky*, 4 (27), 39 – 46.
18. Meshkov, A. V., Bondaryeva, I. A., Kvilinskyi, O. S. (2016). Factors of the region's investment climate formation under modern socio-economic conditions. *Perm University Herald. Economy*, 2(29), 120–134.
19. Pająk, K., Dahlke, P., Kvilinskyi, O. (2016). Determinanty rozwoju regionalnego - współczesne odniesienie. *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy*, 9, 109-122.
20. Price, L. (2010) International experience with key program elements of industrial energy efficiency of greenhouse gas emissions reduction target-setting programs / Price. L., Galitsky C., Kramer K.J. // Ernst Orlando Lawrence

Berkeley Laboratory. Environmental Energy Technologies Division. February. P.49

21. Pysmenna, U. (2010). Osoblyvosti zastosuvannya pokaznyka enerhomistkosti VVP yak indykatora enerhoefektyvnosti natsional'noyi ekonomiky. *Ekonomist*, 6, 28 – 31.

22. Sokha, Yu. (2011). Pryntsypy staloho rozvytku i problema pryrodno-tekhnohennoyi bezpeky. *Visnyk Natsional'noho universytetu "L'vivs'ka politekhnika"*, 698, 103 – 111.

23. *Stalyy rozvytok rehioniv Ukrayiny: zvit Instytutu prykladnoho systemnoho analizu NAN Ukrayiny i MON Ukrayiny.* (2009). Kyiv: NTTU «KPI», 197 s.

24. Stern, N. (2007). *The Economics of Climate Change: the Stern review*, Cambridge, UK: Cambridge University Press, P. 662

25. Strunin, V. (2015). *Innovatsiyini pidkhody do enerhozabezpechennya pidpryyemstv kharchovoyi promyslovosti: avtoreferat disertatsiyi ... kandidata ekonomichnih nauk.* Kyiv: NUHT, 23 s.

26. *Toyota Mirai wins 2016 World Green Car.* Retrieved from <http://pressroom.toyota.com/releases/toyota+mirai+world+green+car+2016.htm>.

27. *Transforming our world: the 2030 Agenda for Sustainable Development* – United Nations, <https://sustainabledevelopment.un.org/post2015/transformingourworld>

28. *Vcheni vidkryly nove dzherelo chystoyi enerhiyi.* Retrieved from <http://ecotown.com.ua/news/Vcheni-vidkryly-nove-dzherelo-chystoyi-enerhiyi>.

THE INSTITUTIONAL DETERMINANTS OF GLOBAL ECONOMIC DEVELOPMENT

The global transformation of the modern world economy is determined by changing technologies and methods of influence of government institutions on the activities of economic entities in the world political and economic space. The signs of this process is the concentration of resources, vertical and horizontal integration, increase in capitalization, structural shifts in the economy by means of predominant development of new industries based on information and knowledge, deformation of the government space, etc.

Now, when the sources of economic growth in the pre-crisis years have been exhausted, entry of the world economy on the path of sustainable development requires institutional reforms defining new parameters for global economic development.

The following authors draw attention to research of the development of the world political and economic space: S. Amin [Globalization... 2009], J. Arrighi [Arrighi 2007], W. Beck [Beck 2007], O. Bilorus [Bilorus 2007], I. Vallerstajn [Vallerstain 2003], A. Halchynsky [Halchynskyi 2012], A. Hrytsenko [Hrytsenko 2012], V. Dementyev [Dementyev V.V. 2006], G. Kolodko [Kolodko 2009], M. Porter [Porter 1993], O. Porohovsky [Porokhovskiyi 2012], V. Sidenko [Sidenko 2012], Ya. Stoliarchuk [Stoliarchuk 2009], E. Toffler [Toffler 2004], F. Uttar [Globalization... 2009], A. Filipenko [Filipenko 2010], S. Kravchenko, O. Kvilinskyi [Kravchenko, Kvilinskyi 2016], A. Meshkov, I. Bondaryeva [Bondaryeva, Kravchenko, Mieshkov 2015; Meshkov, Bondaryeva, Kvilinskyi 2016], V. Lyashenko [Lyashenko, Kvilinskyi 2016], K. Pajak [Pajak, Lyashenko, Kvilinskyi 2015], A. Tolmacheva [Lyashenko, Tolmachova, Kvilinskyi, 2016], O. Blagodarnyi [Blagodarnyi, Tolmachova, Kvilinskyi 2014], B. Kamińska [Pajak, Kamińska, Kvilinskyi 2016] and others.

Researchers have drawn attention to the structural modernization of the world economy in conditions of global competition, the socio-economic impact and asymmetric effects of uneven global development. Therefore, at the present stage of the global economic development, there is a need to study the origins of the institutional features of the evolution of the global political and economic space over creation of the main fundamentals for formation of the world civil society and system-forming priorities of the balanced growth in production and consumption at the level of the world economy.

The global trends of the world economy development imply determination of the value priorities for the integration of economic entities in the world political and economic space. With the development of this process, an opportunity for more effective and ambitious solution of global socio-economic problems, ensuring harmonization of interests of developed countries and developing countries,

actually appears. Globalization of the world's political and economic space as a process that promotes deepening of division of labour, efficient allocation of resources and their use on a global scale, potentially should be accompanied by increased labour productivity and living standards of the population. One cannot but ignore such positive results of globalization, as extension of access of consumers to the global range of products and services, increase in the capacity of the markets as a result of development of trade, simplification of access of investors to the markets of other countries, mutual exchange of achievements in technology and organization of production, etc.

At the same time, globalization of the world political and economic space is the process being too complicated, controversial, multi-vector. In particular, this is about redistribution of resources to the benefit of the countries of so-called civilization center, which are developing on the basis of the post-industrial principles, and accumulation of underdevelopment on the other pole – in the countries having traditional industrial technology and pre-industrial development [Cattaneo O. 2010, p. 6].

Thus, globalization of the world political and economic space is not only benefits, but also a high probability of losses, growth of risks. Globalization means that the countries become not just interdependent due to the formation of the system of integrated international production, growth in the volume of the world trade and flows of foreign investments, intensification of the movement of technological innovations, etc., but also become more exposed to the negative impact of the world economic relations. It is significant that in recent decades, particularly in the recent years, mankind was facing with the effect of synergistic enhancement of adverse factors [Linneroth-Bayer 2010, p. 203-219]. Today, the population and the area of the Earth with numerous economic objects are under potential threat of negative effects of hazardous natural and anthropogenic processes and phenomena. In particular, if for the countries being retarded in the socio-economic aspect the most typical threats in the XX century were starvation and disease, for the most developed ones – disasters, environmental crisis. Today, the main source of hazard for all existing on the planet Earth is the technosphere created by mankind. Accidents and disasters that it occurs in it, lead not only to human losses, but to the destruction of the environment, natural resources, and their irreversible degradation, which, in its turn, causes genetic changes in humans [Greenwood 2008, p. 445-451].

In the light of the recent trends in the development of the world political and economic space, the extent of the impact of accidents and disasters on the social, economic, political and other processes of the modern society have already exceeded the level which allowed to refer to them as to local failures in the regular functioning of public institutions. It is important to focus on the fact that such traditional threats as terrorism, violence, biotechnology have come to the new qualitative level.

Thus, aggravation of global problems has actualized again the issue of the universality of the stages of transformation of the global political and economic space. So, V. Pareto imagined society as a social system that goes through the repeated cycles – balance, destabilization, loss of balance and new balance. This applies to the society as a whole, but the same thing is happening with the components of its segments – politics, economics and ideology [Pareto 1964, p. 5]. Accordingly, the world political and economic space is characterized by existence of the complex effects of interactions and time lags, that ensures preservation of the integrity of the world economic system. In fact, the fundamental contradiction between the desire of the system of the world economy to self-preservation and the ability to achieve this goal through continuous changes of the system itself is being solved in the process of natural selection.

Considering development of the global conflicts throughout the world development, S. Huntington argued that the first conflicts explode between the rulers of the states that have sought to annex new territories to their possessions. After the Great French Revolution the main actors in the conflict became nations. After the Second World War, it is time for the conflict of ideologies, the manifestation of which was the “Cold War”. Its end has brought the conflict of civilizations to the agenda. S. Huntington rightly notes that the difference between civilizations was formed over centuries, they are more fundamental and stable than the ideological and class contradictions, are less susceptible to changes. Therefore, the modern global conflicts will shift from the political and ideological borders towards the line of contact of different local civilizations [Huntington 2003].

As a result, the structure-forming components of the world political and economic space are being constantly in interrelation, mutually conditioned, complementing each other. So, for the concept of the great historical cycle, the initial civilization stage was Eastern: that was the East where the first great civilizations originated – Sumerian, Assyrian-Babylonian, Egyptian, Persian, Indian, Chinese. The stage of the Eastern dominant in the history lasted for about a thousand years and approximately in the 5th century BC, it gave way to the Western Antique stage. The stage of the Western dominant lasted thousands years, – until the end of the Roman Empire. Then the Middle Ages began, which fitted for the new East stage of the world cycle.

The new Western stage started in the 15th century and lasts to this day. This period was initially associated with the era of the Renaissance, flourishing of culture, crafts, putting the army on the new means of armed struggle, formation and development of the industry. However, as early as 1960-1970s, the potential of this phase, having reached the maximum, had begun to decline rapidly. Having faced with the situation of the structural crisis, the governmental and power groups of the world system resorted to searching capabilities of restructuring the world economic system with the aim of recreating the necessary economic, political, social, cultural and ideological conditions of its stable functioning and development [Maliuk 2013, p. 37].

The characteristic feature and the principal difference of I. Vallerstain's theory of the world-system analysis is thorough understanding of the modern global and trans-national processes in the terms of historical retrospective of the last 500 years of the world history. Just then in Europe, and later on in the global scale, the institutional system originated, on which the common division of labor is based and the driving force of which is the permanent accumulation of capital. The specific feature of the world political and economic space is establishment of the hierarchically uneven distribution, when capitalist manufacturers, relying on the support of the government, monopolize certain types of production activities (specifically, key industries). As a result, the latter are concentrated in certain areas, which become the field of concentration of the largest capital, form the zone of the core of the capitalist world economy. Moreover, besides monopolization and concentration of the most technologically advanced industries, the powerful centralized government structures and high level of per capita consumption are also inherent to the zone of the core. The zone of the core prevails over the other parts of the world-system – the periphery and semi-periphery. The periphery, compared with the core, is characterized by availability of low-income and thus non-monopolized types of production, governed by the laws of market competition, with weak government structures, spread of non-economic forcing and low consumption level [Vallerstain 2003].

Among the existing points of view, the following approach deserves the special attention that explains that the crisis of the late 20th – early 21st century is system-wide and it should be compared with the crisis of the 15th – the beginning of the 16th century, when the capitalist system was originating, the basic institutions arose – market, state, politics, etc. [Horbunov 2010, p. 158].

As is well-known, the notion of institutionalization became central in the conceptual model developed by T. Parson. The T. Parson's category "social institution" expresses the essence of the ordered social life. In his theory, social institutes act both as special value-regulatory complexes, regulating the behavior of the individual, and as stable configurations, setting the structure of society [Parsons 1971, p. 48]. Therefore, the world political and economic space is defined by such important component elements as politics, economics, social environment, their mutual influence in the process of globalization.

In D. Bell's opinion, the changes in the social structure, occurring in the middle of the 20th century, indicate that the industrial society evolves towards the post-industrial one, that just should become the determinant social form of the 21st century, primarily in the developed countries [Bell 1973, p. 10]. The post-industrial stage is characterized by the transition from production of things to production of services, while these services are associated with healthcare, creativity, research and management. If the industrial society is organization of machines and people to manufacture things, then the central place in the post-industrial society, according to D. Bell, is taken by knowledge, primarily, theoretical. Orientation to the future – the another feature of the post-industrial society – assumes control over

the technology, evaluation of technology, developing models of technological forecasting: “Any modern society lives due to innovations and social control over the changes, it tries to predict the future and carry out planning. That is the change in the awareness of the nature of innovation that makes the theoretical knowledge to be decisive” [Bell 1973, p. 20].

Such opinion is held by M. Castells, according to which “the new world has acquired the outlines at the end of our millennium. It originated somewhere in the late 1960s – mid 1970s in the historic coincidence of three independent processes: the revolution of information technology; the crisis of both capitalism and etatism, with their subsequent restructuring; flourishing of cultural, social movements, such as liberalism, struggle for the human rights, protection of the environment. The interaction between these processes and the reaction provoked by them had created the new dominant social structure, the network society; the new economy, being informative/global; and the new culture, the culture of real virtuality. Logic laid down in this economy, in this society and this culture also underlies combined actions of social institutions in the interdependent world” [Castells 1998, p. 336-337].

However, the current world political and economic space combines economic systems of post-industrial, industrial and pre-industrial development which are qualitatively different in the level of economic activity, degree of influence, dominant elements of economic mechanisms. Alongside with that, the transformational changes in the institutional structure of the world political and economic space express themselves through the established system of cooperation, the growing trend of regional conflicts and contradictions, struggle for intellectual capital. The innovative type of economic development increasingly becomes the foundation that defines the economic strength of the country and its prospects on the world market.

The main feature of contemporary political and economic dominance is considerable breakaway of the countries with the innovation-oriented economy that are actively forming the new global markets, from the less powerful countries, which are forced to completely depend on the position of “active players”. In the countries belonging to the innovative leaders, there is a high concentration of the most profitable businesses (with the largest concentration of added value in the price of the product), mainly the high-tech structure of national production and concentration of the biggest financial flows [Meshko 2008, p. 287].

According to the analysis, the countries that implement the strategy of innovative development of national economies have several significant common features: the highest indicators of the Global Competitiveness Index (GCI) (tab. 1), effectively functioning national innovation systems, government mechanisms of regulation of innovation activity of market entities.

Table 1 – Ratings of the countries of the world political and economic space according to the Global Competitiveness Index GCI for the period 2015-2016

Country	Global Competitiveness Index (GCI) 2015-2016		Country	Global Competitiveness Index (GCI) 2015-2016	
	Rating	Score		Rating	Score
1	2	3	4	5	6
Switzerland	1	5,76	Botswana	71	4,19
Singapore	2	5,68	Morocco	72	4,16
United States	3	5,61	Uruguay	73	4,09
Germany	4	5,53	Iran	74	4,09
Netherlands	5	5,50	Brazil	75	4,08
Japan	6	5,47	Ecuador	76	4,07
Hong Kong	7	5,46	Croatia	77	4,07
Finland	8	5,45	Guatemala	78	4,05
Sweden	9	5,43	Ukraine	79	4,03
United Kingdom	10	5,43	Tajikistan	80	4,03
Norway	11	5,41	Greece	81	4,02
Denmark	12	5,33	Armenia	82	4,01
Canada	13	5,31	Laos	83	4,00
Qatar	14	5,30	Moldova	84	4,00
Taiwan	15	5,28	Namibia	85	3,99
New Zealand	16	5,25	Jamaica	86	3,97
United Arab Emirates	17	5,24	Algeria	87	3,97
Malaysia	18	5,23	Honduras	88	3,95
Belgium	19	5,20	Trinidad and Tobago	89	3,94
Luxembourg	20	5,20	Cambodia	90	3,94
Australia	21	5,15	Côte d'Ivoire	91	3,93
France	22	5,13	Tunisia	92	3,93
Austria	23	5,12	Albania	93	3,93
Ireland	24	5,11	Serbia	94	3,89
Saudi Arabia	25	5,07	Salvador	95	3,87
South Korea	26	4,99	Zambia	96	3,87
Israel	27	4,98	Seychelles	97	3,86
China	28	4,89	Dominican Republic	98	3,86
Iceland	29	4,83	Kenya	99	3,85
Estonia	30	4,74	Nepal	100	3,85
Czech Republic	31	4,69	Lebanon	101	3,84
Thailand	32	4,64	Kyrgyz Republic	102	3,83
Spain	33	4,59	Gabon	103	3,83
Kuwait	34	4,59	Mongolia	104	3,81
Chile	35	4,58	Bhutan	105	3,80
Lithuania	36	4,55	Argentina	106	3,79
Indonesia	37	4,52	Bangladesh	107	3,76
Portugal	38	4,52	Nicaragua	108	3,75

End of table 1

1	2	3	4	5	6
Bahrain	39	4,52	Ethiopia	109	3,74
Azerbaijan	40	4,50	Senegal	110	3,73
Poland	41	4,49	Bosnia & Herzegovina	111	3,71
Kazakhstan	42	4,48	Cabo Verde	112	3,70
Italy	43	4,46	Lesotho	113	3,70
Latvia	44	4,45	Cameroon	114	3,69
Russian Federation	45	4,44	Uganda	115	3,66
Mauritius	46	4,43	Egypt	116	3,66
Philippines	47	4,39	Bolivia	117	3,60
Malta	48	4,39	Paraguay	118	3,60
South Africa	49	4,39	Ghana	119	3,58
Panama	50	4,38	Tanzania	120	3,57
Turkey	51	4,37	Guyana	121	3,56
Costa Rica	52	4,33	Benin	122	3,55
Romania	53	4,32	Gambia	123	3,48
Bulgaria	54	4,32	Nigeria	124	3,46
India	55	4,31	Zimbabwe	125	3,45
Vietnam	56	4,30	Pakistan	126	3,45
Mexico	57	4,29	Mali	127	3,44
Rwanda	58	4,29	Swaziland	128	3,40
Slovenia	59	4,28	Liberia	129	3,37
Macedonia,	60	4,28	Madagascar	130	3,32
Colombia	61	4,28	Myanmar	131	3,32
Oman	62	4,25	Venezuela	132	3,30
Hungary	63	4,25	Mozambique	133	3,20
Jordan	64	4,23	Haiti	134	3,18
Cyprus	65	4,23	Malawi	135	3,15
Georgia	66	4,22	Burundi	136	3,11
Slovak Republic	67	4,22	Sierra Leone	137	3,06
Sri Lanka	68	4,21	Mauritania	138	3,03
Peru	69	4,21	Chad	139	2,96
Montenegro	70	4,20	Guinea	140	2,84

Source: compiled by the Author on the basis of the source [The Global Competitiveness Index 2015-2016 – information about the research. IAA Centre of Humanitarian Technologies]

Alongside with that, by the definition of O. Porokhovskiy, the progress of labour division, based on the information and innovative development, leads in the modern society to the unlimited increase of the objects of purchase and sale. This particularly relates to financial and information markets, which form their world, their environment, sometimes are weakly bound processes in the real economy. As a result, along with the trade and monetary fetishism, being ordinary for the market economy, fetishism of a special kind – financial and informative – increasingly spreads out [Porokhovskiy 2012, p. 27-28]. Under such conditions, the architecture of the modern world political and economic space provokes irresponsible behavior

both of borrowers and lenders. The economic policy of the overwhelming majority of the countries aimed at stimulating consumption also contributes to this [Boryshkevych 2012, p. 43].

O. Bilorus remarks on this more specifically: "In fact, today we are at the beginning of the world so-called tragic Hobbes era, during which the anarchy of global markets, depletion of natural resources, chronic, permanent global crisis will cause powerful geopolitical conflicts for the sake of survival, but without a real chance of survival. In such circumstances, the role and importance of the protective function of the national states increases. Only they are still able to protect their citizens from the irreversible effects of the power globalization processes. Therefore, global solidarism of states and peoples becomes a historical imperative of the 21st century" [Bilorus 2007, p. 12]. The latter provides for the formation of the new quality of system links between actors of international relations within the world political and economic space.

Therefore, the origins of the institutional features of the evolution of the world political and economic space are reflected in the chain "social contradictions – driving forces – institutional transformations" (tab. 2). This indicates that strengthening the social cohesion of society based on timely disclosure and overcoming contradictions of development of the world economy is one of the leading patterns of evolution of the world political and economic space.

Table 2 – Origins of the institutional features of evolution of the world political and economic space

Social Contradictions	Driving forces	Institutional transformations
1	2	3
1. Contradiction between productive forces and production relations.	1. Formation of new value-regulatory structure of society, social stratification.	1. Creation of the sinergetic type of public relations in the scale of the world political and economic space.
2. Contradiction between the growing social needs and the reached level of social production.	2. Emergence of new network forms of business organization, proliferation of remote labor relations.	2. Formation of new international mechanisms of capital accumulation, labour migration, changes in the ownership of the means of production.
3. Contradiction between own and public interests of actors of the world political and economic space.	3. Strengthening the public control over the process of elaboration and adoption of intergovernmental decisions on ensuring protection of vital interests of mankind and society.	3. Definition and creation of mechanisms to protect the environmental rights of the actors of international relations, transformation of general human values into the determinant factor of social development.

End of table 2

1	2	3
4. Contradictions between national interests within the world political and economic space.	4. Processes of the interstate and interregional integration, transnationalization of business and capital.	4. Transformation of power in the terms of its distribution among the major global players.
5. Growth in the fragmentarity of the world economy, disturbance of its organizational and functional balance and strengthening the multipolarity and multidirectionality of its development.	5. Transformation of information and knowledge into the dominant resources of the global socio-economic development.	5. Replacement of the centralized hierarchical structures by the flexible network organization types that are adapted to the rapid changes and innovation development, development of local civilizations.
6. Contradiction between the individualization and the socialization of human development.	6. Increase of the role between the state regulation based on informatization and intellectualization of production.	6. Legitimization of human rights, the growing influence of international non-governmental organizations.
7. Contradictions between private national interests of the actors of international relations.	7. The growing network of international institutions and treaties, institutionalization of international relations, changing the direction of international capital flows.	7. Revision of the international order, development of the growth of the role of the international labor division and labor cooperation in the development of national economies.
8. Contradictions of civilization development.	8. Destruction of institutionalized social norms, emergence of global conflicts.	8. Creation of new institutions of the international civil society formation.
9. Contradiction between the public nature of the progress and the private appropriation of its results.	9. Strengthening the international labour division, development of international cooperation in the field of information and communication technologies, development of public institutions.	9. Changes in the models of social organization and international cooperation, development of the world integration processes.

Source: compiled by the Author on the basis of [Globalization of opposition: Struggle in the world 2009; Arrighi 2007; Beck 2007; Bilorus 2007; Vallerstain 2003; Halchynskyi 2012; Hrytsenko 2012; Dementyev 2006; Kolodko 2009; Porter 1993; Porokhovskiy 2012; Sidenko 2012; Stoliarchuk 2009; Toffler 2004; Filipenko 2010]

Therefore, the institutional development of the person, revealing the reserves to strengthen international cooperation in the current economic environment become the objective basis for the directions of institutional transformation of the world political and economic space.

Conclusions. The world political and economic space is characterized by existence of the complex effects of interactions and time lags, that ensures preservation of the integrity of the world economic system. In fact, the fundamental contradiction between the desire of the system of the world economy to self-preservation and the ability to achieve this goal through continuous changes of the system is solved in the process of natural selection.

However, the current world political and economic space combines economic systems of post-industrial, industrial and pre-industrial development which are qualitatively different in the level of economic activity, degree of influence, dominant elements of economic mechanisms. Alongside with that, the transformational changes in the institutional structure of the world political and economic space express themselves through strengthening the international labour division, development of international cooperation in the field of information and communication technologies, as well as the growing trend of regional conflicts and contradictions, struggle for intellectual capital.

The origins of the institutional features of the evolution of the world political and economic space are reflected in the chain “social contradictions – driving forces – institutional transformations”.

References

1. Arrighi, G. (2007). *Adam Smith in Beijing: Lineages of the twenty-first century* / G. Arrighi. – London: Verso, 2007. 418 p.
2. Beck, W. (2007). *Power and its opponents in the globalizm epoch. New worldwide political economy*. Moskva: Progress-Traditsia; Publishing House “Territory of Future”, 464 p.
3. Bell, D. (1973). *The Coming of Post-Industrial Society: A Venture in Social Forecasting*. New York: Basic Books, 507 p.
4. Bilorus, O. (2011). Political economy of globalism and problems of the structural modernization of the national economy. *Research of International Economics: Collection of scientific papers. 2nd Edition*, 3-26.
5. Blagodarnyi, A. I., Tolmachova, H. F., Kvilinskyi, O. S. (2014). Investigation of the impact of regional characteristics on the development of small businesses, *Economics and Law*, 1, 30-37.
6. Bondaryeva, I. A., Kravchenko, S. I., Mieshkov, A. V. (2015). Features of the investment and innovative orientation in students` training in technical higher educational institution (on the example of Donetsk region). *St. Petersburg state polytechnical university journal. Economics*, 4 (223), 236-244.
7. Boryshkevych, O. (2012). *International movement of the capital and problem of external debt. Bulletin of the NBU*, 10, 40-47.
8. Castells, M. (1998). *The Information Age: Economy. Society and Culture*. – Vol. III. *End of Millennium*. Oxford: Blackwell Publishes, 418 p.

9. Cattaneo, O., Gereffi, G., Staritz, C. (2010). *Global value chains in a postcrisis world: a development perspective*. The World Bank, The International Bank for Reconstruction and Development, 416 p.
10. Dementyev, V. V. (2006). *Economy as the system of power*. Ministry of Education and Science of Ukraine. Donetsk National Technical University. – 2nd Edition. – Donetsk: “Druk-Info”, 404 p.
11. Filipenko, A. (2010). *Economic globalization: origins and results*. Moscow: “Economy”, 511 p.
12. *Globalization of opposition: Struggle in the world*. (2009). Ed.-in-Chief S. Amin and F. Uttar: Transl. from English. / Edited and introduced by A.V. Buzgalina. 2nd Edition. Moscow: Books House and “LIBROKOM”, 312 p.
13. Greenwood, D., Holt, R. (2008). Institutional and Ecological Economics: The Role of Technology and Institutions in Economic Development. *Journal of economic issues*. Vol. XLII, 2, 445 – 451.
14. Halchynskiy, A. (2012). Economic development: methodology of the renewed paradigm. *Economy of Ukraine*, 5, 4-17.
15. Horbunov, E., Vozniak, S., Solovei, O. (2010). Geo-political laws of development of the global world. *Political Management*, 2, 156-165.
16. Hrytsenko, A. (2012). Political economy: problem actualization, methodological potential and cohesion with institutionalism. *Economic Theory*, 1, 5-20.
17. Huntington, S. (2003). *The third wave. Democratization at the end of the 20th century*. Moskva: ROSSPEP, 368 p.
18. Kolodko, G. V. (2009). *World in motion*. Moskva: Magistr, 575 p.
19. Kvilinskyi, O., Kravchenko, S. (2016). Optimization of innovative project realization conditions. *Zeszyty Naukowe Politechniki Poznańskiej. Seria: Organizacja i Zarządzanie*, 70, 101-112.
20. Pająk, K., Kamińska, B., Kvilinskyi, O. (2016). Modern trends of financial sector development under the virtual regionalization conditions. *Financial and Credit Activity-Problems of Theory and Practice*, 2(21), 204-217.
21. Linneroth-Bayer, J., Amendola, A. (2010). Global Change, Natural Disasters and Loss Sharing: Issues of Efficiency and Equality. *The Geneva Papers on Risk and Insurance*, 25, 203–219.
22. Lyashenko, V., Kvilinskyi, O. (2016). Evolutionary aspects of reflective processes in economic systems in case of political history of Ukrainian-Polish relations. *International Collection of scientific proceedings “European Cooperation”*, 1, 9-24.
23. Maliuk, A. (2013). Change of the socio-class strategy of the power groups in the West under the conditions of the structural crisis of capitalism. *Sociology: theory, methods, marketing*, 2, 36-51.
24. Meshko, N. (2008). Global and local consequences of the innovation development of the world economy. *Bulletin of the Lviv University*, 25rd Issue, 286-294.

25. Meshkov, A. V., Bondaryeva, I. A., Kvilinskyi, O. S. (2016). *Factors of the region's investment climate formation under modern socio-economic conditions // Vestnik Permskogo universiteta. Seria Ekonomika = Perm University Herald. Economy*. 2016. № 2(29). P. 120–134. doi: 17072/1994–9960–2016–2–120–134
26. Pajak, K., Lyashenko, V., Kvilinskyi, O. (2015). Operation of a business entity in the context of globalization. *Economic Herald of the Donbas*, 4(42), 18–23.
27. Pareto, V. (1964). *Trattato di sociologia generale*. Milano. Vol. 2. P. 5.
28. Parsons, T. (1971). *The system of modern societies*. Englewood Cliffs, N.J.: Prentice-Hall, 152 p.
29. Porokhovskiy, O. (2012). Political economy at the beginning of the 21st century. *Economic Theory*, 2, 17–28.
30. Porter, M. (1993). *International competition*. Moscow: International Relations, 896 p.
31. Sidenko, V. (2012). Modification of the world economy under the influence of new factors of global transformation. *Economy of Ukraine*, 5, 18–31.
32. Stoliarchuk, Ya. (2009). *Global asymmetry of economic development: monograph*. Kyiv: KNEU, 302 p.
33. *The Global Competitiveness Index 2015-2016 – information about the research*. IAA Centre of Humanitarian Technologies. Retrieved from <http://gtmarket.ru/ratings/global-competitiveness-index/info>.
34. Toffler, E. (2004). *The third wave*. Moscow: AST, 781 p.
35. Lyashenko, V., Tolmachova, A., Kvilinskyi, O. (2016). Państwowa polityka rozwoju przedsiębiorczości w kontekście stabilności społecznoekonomicznej (na przykładzie Ukrainy). *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze*, 4, 155–164.
36. Vallerstain, I. (2003). *After liberalism*. Moscow: Editorial of URSS, 256 p.

E-MONEY PAYMENTS IN SUSTAINABLE TOURISM DEVELOPMENT

Introduction. Analysis of the effectiveness of the project on the use of electronic money for settlements between people and sellers of goods and services should be based on scientifically-based analysis. Thus, investigating the activities of the issuer of legal tender (in Ukraine today – we are talking about banks), performance analysis can be based on a study of the yield of issuing electronic money and the organization of their circulation for sustainable tourism development.

By studying the activity of other entities involved in their circulation, the analysis can be made based on reducing maintenance costs of cash payments after the introduction of electronic money, depending on the social impact that is associated with improvement of cashiers working conditions, etc. This toolkit was studied in our previously published papers [Melnychenko 2015].

In addition, we studied the methods based on queuing theory [Erlang 1909, Palm 1943, Sztrik 2012], which made it possible to assess the effectiveness of implementing electronic money payments in supermarket chains by reducing the amount of time spent at the box office to pay for goods or services and increase cash desks bandwidth by an easier and more rapid method of checkout – electronic money.

In our studies multiplicative method of forming integral (total) amount of time of customer service was used to determine the bandwidth of cash desks as more effective and convenient one to use. In this paper we demonstrate and justify the choices of using an approach that is based on the formation of multiplicative assessment features and advantages compared to additive method.

Literature review and the problem statement. Many works of specialists in various fields are devoted to modeling of economic processes through economic and mathematical methods [Lei, Wang 2008, Amosha, Kharazishvili, Liashenko, Kvilinskyi 2016; Kharazishvili, Liashenko, Zaloznova, Kvilinskyi 2016, Kravchenko, Kvilinskyi 2016, Lyashenko, Tolmachova, Kvilinskyi 2016, Pająk, Dahlke, Kvilinskyi 2016]. Enumeration of each one does not make sense as many authors make their contribution to the development of this very scientific area. Just let us support the great delineation of tools for modeling economic processes by Litvinov A.L. [Litvinov 2003]: mathematical programming, queuing theory, inventory control, game theory. Listed sections make up applied mathematics, methods of which solve critical issues primarily of a practical nature. Each of them plays an important role and gets focused on in the scientific literature. Thus, in our work we stopped in applying methods of queuing theory, which seems logical given the object of our study – electronic money

[Melnychenko 2015], which in fact are intended primarily for use in system maintenance [CGAP 2010, Steed 2010].

Features of the application of various methods of economic and mathematical modeling, mathematical approaches that can be used effectively in a particular subject plane (for the class of specific economic problems) and the nuances of their use depending on the purpose of the study, analysis of economic entities objectives and tasks for solution of which the simulations are carried out remain important in this case [Darroch, Speed 1983].

Thus, in our papers we stopped to study the efficiency of implementing electronic money payments by determining the capacity of cash departments and desks as well as its increase through the introduction of electronic money. We proposed to calculate this indicator on the basis of the work of cashiers in terms of asymmetry of data when indicators with different dimensions and different numerical values should be included in the integrated indicator. In this paper, we justify the choice of approach to normalize data for calculations.

Methods of normalization of the indicators are analyzed in the works of authors who also study the identification of problematic situations in banks and there are 4 of them in general [Trydid, Samorodov, Goykhman 2014], outlining in particular:

- average value of a particular index in a common set of its values;
- standard deviation of actual values;
- approach "better – worse";
- values of column–vector norms in determining the normalized values of indicators.

The authors distinguish such approaches to the calculation of integral indicators:

1. Additive approach – the sum of normalized values of indicators.
2. Multiplier approach – the multiplication of normalized values.
3. Determination of the Euclidean distances between the actual values of the indicators.

Note that normalized values of indicators that are measured and on which estimate function is based may be corrected for the weighted coefficients of corresponding importance if needed [Samorodov 2011; Samorodov, Trydid, Samorodov 2012].

In these works, the authors assess the adequacy of proposed methods based on theoretical data. We are taking these approaches and sharing views on the possibility of their use in the analysis of banking activities, make comparisons of appropriateness and objectivity of using two of them, namely additive and multiplicative integral factor in analyzing the effectiveness of the electronic money settlements. As methodological approach used for normalization of the studied parameters, we choose one that is based on the definition of the average value of a particular index in a common set of its values.

The purpose of this paper is to study methods of the assessment function construction – the integral index, which characterizes the total time of customer service to determine the cash desks bandwidth when using electronic money as means of payment between the customer and the seller of goods and substantiate use of these methods in analyzing the effectiveness of the electronic money settlement for sustainable tourism development.

Research results. So, as we noted in [Melnychenko 2015] practical cash desks bandwidth μ_{pract} should be calculated using the following relationship:

$$\mu_{\text{pract}} = \frac{NC}{TR(LQ,OP)+TP(AP,FP,AC,LQ,AL,OP)+TI(PI,OP)}, \quad (1)$$

where NC – the number of clients that "passed" through the cash desk;
 TR(LQ, OP) – time required for customer service (taking applications for processing, document preparation, etc.);
 LQ – level of cashier qualification;
 OP – other parameters;
 TP(AP,FP,AC,AL,CA,OP) – time for payment of the customer;
 AP – amount paid;
 FP – form of payment (cash or bank transfer);
 AC – amount of cash – banknotes and coins that are transferred from the payer to the cashier and vice versa;
 AL – cash desk automation level;
 TI(PI,OP) – cashier idle time;
 PI – the probability of receipt incoming.

Value of μ_{pract} will be calculated precisely because of the normalization of the data for one of the above algorithms. In [Melnychenko 2015] we used a multiplier approach to calculation of the integral index and the average value of a particular index in a common set of values for its normalization of values of indicators as the most appropriate for the task: evaluation of cash desks bandwidth. Below we justify the selection of this instrument.

Based on the data of one of the supermarkets in Poland table 1 shows the average productivity of cashiers for 3 days (except for values of indicators "Payment", "Quantity of cash", "Cash desks automation level", "The probability of receipt of the application for service" "Other factors" which are defined empirically). The survey sampling comprised 109 man–days, in which customers purchased goods worth a total of 1 531 226.29 PLN.

For greater clarity of our calculations in this article, we took the average values in the context of the studied days and will operate with three average ones instead of 109.

Table 1 – Performance of supermarket cashiers

Indicator	Average value	Average value per day		
		17.12.2016	21.12.2016	22.12.2016
Turnover, PLN	15 119,62	11 687,17	16 781,23	16 890,46
Form of payment	0,80	0,80	0,80	0,80
Quantity of cash	20,00	20,00	20,00	20,00
Cash desk automation level	0,80	0,80	0,80	0,80
The probability of receipt incoming	0,92	0,85	0,95	0,95
Scan time, hours	2:19:07	1:44:42	2:31:20	2:41:18
Payment time, hours	1:33:07	1:27:14	1:35:12	1:36:54
Other factors	1,00	1,00	1,00	1,00
Number of clients	130,00	131	130	129

Source: built on the basis of our own research

To give some explanation of the indicators listed in the table 1 and determined empirically:

1. Form of payment:

– cash, which includes the likelihood of the need to issue the residue back to the client, takes more time for a re-calculation and double-checking.;

– bank transfer, credit or debit card, electronic money that will not require the issuance of the residue back to the client.

We propose to determine the value of FP, it may take:

– $FP = 1$, if there is a need to use cash for the payment and to issue the residue back to the client;

– $FP = 0,8$ if payment is made by means of cash with consequences mentioned in p. 1 above, or a bank card with the need to enter a PIN or sign the receipt, as well as by means of e-money;

– $FP = 0,5$ if payment is processed only by means of bank cards and e-money.

2. Amounts of cash. Clearly, any cash denomination is accepted as payment means, so it is probable that the customer can pay, for example, 500 monetary units as one banknote, maybe 10 banknotes fifty each, or 500 banknotes and/or coins and more. Also, when buying something cheap customer can pay with large denominations (100, 200, 500 monetary units).

The approximate average value of the amount of cash that the buyer is using equals to 20 pieces of banknotes and coins.

3. Cash desk automation level. The speed of the cashier when taking money and when issuing the rest for the client depends on setting up an information system in general as well as on the software which runs a particular cash desk, same for the availability of machines for counting banknotes and coins and on their class and specification.

The workstation level software for cashiers today can be considered as high, given that many of the functions are performed automatically. For example, bank cashiers do not need to calculate bank commission on payments received from customers or write the same type of documents or make accounting entries in the accounts. In supermarkets, in most cases, the cashier does not have to enter code for a specific good or make transactions with cards when paying manually. All these operations are carried out by automated systems. However, there is still a need, for example, in calculation and issuance of the residue for clients, issuing checks, receipts, etc. Therefore, the cash desk automation level is defined at 0.8, which is considered a reduction factor due to a need of a cashier's manual work.

Other factors can, in particular, include: possible faults in cashiers equipment, rate of change checks by customers, delays associated with the provision of cash desk (cash, securities, etc.), etc. In our case, the index takes value of 1 (there are other factors) or 0 (other factors do not affect the cash desk bandwidth).

So, going directly to calculation of values of cash desk bandwidth integrated indicators, it should be noted that the definition of normalized values of performance appraisal will use the formula:

$$\tilde{H}_i^{(t)} = \frac{\Pi_i^{(t)}}{\bar{\Pi}_i^{(t)}}, i = \overline{1, n}; t = \overline{1, T}, \quad (2)$$

where $\tilde{H}_i^{(t)}$ – normalized values of indicators; $\Pi_i^{(t)}$ – actual values of indicators; $\bar{\Pi}_i^{(t)} = \frac{1}{T} \sum_{t=1}^T \Pi_i^{(t)}$ – average values for every analyzed time period; $i = \overline{1, n}$ – indicator number; n – quantity of indicators; $t = \overline{1, T}$ – time period number; T – quantity of time periods.

To calculate the numerical values of the equation denominator (1) we will use two approaches.

The first approach is based on the use of formulas:

$$\mu_{\text{pract}}^{(t)} = \frac{NC}{TR(LQ, OP) \times TP(AP, FP, AC, LQ, AL, OP) \times TI(PI, OP)} = \frac{KK}{I^{(t)}} = \frac{KK}{\prod_{i=1}^7 \tilde{H}_i^{(t)}}, \quad (3)$$

$$\mu_{\text{pract}}^{(t)} = \frac{NC}{TR(LQ, OP) + TP(AP, FP, AC, LQ, AL, OP) + TI(PI, OP)} = \frac{KK}{I^{(t)}} = \frac{KK}{\sum_{i=1}^7 \tilde{H}_i^{(t)}}, \quad (4)$$

That is, in the case of formula (3) we calculate multiplicative integral indicator to determine the numerical value of the equation denominator (1) including all of its components together, and using the formula (4) – additive integral indicator.

The second approach will consist in calculating the corresponding components of the denominator in the formula of (1) for each component: TR (time for customer service), TP (payment processing time) and TI (cashier idle time), using the same approach – multiplicative and additive integral indicators. That is, in this case, the following formula should be used:

$$\mu_{\text{pract}}^{(t)} = \frac{KK}{\text{TR(LQ,OP)} \times \text{TP(AP,FP,AC,LQ,AL,OP)} \times \text{TI(PI,OP)}} = \frac{KK}{I_1^{(t)} + I_2^{(t)} + I_3^{(t)}} = \frac{KK}{\prod_{i=1}^2 \tilde{H}_i^{(t)} + \prod_{i=1}^6 \tilde{H}_i^{(t)} + \prod_{i=1}^2 \tilde{H}_i^{(t)'}}$$
 (5)

$$\mu_{\text{pract}}^{(t)} = \frac{KK}{\text{TR(LQ,OP)} \times \text{TP(AP,FP,AC,LQ,AL,OP)} \times \text{TI(PI,OP)}} = \frac{KK}{I_1^{(t)} + I_2^{(t)} + I_3^{(t)}} = \frac{KK}{\sum_{i=1}^2 \tilde{H}_i^{(t)} + \sum_{i=1}^6 \tilde{H}_i^{(t)} + \sum_{i=1}^2 \tilde{H}_i^{(t)'}}$$
 (6)

First, we will demonstrate the adequacy of the results that may be obtained using formulas (3) – (6) for conventional data close to real one (table 2).

We propose to simulate a situation where the results of the same cash desk workflow are constant for all three days selected (table 3).

Table 2 - Input data (identical) to verify the adequacy of the proposed models

Indicator	Average value	Average value per day		
		17.12.2016	21.12.2016	22.12.2016
Turnover, PLN	16 781,23	16 781,23	16 781,23	16 781,23
Form of payment	0,80	0,80	0,80	0,80
Quantity of cash	20,00	20,00	20,00	20,00
Cash desk automation level	0,80	0,80	0,80	0,80
The probability of receipt incoming	0,95	0,95	0,95	0,95
Scan time, hours	1:44:42	1:44:42	1:44:42	1:44:42
Payment time, hours	1:27:14	1:27:14	1:27:14	1:27:14
Other factors	1,00	1,00	1,00	1,00
Number of clients	130,00	130	130	130

Source: built on the basis of our own research

Table 3 shows the calculations obtained using formulas (3) – (6) for the input data from table 2.

Table 3 – Modeling of indicator $\mu_{\text{pract}}^{(t)}$ for the same input data of cash desk

Indicator name	Integral criteria type	Formula used for calculation	Average value per day		
			17.12.2016	21.12.2016	22.12.2016
$\mu_{\text{pract}}^{(t)}$	Multiplicative	(3)	1	1	1
	Additive	(4)	0,125	0,125	0,125
	Multiplicative	(5)	0,33333333	0,33333333	0,33333333
	Additive	(6)	0,08333333	0,08333333	0,08333333

Source: built on the basis of our own research

Table 3 shows that the calculation of values of indicator $\mu_{\text{pract}}^{(t)}$ by formulas (3) – (6) we obtained the same qualitative values.

Let's complicate the task, and model the situation in which we get one worst period characterized accordingly by a worst (minimum) indicator value of $\mu_{\text{pract}}^{(t)}$ cash desk bandwidth. Input data is mentioned in table 4.

Table 4 – Input data (different) to verify adequacy of the proposed models

Indicator	Average value	Average value per day		
		17.12.2016	21.12.2016	22.12.2016
Turnover, PLN	16 781,23	16 781,23	16 781,23	16 781,23
Form of payment	0,80	0,80	0,80	0,80
Quantity of cash	20,00	20,00	20,00	20,00
Cash desk automation level	0,80	0,80	0,80	0,80
The probability of receipt incoming	0,95	0,95	0,95	0,95
Scan time, hours	2:04:42	2:44:42	1:44:42	1:44:42
Payment time, hours	1:47:14	2:27:14	1:27:14	1:27:14
Other factors	1,00	1,00	1,00	1,00
Number of clients	130,00	130	130	130

Source: built on the basis of our own research

Table 4 shows that the scan time and payment time for the first time period are different from the corresponding values for the other studied periods. The values of every other parameters are the same.

Table 5 contains calculations obtained after using formulas (3)–(6) for input dates of table 4.

Table 5 – Modeling indicator $\mu_{\text{pract}}^{(t)}$ for different input of cash desk

Indicator name	Integral criteria type	Formula used for calculation	Average value per day		
			17.12.2016	21.12.2016	22.12.2016
Value $\mu_{\text{pract}}^{(t)}$	Multiplicative	(3)	1,813427718	0,683024404	0,683024404
	Additive	(4)	0,133592301	0,118760869	0,118760869
	Multiplicative	(5)	0,475537457	0,2545726	0,2545726
	Additive	(6)	0,091150037	0,0778782	0,0778782

Source: built on the basis of our own research

Table 5 shows that carrying out calculations of indicator values $\mu_{\text{pract}}^{(t)}$ gives same qualitative results. However, if we analyze their relevance, we see that the results do not correspond with reality. The results should have indicated the lowest cash desk bandwidth as of 17.12.2016, since that day scanning time was equal to 2:44:42, while payment time was 2:27:14, both being worst results compared to other days, accordingly it would adversely affect the value of $\mu_{\text{pract}}^{(t)}$.

Here, the root cause lies in the essence of integrated criteria used for denominator calculation in (3) – (6), namely being the accumulation of values in a situation of "more is better". However, realizing the fact that the maximum cash desk bandwidth:

$$\mu_{\text{max}} = \frac{NC}{TR_{\text{min}} + TP_{\text{min}} + TI_{\text{min}}} \quad (7)$$

is a functional, in which the denominator is reduced in absolute terms, we should revert its value.

In this case we will have for the general indicator $\mu_{\text{pract}}^{(t)}$, the following formula:

$$\mu_{\text{max}} = \frac{NC}{(TR + TP + TI)^{-1}} = NC(TR + TP + TI) \quad (8)$$

When using the formula (8) the result should not be understood as the number of customers over the same period of time but as the time required for servicing a certain number of customers.

Using formula (8) for data from table 5, we get the following results (table 6):

Table 6 - Modeling of $\mu_{\text{pract}}^{(t)}$ for different input data with inversion

Indicator name	Integral criteria type	Formula used for calculation	Average value per day		
			17.12.2016	21.12.2016	22.12.2016
Value $\mu_{\text{pract}}^{(t)}$	Multiplicative	(3)	0,551441885	1,46407653	1,46407653
	Additive	(4)	7,485461303	8,42028196	8,42028196
	Multiplicative	(5)	2,102883771	3,9281531	3,9281531
	Additive	(6)	10,97092261	12,840564	12,840564

Source: built on the basis of our own research

Table 6 shows the results adequacy, thus we should consider formula (8) being a proper one.

The next stage of the study is the determination of a specific approach that most appropriately reflects the results in solving economic problems of this class.

Let us analyze graphical form of results obtained in table 6 (Fig. 1, 2).

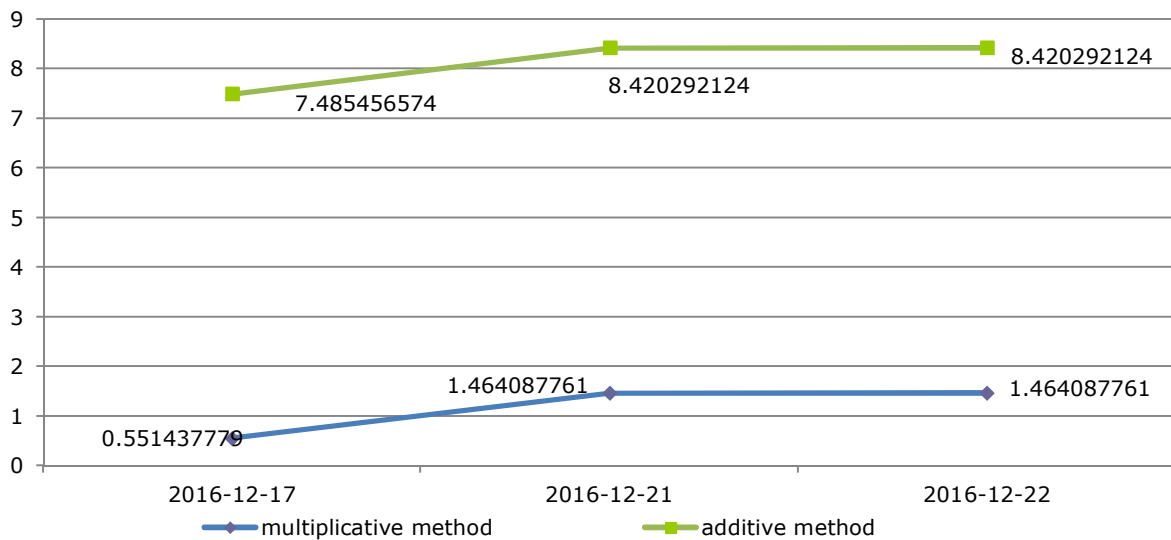


Figure 1 - Graphical interpretation of $\mu_{\text{pract}}^{(t)}$ calculated by formulas (3)–(4) with an inversion used

Source: built on the basis of our own research

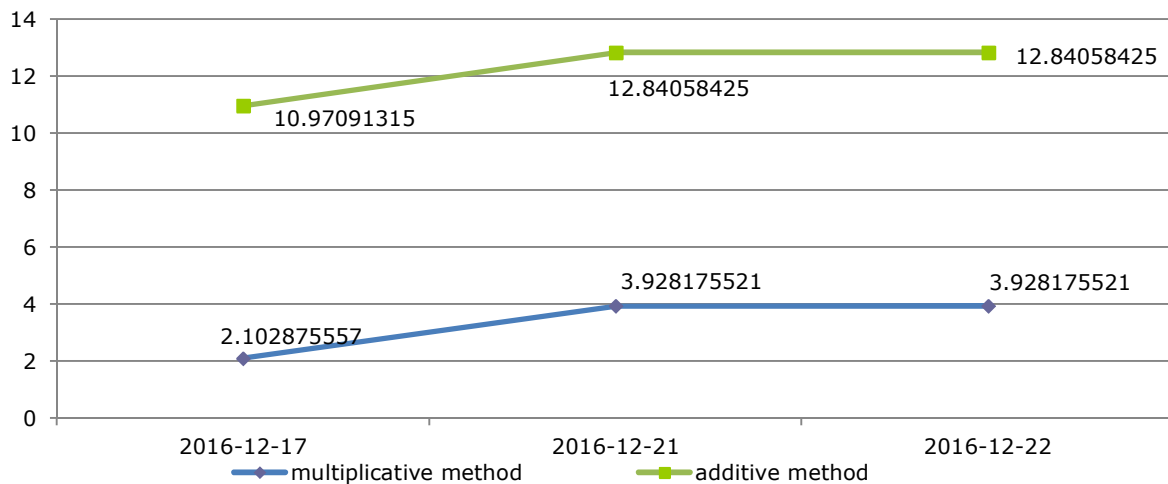


Figure 2 – Graphical interpretation of $\mu_{\text{pract}}^{(t)}$, calculated by formulas (5)–(6) with an inversion used

Source: built on the basis of our own research

From fig. 1, 2 and the data from table 6 it is obvious that the results differ quantitatively with the same quality. Therefore, in this case we should firstly decide which formulas to choose for calculation of $\mu_{\text{pract}}^{(t)}$. We propose to stop at this point in formulas (5) and (6) due to the fact that they completely describe the structure of time-consuming, with each cost of time function calculated separately as part of the denominator of the formula (1) (check formula (7) as well).

Regarding grounded recommendations of using a particular approach to an integral parameter construction (additive or multiplicative), you should explore the relative change of values of $\mu_{\text{pract}}^{(t)}$. Relative change in this case is important for visualization of the results. Note that we explore only three time periods and thus it is graphically identifiable on which date we have better results of $\mu_{\text{pract}}^{(t)}$. With the growing number of periods analyzed results will inevitably match in quality, but visually they will be difficult to analyze.

Lets analyse relative changes of $\mu_{\text{pract}}^{(t)}$, based on formulas (5) and (6) according to (8). Results are shown in table 7.

Table 7 shows that quantitatively the relative change in value of the index $\mu_{\text{pract}}^{(t)}$ is bigger while using multiplicative approach to integrated parameter construction. Using this approach will allow to obtain results that can be analyzed in a more convenient way by increasing the number of analyzed periods.

Table 7 – Relative changes of $\mu_{\text{pract}}^{(t)}$

Name of indicator	Integral criteria type	Formula used for calculation	Average value per day		
			17.12.2016	21.12.2016	22.12.2016
Relative change of $\mu_{\text{pract}}^{(t)}$	Multiplicative	(5)	–	86,79839164	0
	Additive	(6)	–	17,04178765	0

Source: built on the basis of our own research

So we reasonably chose a tool the use of which is not only possible when analyzing the efficiency of payments by electronic money, but also allows you to get adequate results which are characterized by clarity of their presentation both graphically and in tabular form.

Using the selected tool based on the determination of the average value of a particular indicator in a common set of values for its standardization parameters (formula (2)), as well as mathematical approach to the formation of the assessment function – integral index, based on multiplicative approach (formula (5)), and denominator inversion (formula (8)), we will calculate value of practical cash desk bandwidth $\mu_{\text{pract}}^{(t)}$ using table 1 – real data. Results are shown in table 8.

Table 8 – Calculation of $\mu_{\text{pract}}^{(t)}$ for real data

Name of indicator	Integral criteria type	Formula used for calculation	Average value per day		
			17.12.2016	21.12.2016	22.12.2016
Indicator $\mu_{\text{pract}}^{(t)}$	Multiplicative	(5)	3,4682047	2,9333085	2,7693844
Relative changes of $\mu_{\text{pract}}^{(t)}$			–	–15,422854	–5,5883715

Source: built on the basis of our own research

Graphical interpretation of calculation of $\mu_{\text{pract}}^{(t)}$ for real data is shown on fig. 3.

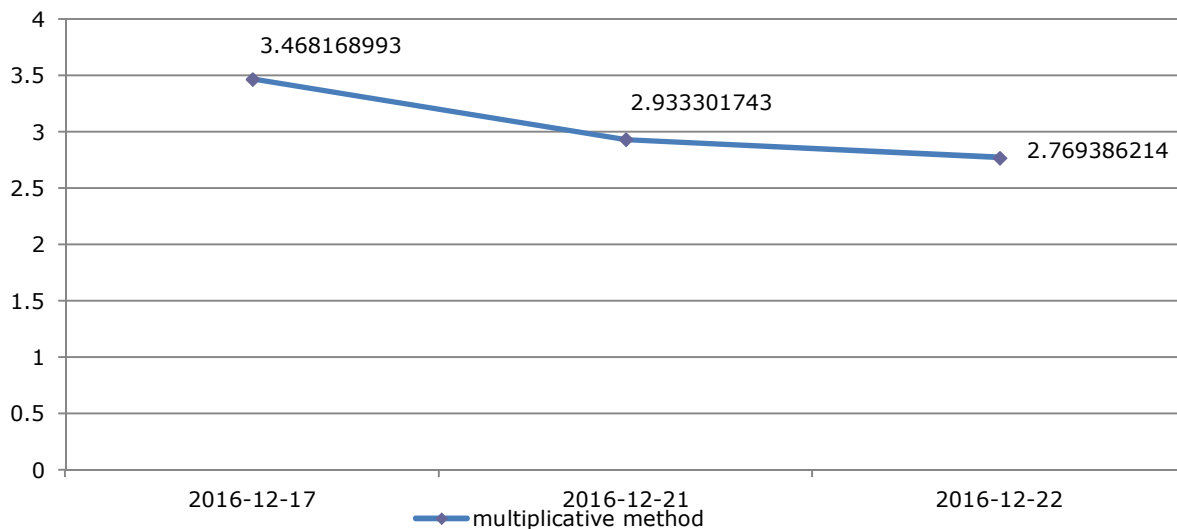


Figure 3 – Graphical form of $\mu_{\text{pract}}^{(t)}$, using formula (5) and inversion
Source: built on the basis of our own research

Table 8 and figure 3 show that best results of cash desk bandwidth $\mu_{\text{pract}}^{(t)}$ were obtained on 17.12.2016. Obtained maximum is primarily characterized by minimal time to scan and process the payment, despite the fact that turnover during this day is minimal compared to other time periods studied.

Conclusions. Research of methods for constructing the assessment function – integral index, which characterizes the total time of customer service to determine the cash desk bandwidth using electronic money as means of payment between the customer and the seller of goods made the justification of the use of specific approaches in analyzing the effectiveness of the electronic money settlements possible for sustainable tourism development.

Using tools based on the determination of the average value of a particular indicator in a common set of values for its standardization parameters (formula (2)), as well as mathematical approach to the assessment functions formation – integral index, which is based on the multiplier approach (formula (5)), using the denominator inversion (formula (8)), gives adequate results, which are characterized by clarity of their presentation both graphically and in tabular form.

References

1. Amosha, O., Kharazishvili, Y., Liashenko, V., Kvilinskyi, O. (2016). *Economic security of sustainable development of the regions (based on the example of the Donetsk region)* w: (red.). *Gospodarka niskoemisyjna i jej wpływa na rozwój województwa wielkopolskiego*. Wydawnictwo Naukowe PWN, s. 19-34.
2. CGAP (2010). *Nonbank E-Money Issuers: Regulatory Approaches to Protecting Customer Funds*. Retrieved from

<http://www.cgap.org/sites/default/files/CGAP-Focus-Note-Nonbank-E-Money-Issuers-Regulatory-Approaches-to-Protecting-Customer-Funds-Jul-2010.pdf>.

3. Darroch, J. N., Speed T. P. (1983). Additive and Multiplicative Models and Interaction. *The Annals of Statistics, Vol. 11, No. 3.*, 724-738.

4. Erlang, A. (1909). The theory of probabilities and telephone conversations. *Nyt Tidsskrift for Matematik B, Vol. 20*, 33 – 39.

5. Kharazishvili, Y., Liashenko, V., Zaloznova, Y., Kvilinskyi, O. (2016). Impact of infrastructure component on socioeconomic approach to modernization of the region. *Współpraca Europejska / European Cooperation, 8 (15)*, s. 108-119.

6. Kravchenko, S., Kvilinskyi, O. (2016). Оптимизация конкурентоспособности инновационного проекта в условиях стратегической синергетизации. *Вісник економічної науки України, 1(30)*, s. 70-77.

7. Lei, K., & Wang, Z. (2008). Emergy synthesis of tourism-based urban ecosystem. *Journal of environmental management, 88(4)*, 831-844.

8. Litvinov, A. L. (2003). Комп'ютерное моделирование в экономике. Belhorod: BelHU.

9. Lyashenko, V., Tolmachova, A., Kvilinskyi, O. (2016). Państwowa polityka rozwoju przedsiębiorczości w kontekście stabilności społecznoekonomicznej (na przykładzie Ukrainy). *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze, 4*, s. 155-164.

10. Melnychenko, O. V. (2015). *Teoriia, metodolohiia ta praktika obliku, analizu i auditu elektronnih hroshei v bankah*. Zhitomir: ZhDTU.

11. Melnychenko, O. (2015). Zastosuvannya metodiv teorii masovoho obslugovuvannya v ekonomichnomu analizi operatsii z elektronnimi hroshima. *Problemi ekonomiki, 1*, 198-207.

12. Meshkov, A., Bondaryeva, I., Kvilinskyi, O. (2016). Характеристика факторов формирования инвестиционного климата региона в современных социально-экономических условиях. *Вестник Пермского университета. Серия «Экономика» = Perm University Herald. Economy, 2 (29)*, s. 120-134.

13. Pająk, K., Dahlke, P., Kvilinskyi, O. (2016). Determinanty rozwoju regionalnego - współczesne odniesienie. *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy, 9*, s. 109-122.

14. Palm, C. (1943). Intensitätsschwankungen im Fernsprechverkehr, *Ericsson Technics, 44*.

15. Samorodov, B. V. (2011). Alternativniy pidhid do analizu nadiynosti banku yak etapu upravlinnya finansovim rozvitkom. *Innovatsiyna ekonomika: Vseukr. nauk.–virob. zhurnal, 7(26)*, 238-240.

16. Samorodov, B., Trydid, O. & Samorodov, V. (2012). Osoblivosti matematichnoi obrobki danih pri vikoristanni ekspertnih pidhodiv dlia viznachennya reytingiv bankiv. *Visnik Natsionalnoho banku Ukraini, 1*, 18-21.

17. Steed, A. (2010). The business of e-money. *The Daily Telegraph Supplement*, 7 September 2010. Retrieved from http://www.envoyservices.com/pressr/business_of_e-money.pdf.

18. Sztrik, J. (2012). *Basic Queueing Theory*. University of Debrecen, Faculty of Informatics.

19. Trydid, O. M., Samorodov, B. V. & Goykhman, M. I. (2014). Identifikatsiya problemnih situatsiy v bankivskiy diyalnosti z urahuvannyam asimetrii danih. *Chasopis ekonomichnih reform*, 3(15), 63-76.

**IMPROVEMENT OF CAPACITY MARKET PARTICIPANTS'
EFFICIENCY THROUGH THE IMPLEMENTATION OF SHARED
SERVICES CENTRES
IN THE BUSINESS**

Introduction. Presently, an important consideration connected with the services standards system is the provision of such system closely tied to other management process elements, also on the macro scale, in individual organisations providing specific services. In business one of the solutions may be signing a “framework agreement” defining the rules of transfer of individual support functions to a Shared Services Centre. This also means developing a method of calculating the remuneration for the services rendered by this entity (Dobiegała – Korona, Doligalski, 2010, p. 93 and subsequent). It is also necessary to add to such framework agreement the so-called services sheet covering details, standards, performance and quality indicators used to classify the services. Effective management of services requires:

- building an integrated services information platform,
- increasing the commitment of human capital in the management and development processes, also through the promotion of good practices and the development of a network of contacts with the surroundings,
- developing and implementing unified communication standards in customer and businesses support,
- introducing periodic audits, evaluations regarding the functioning of the SSC with regard to customers and business support,
- developing and implementing services feedback acquisition based on the citizen sourcing concept [Strategia, 2011, s. 2].

Standardisation of functions as the first stage of creating a shared services centre. In order to correctly combine services during subsequent stages of building an SSC it is necessary first of all to standardise them in individual areas prior to their centralisation. However, this is a complex process and it may not be possible to carry it out in whole in every case. Nonetheless, it is necessary to strive towards a compromise, seek the best solutions. The problems and barriers which must be overcome are connected with the IT system, legal, technical and logistic differences, or even with habits developed by employees functioning in branches and corporations, in distant locations or countries. Together with the customer support or sales processes it is necessary to introduce uniform standards of documents, master agreements, rules and regulations. In the case of accounting, it is necessary to adjust the accounting standards and policies, posting and calculation, controlling and reporting processes. In the case of HR service and payroll processes it is necessary to standardise the processes and procedures connected with pay regulations and collective bargaining agreements signed with

the social partner, if they exist. In the case of logistic, administrative services it is necessary to standardise procurement regulations, discretion limits, documents management rules. The most difficult area to standardise are the IT services. Here, one may use a methodology which systematises IT products and internal services. Over 50% of the personnel at the IT departments of power undertakings are employees dealing with the IT infrastructure and operations. Most of them perform routine, everyday operational processes. Standardisation enables optimising the number of employees and the related costs and leads to an improvement of the service quality and management. According to a report published by the IT Governance Institute and the Information Systems Audit and Control Association (ISACA), the most popular methodology is ITIL (Information Technology Infrastructure Library) which allows increasing business efficiency at over 80% of organisations which use it. [www.osnews.pl].

It is worth drawing attention to the fact that in a report published in 2011 Gartner's experts estimate that 60% of the global IT expenditures are spent on IT infrastructure and operations (I&O). Thanks to 10 key actions it is possible to generate savings in the I&O area of 10% (in 12 months), or even 25% (in three years). Obviously, this requires implementing good practices in the IT department (ITIL) as part of a strategy aimed at improving the effectiveness of IT operations. The data quoted including the results of the latest survey carried out by Forrester in 2011 show that ITIL has a positive impact upon: efficiency (85%), quality of services (83%), appraisal of the work of the IT departments (65%) and generation of savings (41%). Implementing the ITIL methodology allows minimising risk, increasing productivity, contributes to raising customer satisfaction and increases flexibility in the response of a given firm to the changing business reality. ITIL (Information Technology Infrastructure Library) is a global standard in the management of IT services IT (ITSM – IT Service Management). An ITIL is a set of best practices which may be applied by organisations operating in various sectors of the economy, regardless of their size, software or hardware used. According to the information published by the Opennetworks portal, best ITIL practices are used at over 15,000 leading organisations world-wide. [Foray, 2009, pp. 15-26]

Alas, there are still no good practice standards and solutions for areas such as customer support or accounting, HR or payroll management. At the standardisation stage one should seek intermediate solutions which at the centralisation stage will allow departments to be merged thanks to functions compatibility. Also in the area of communication this consolidation refers to building a team spirit in the functioning of individual SSC structures. This simple idea is presented in Figure 1.

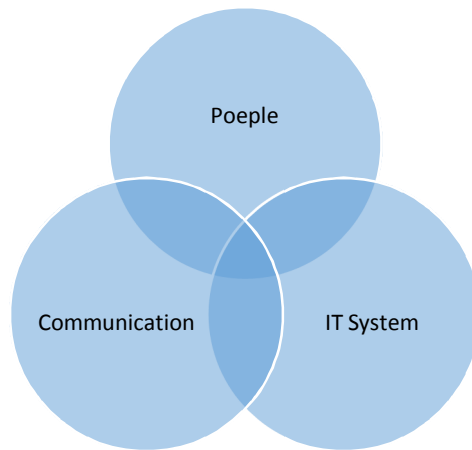


Figure 1 - Consolidation dimensions within the frame of standardisation

Source: elaborated by the author

Functions centralisation as the second stage of creating a shared services centre. Creating a SSC with regard to each support function follows a similar path. The literature states that standardisation is followed by centralisation. It consists in transferring functions and tasks with employees hitherto performing them in individual companies to the company operating as a SSC. Such concentration of support functions from different entities in one place greatly facilitates standardisation and optimisation of processes as the next stage of building a SSC at the ENEA Capital Group. As a result, a new process and operational model is created with regard to a given function: SSC FA – finances and accounting, SSC CS – customer and sales support, SSC IT – IT services, SSC HR – human resources and payroll, SSC Logistics – shared procurement and administration. [Data: Enea S.A.].

As part of the process approach in respect of each centralised function a set of procedures and processes is identified, their courses are designed with particular attention paid to the points of contact with the companies served by the SSC. Prior to centralisation these processes are described as, for example, process maps using such software like ARIS. As a result products are delivered which create the tree of products offered to the serviced companies. In order to ensure the required quality and to establish an effective efficiency improvement system preliminary key performance indicators (KPI) are set for the transitional period of centralisation.

Centralisation does not mean a need to transfer employees geographically. The most effective solution is the use of the new communications technologies, videoconferences, e-learning, e.g. for conducting training courses, and the intranet for conveying internal information. Most importantly, the combined functions must be uniformly managed, based on the same procedures and processes. Locations may be chosen according to the strongest competencies and divided, for instance, according to the functional areas. However, it is also possible to

geographically separate the customer support function by individual processes, such as: Correspondence Support Centre, Debt Recovery Centre, Call Centre, Contracts Support Centre. This process may be combined with geographical assignment of functions, i.e. one function located in a given town, thus making this branch the centre of its services. This made relocating staff unnecessary, but only required a change of competencies and additional training. It improved the management process and the idea is presented in Figure 2.

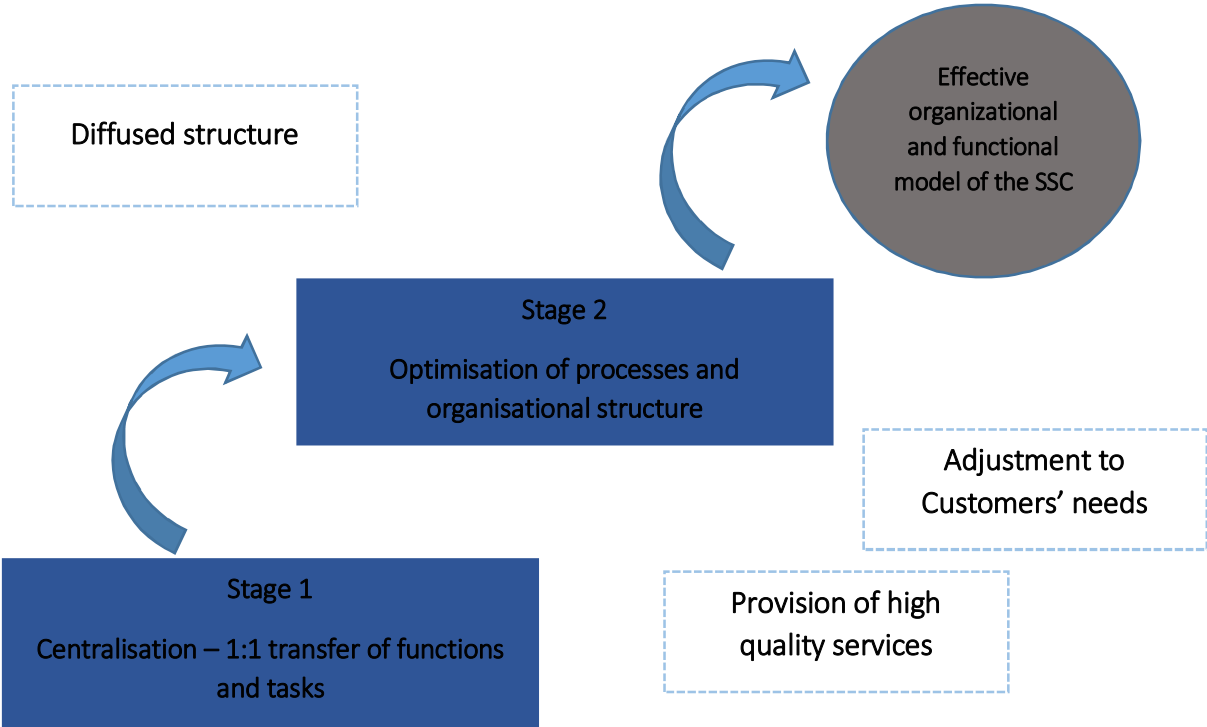


Figure 2 – Methodology of SSC building

Source: elaborated by the author

Third stage of building an SSC – improved efficiency and optimisation of operations. The reasons for implementing a shared services centre include, above all, the desire to make processes more efficient and speed up services quality improvement. Important factors in this respect are: better effectiveness, reduction of bureaucracy, unified management standards, unified procedures, infrastructure and IT tools. This better use of the existing resources and gathering expert knowledge in one, uniformly managed location is designed to strengthen market position and secure competitive advantage. The benefits are felt both by the organisation and its employees, for instance, in the form of unification of the pay systems, implementation of transparent incentive systems or building precise development and promotion paths in a wider structure. These benefits were also the reason for building Shared Services Centres by power enterprises which began operating in the liberalised energy market. A Shared Services Centre in the

business model of a power undertaking provides support in areas such as IT, customer services, administration, legal services, financial and accounting support, HR and payroll support and logistics for the benefit of companies forming the Capital Group. Based on the analyses carried out one may divide the implementation of an SSC into stages, so that services are provided gradually for an increasing number of entities in the group. In one case a decision was taken at a power undertaking that its Shared Services Centre would provide services first of all on behalf of the largest companies in the Group from the production, trade and distribution segment. In another case a power undertaking decided to implement an SSC for smaller companies and the head office, leaving the largest production and mining entities until the second stage. It is also possible to divide the implementation process into steps according to the support functions, i.e. begin with financial and accounting services and then progress to cover the entire structure of the enterprise. [Data: Enea S.A.]

Subsequent SSC implementation steps strongly depend on the organisation in which the implementation takes place and the degree to which it is prepared for shared services and the existence of other conditions, e.g. external ones which would require accelerating or delaying the implementation of individual support functions.

Continuous improvement, i.e. optimisation of the functioning of the SSC is an extremely important element. This process should be activated on the first day of the functioning of the new organisation and may not be stopped until the end of its operation. At least, this is how it should be in the case of an SSC created within the existing structures, taking over the existing processes and procedures, carrying a burden of the past in the form of contracts with employment guarantees or too high operating costs. These individual imperfections should be successively eliminated so that the functioning organisation does not experience the SSC as a burden but a source of support. Of course, one can compare oneself here to the national, global, European benchmarks with regard to the effectiveness of functioning of external SSCs. These are necessary comparisons which show the degree of optimisation of the SSC.

An important area of operation of a Shared Services Centre is processes optimisation. Very often this pertains to customer services which greatly affects the image and the level of support and sales costs. This process consists of a number of sub-processes which in turn contain individual sets of procedures. Another level of detail are manuals and scripts, but we are not going to discuss this level in the present paper. We can distinguish here sub-processes which pertain to contacts with customers, as well as documents and events which occur in the course of using electrical energy. By relocating customer services to a Shared Services Centre power undertakings have built a model which allows the support of comprehensive, sales and distribution customers. Comprehensive customers are those who have entered into comprehensive agreements, i.e. for the supply of energy as a product and distribution services. Sales customers are those who take advantage of the TPA

principle and have contracts with the firm concerning only energy as a product, while buying distribution services locally from the energy distributor assigned to a given network. Distribution customers are those who have current contracts with a local energy distributor. In a further part of the paper the author will focus on systematising support for comprehensive customers in a Shared Services Centre.

Transparent organisational structure as a key element of building an SSC. A necessary element improving the effectiveness of the processes performed in an SSC are IT systems. Processes standardisation makes it possible to effectively determine the needs in the area of IT systems and their quicker implementation and costs reduction. At the ENEA Capital Group, parallel to the work on processes standardisation and optimisation, the functional requirements are determined and IT systems supporting the work of almost every SSC areas are implemented. [Data: Enea S.A.].

The analysis of the processes also provides the point of departure for another step, i.e. optimisation of the organisational structures. Their simplification is an important stage in the process of improving the effectiveness of centralised support functions. At the SSC of the ENEA Capital Group the designed structure is based on competence centres which means that actions are flattened in individual areas of horizontal actions. The new organisation is bound to bring about many benefits, such as improved management process efficiency (shortening of the decision-making processes), greater HR management flexibility, elimination of performance of the same tasks by different business units, establishment of a clear division of competencies and responsibilities. The manning of this new structure is preceded by testing the competencies of individual groups of employees. The aim of these measures is to ensure the most effective adjustment of resources so that on the one hand the organisation operates effectively and on the other hand the employees can use their potential.

From the theoretical point of view there is no universal model of effective implementation of a services centre since every organisation is different. However, experts indicate several basic conditions for success. Above all, it is necessary to precisely define the vision of the functioning and development of the SSC over many years and to embed it deeply in the organisation's long-term strategy. Of huge importance is also the involvement of employees in the change through credible and open communication and utilisation of their initiatives. Ensuring effective IT systems playing a key role in functions integration is also essential. Moreover, it is also vital to plan a precise implementation schedule taking into account the nature of the integrated areas and the experiences of the organisation.

The following factors undoubtedly played a significant role in the process of building the Shared Services Centre of the ENEA Capital Group:

- rational, concrete and effectively implemented strategy – construction of the Shared Services Centre. It is confirmed in the corporate and area strategy. It defines clear objectives, initiatives, deadlines and specific target indicators. The

strategy has been disseminated throughout the organisation and its implementation is subject to constant monitoring and evaluation;

- the stages and expected deliverables have been clearly defined and the process of building the Shared Services Centre is based on two “Programmes”. Under each of them projects are implemented with precisely defined stages, milestones and deliverables. Actions and their results are subject to acceptance by the Steering Committees;

- comprehensively defined and implemented optimisation projects – both by individual strategic initiatives and actions resulting from the aforesaid Programmes. Projects set forth objectives, deliverables and assign responsibility for their achievement. The projects portfolio of the company operating as the SSC contains dozens of items. The project management methodology applied allows their efficient implementation. However, this requires considerable discipline and consistency;

- permanent and clear communication addressed to the stakeholders. Good communication proved to be a very important element of the process of change. Its effectiveness is attested by the fact that it is conducted over numerous channels in order to reach every employee. Appropriate information brochures were published and a dedicated SSC website created. Articles were published regarding subsequent stages, their purpose and scope of change. A contact mail box was set up to answer questions posed by employees. In addition, the Management Board and key managers held over 70 meetings in 18 locations attended by some 1,000 persons. Open communication is also conducted with the social partner;

- modern and mobile human capital, committed managers and employees of the ENEA Capital Group – they proved an invaluable key to success in the implementation of so many important changes. Having such large substantive potential they will successfully pursue the goals set by the company. Selection of the human capital offers hope for their further development and the SSC provides them with a unique opportunity to develop their competencies and to achieve self-fulfilment;

- rational organisation, management and consistency in the process of building the SSC. For the initiators of the project implementation of new methods and management tools (e.g. project, process management), personal allocation of responsibilities and permanent accounting for the results and constant monitoring and evaluation of the SSC strategy still remains important.

Analysing the foregoing one may note that actions have been developed at ENEA S.A. stabilising the structure of the SSC. A study conducted by a consultancy firm confirms that 80% of companies have already analysed the profitability of implementing such a system, while the average return on investment (ROI) is 20%, and the average return period of three years. First benefits of the implementation of the SSC can already be observed from the point of view of the corporation. They include, among others:

- reduction of the unit costs of mass mailing,

- increased proportion of incoming calls answered at the contact centre,
- reduction of the average call waiting time at the contact centre,
- increased volume of sales through low-cost contact channels,
- increased number of cases dealt with during the first contact,
- more efficient implementation of IT systems,
- reduced banking costs,
- reduced cost of licenses purchase,
- improved debt recovery process. [Reports of Enea S.A.]

Implementation of a Shared Services Centre is no mean task. It poses a huge challenge. Not every organisation has the sufficient resources to carry it out. However, the benefits created by shared services centres are worth the challenge. The market continuously tests new management tools and changes in organisation and processes. Services centres withstand these tests and become not only an effective business solution, but also a strong weapon in the fight for customers. Thanks to the concentration in one location of expert knowledge, standardisation and automation of processes, a transparent and effective management (based on quality, timeliness and effectiveness indicators) the SSC of the ENEA Capital Group will strive towards process perfection and cost effectiveness bringing benefits to the entire Capital Group.

Summary. The process of building a Shared Services Centre at the ENEA Capital Group shows a considerable potential for improving the effectiveness of the functioning of the power group which may be released by way of an appropriate restructuring based on three pillars:

- Group Companies focusing on their core activity,
- transfer of all support functions to a specialised entity,
- centralisation, standardisation and automation of processes, made possible thanks to their allocation to one firm.

By adding to this a uniform Group management policy (corporate governance) it is possible to achieve significant business benefits over a relatively short time. The main benefits include:

- reducing the duration of processes,
- reducing unit costs,
- improving the quality of services,
- improving business processes effectiveness,
- greater and more effective use of resources.

The experiences of the ENEA Capital Group gathered to-date clearly demonstrate that the decision to set up a Shared Services Centre was a step in the right direction and the Group intends to continue with this process by gradually transferring other support functions to the SSC and by using the economies of scale and synergy significantly improve the effectiveness of the functioning of the

Group.¹ The foregoing brings the ENEA Capital Group significantly closer to the attainment of the main strategic objective mentioned at the beginning, i.e. *an increase of the value for the shareholders*.

It is worth noting here that, based on the business solutions of the SSC one can observe a process of actions aimed at introducing them in the structures of the State and local administration. In a document entitled “Efficient State 2020” the building of a Shared Services Centre is envisaged for modern management of public services. The Local Government Act adopted by the Parliament on 15 May 2015 provides for building SSCs which are to increase independence and flexibility of local authorities in the area of public services. Using solutions first implemented in the business sector, potential benefits from the implementation of such Centres are estimated at between PLN 350 and PLN 1,060 million. [“Efficient State 2010” Strategy, 2011, p. 98].

References

1. ABSL, 2014, Sektor nowoczesnych usług biznesowych w Polsce (Modern business services sector in Poland), ABSL, Warszawa.
2. Bartkowiak, R., 2008, Historia myśli ekonomicznej (History of economic thought), PWE, Warszawa.
3. Bergman, L., 2003, European Electricity Market Integration: the Nordic Experiences, Research Symposium European Electricity Markets, Hague, September, http://www.ecn.nl/fileadmin/ecn/units/bs/Symp_Elctricity-markets/c1_2-paper.pdf, [access 23.01.2013].
4. Borkowska, B., 2009, Regulacja monopolu naturalnego w teorii i praktyce (Regulation of the natural monopoly in theory and in practice), Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław.
5. Borowski, P.F., 2009, Regulacje w sektorach gospodarki (Regulations in sectors of the economy), „Myśl ekonomiczna i prawna” (“Economic and legal thought”), No 4.
6. Collins, J., Porras J.I., 2002, Wizjonerskie Organizacje. Skuteczne praktyki najlepszych z najlepszych (Organisations with a vision. Effective practices of the best of the best.) MT Biznes, Warszawa.
7. Dobiegała-Korona, B., Doligalski, T. (ed.), 2010, Zarządzanie wartością Klienta. Pomiar i Strategie, (Customer Value Management. Measurement and Strategies.) Poltext, Warszawa.
8. Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity, OJ UE L 27 of 30.01.1997.
9. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources

¹ Collins J., Porras J.I., *Wizjonerskie Organizacje. Skuteczne praktyki najlepszych z najlepszych (Organisations with a vision. Effective practices of the best of the best.)*, MT Biznes, Warszawa, 2002. p. 193

and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ UE L 140 of 5.06.2009.

10. Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, OJ UE L 211 of 14.08.2009.

11. Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), OJ EU L 334 of 17.12.2010.

12. Jerzyk, E., Leszczyński, G., Mruk, H., 2004, *Kreatywność w biznesie (Creativity in business)*, Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań.

13. Kisiel, R., Marks-Bielska, R. (red.), 2013, *Polityka gospodarcza (wybrane zagadnienia) (Economic policy – selected issues)*, Uniwersytet Warmińsko-Mazurski w Olsztynie, Olsztyn.

14. Levitt, T., 1992, *Production Line Approach to Service*, „Harvard Business Review”, No VIII/IX.

15. Nagaj, R., 2011, *Asymetria informacji na rynkach podlegających regulacji (Lack of symmetry of information in regulated markets)*, *Zeszyty Naukowe Uniwersytetu Szczecińskiego No 650, Ekonomiczne Problemy Usług, No 67, vol. I*, Wydawnictwo uniwersytetu Szczecińskiego, Szczecin.

16. Nagaj, R., 2014, *Regulacja rynku energii elektrycznej w Polsce – ex ante czy ex post (Regulation of electrical energy market in Poland – ex ante or ex post)*, unpublished manuscript, Szczecin.

17. *Outsourcing World Summit 2015 about the future of the sector, 2015, Outsourcing & More, No 2, p. 14 and following.*

18. PAIiIZ, 2015, *10 lat sektora nowoczesnych usług biznesowych w Polsce (10 year of the modern business services sector in Poland)*, PAIiIZ, Warszawa.

19. Mazurkiewicz, J., Pająk, K. (red.), 2014, *Gospodarka niskoemisyjna. Uwarunkowania i wyzwania (Low emission economy. Background and challenges.)*, Wydawnictwo Adam Marszałek, Toruń.

20. Pająk K., Mazurkiewicz J., 2014, *Mechanizmy wspierania rozwoju energetyki odnawialnej (Mechanisms supporting renewable energy development)*, in: Barteczek, A., Rączaszek, A. (red.), *Polityka gospodarcza w okresie transformacji i kryzysu (Economic policy during the period of transformation and crisis)*, *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, Studia Ekonomiczne, No 166*, Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach, Katowice, pp. 249-260.

21. Quinn, B., Cooke, R., Kris, A., 2000, *Shared Services – Mining for Corporate Gold*, Pearson Education Limited, Harlow, Essex.

22. Rogoziński, K., 2011, *Nowy (?) paradygmat teorii usług (New (?) paradigm of the services theory)*, in: Grzelak, A., Pająk, K. (red.), *Nowe trendy w metodologii nauk ekonomicznych i możliwości ich wykorzystania w procesie*

kształcenia akademickiego (New trends in the methodology of economic sciences and the possibilities of their use in the course of academic training), volume 2, Problemy szczegółowe metodologii nauk ekonomicznych (Detailed methodological problems of economic sciences), Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, Poznań, pp. 303 and following.

23. Rynek pracy – Poznań, 2015, „Outsourcing α More”, No 3, pp. 40 and following.

24. URE, 2014, Sprawozdanie z działalności Prezesa URE w 2013 roku (Report on the activity of the President of the Energy Regulatory Office in 2013), URE, Warszawa.

25. Act of 29 June 2007 on the Rules of Meeting the Costs Arising at Producers in Connection with Early Termination of Long-term Capacity and Electrical Energy Sale Contracts, Journal of Laws No 130, item 905, as amended.

26. Act of 26 July 2013 on the Amendment to the Energy Law Act and Certain Other Acts, item 984.

27. Collins J., Porrás J.I., Wizjonerskie Organizacje. Skuteczne praktyki najlepszych z najlepszych (Organisations with a vision. Effective practices of the best of the best.) MT Biznes, Warszawa, 2002.

28. Quinn B., Cooke R., Kris A., Shared Services – Mining for Corporate Gold, Pearson Education Limited, Harlow, Essex, 2000

29. Zarządzanie wartością Klienta. Pomiar i Strategie. (Customer Value Management. Measurement and Strategies.), Ed. by: B. Dobiegała-Korona,, T. Doligalski, Poltext, Warszawa, 2010.

Wojciech Drożdż
Piotr Głowski
Marcin Pawlicki
Andrzej Midera

CAPACITY MECHANISM AS A POTENTIAL INSTRUMENT INCREASING ENERGY SECURITY OF THE EUROPEAN UNION

Introduction. The dynamically changing geopolitical situation necessitates intensifying measures aimed at guaranteeing stable foundations for the development of societies and national economies. One of the basic pillars on which social development and economic growth is based is constant and certain supply of energy sufficient to meet the consumption requirements of a given economic organism. This is why globally and locally efforts are made to increase energy security, using tools available in a given geo-political space, or attempts are made to create new instruments which may positively affect energy supply security.

The European Union as an economic organisation of 28 Member States also faces the challenge of increasing its energy security. This is a particularly difficult task since taking into account the entire Community it is not energy self-sufficient. Its relatively small natural energy resources coupled with high energy consumption mean that the united Europe is an importer of energy.

It should be observed here that security of deliveries of raw materials for energy generation to the countries of the European Union has been systematically deteriorating over recent years. This is due to the changing geo-political situation, and in particular: tense political and economic relations with Russia following its aggression in Ukraine; the emergence of the so-called Islamic State and new flashpoints in the Middle East; revolutions in the countries of Northern Africa, including the fall of Libya as a state; increased threat of terrorist attacks, including attacks against energy installations. All this makes it necessary to urgently systematise and co-ordinate measures based on market mechanisms in order to increase energy security of the European Union. Of course, one must take into consideration such factors as the shortage of energy raw materials and the obstacles to their acquisition, the possibilities of replacing the conventional energy sources with renewable sources, historic legal and organisational conditions existing in the Member States or technical capabilities of the system infrastructure.

Conditions of energy security. The term “energy security” is used universally and defined quite often, although creating its highly precise definition poses serious problems. This is due to the subjective assessment of the actual state of affairs on the basis of a number of prerequisites and circumstances.

In the EU documents the term “energy security” is often identified with the term “security of supply”. However, it seems that energy security is a wider and

more complex term. It is expedient to adopt a three-element structure of energy security comprising:

- guaranteeing the continuity of supply (classic element of the definition);
- ensuring a liberalised and competitive energy market (specific element of the definition);
- observance of environmental protection requirements (accessory element of the definition) [Przybojewska 2015].

From among the numerous definitions which to a greater or lesser degree incorporate the above components one can quote the following as an example:

1. Energy security is a state of the economy allowing meeting the current and prospective demand of customers for fuels and energy, in a technically and economically justified manner, while minimising the negative impact of the energy sector upon the environment and living conditions of society [Paska 2013].

2. Energy security of the state is the ability to satisfy the domestic demand for fuels and energy by way of supply originating from own production or imports, at a price resulting from the supply and demand equilibrium, while meeting the environmental protection requirements [Leszczyński 2013].

3. Energy security consists in supplying energy of sufficient quantity and quality at economically justified prices [Ney 2000].

It should be concluded that ensuring energy security requires taking measures aimed at creating a legal and economic system conducive to the reliability of supply, market competitiveness and fulfilment of environmental protection requirements [Motowidlak 2007]. An effective form of creating instruments used for attaining such goals may be the implementation of market mechanisms, also pertaining to capacity.

In their definitions of energy security Western European authors usually stress the following issues: permanent access to energy carriers, regularity of their supply, affordable prices of energy raw materials, limiting energy dependence through diversification of the supply of these raw materials, protection of power facilities against terrorist attacks, rational energy management and implementation of market mechanisms and new technologies [Bodio 2009].

Issues of electrical energy supply security in the European Union. Ensuring sufficiency of the generation resources in the power system is one of the key elements necessary for guaranteeing security of electrical energy supply to customers. This security, provided it is achieved at moderate costs to customers, makes it possible for domestic economies to develop and compete, and in a wider context, allows the European economy to grow and be competitive.

The basic means of ensuring sufficiency of the generation resources, strongly promoted by the European Commission, is a common single-commodity electrical energy market in the European Union. The combined national electrical energy markets are to ensure energy costs rationalisation for consumers and provide signals for investments in new production capacities or for decommissioning those which are surplus to requirement.

In accordance with the theory of a single commodity electrical energy market price signals should effectively adjust the number of generation resources necessary for ensuring long-term security of electrical energy supply to customers. In practice achieving sufficiency of generation resources only through price signals in a single commodity energy market is difficult [Majchrzak, Midera, Sikorski 2015]:

- Electrical energy prices in the wholesale market do not reflect the costs of maintaining capacity reserves in the system, i.e. generation capacities exceeding the demand among the customers required for ensuring security of electrical energy supply in the event of restricted operation of the generation resources due to incidents on the side of these resources or the power system.

- Electrical energy prices are not shaped in the market completely freely. The mechanisms of protecting customers against high energy prices applied in view of the risk of using structural or local market strength of producers result in energy prices being understated. The need to apply these mechanisms stems from the inability of the customers to resist the producers due to still low demand flexibility.

The costs of maintaining the required surplus capacity are not reflected in the prices of energy because at present the market prices reflect only the preferences of customers regarding energy value in the sense of its usefulness for the activity pursued by them. Energy prices do not include energy supply security aspects because security has the status of a “*guaranteed*” public good. If security of supply is ensured, then all customers take advantage of this security to the same extent and vice versa, if it is not ensured, it affects all customers, regardless of the price individual customers are willing to pay for this security [RTE 2014]. It should also be noted that without appropriate interventions the energy market does not ensure the acquisition of capacities necessary for guaranteeing security of energy supply and in particular is unable to determine the volume of the required capacity surplus needed for attaining the appropriate level of energy supply security. While implementing a reform of the energy market the United Kingdom defined the reliability of supply as the inability to meet the demand for a maximum of three hours per year, indicating that the reliability of supply is a public good, set administratively and should not depend on the capacity defined by a single commodity energy market [EC 2014].

The aforesaid factors mean that a single commodity energy market may temporarily experience the missing money problem (insufficiency of market revenues to maintain the required level of production capacities), which may result in the absence of investments in new production capacities and in the decommissioning of the existing production capacities, thus posing a threat to supply security.

The missing money problem mentioned above is exacerbated in Europe by the use of non-market mechanisms supporting the development of renewable energy sources or low-emission technologies. Dynamic development of wind and

photovoltaic sources with a support system and grid access priority pushes from the market conventional sources which are still needed for ensuring supply security. A shorter time of operation of conventional sources coupled with energy prices restrictions reduces the ability to cover the costs of functioning of these sources in a single commodity energy market.

In such situation the possible remedial actions aimed at guaranteeing security of supply in the energy market are:

- Implementation of effective methods of energy and capacity reserves valuation [Hogan 2013].

- Implementation of the capacity mechanism as a solution supplementing the single commodity electrical energy market.

Experiences regarding the functioning of a single commodity energy market and analyses of the implemented solutions indicate that the implementation of a correct single commodity energy market with energy prices and capacity reserves ensuring appropriate price signals for co-ordinating the number of generation resources is very complex. This complexity stems, among others, from competition distortions caused by a small number of market players, system constraints or off-market support systems for specific generation technologies. Moreover, basing the development of generation capacities on price signals from the energy market and capacity reserves creates a risk of highly unstable prices for customers due to periodic shortages and surpluses of capacity in the system. Unstable energy prices, with periods of very high rates, increase investment risk, thus hampering economic growth, and in addition are “politically” acceptable. According to ACER, in a single commodity energy market only sufficiently high energy prices, reflecting the value of energy shortages, may ensure the maintenance of the existing and the development of new generation capacities. The absence of political acceptance of these prices is the main reason for seeking alternative solutions and State intervention in the functioning of a single commodity energy market [ACER 2013].

The complexity of the implementation of a correct single commodity electrical energy market, stability of prices for customers, the need to attain the EU targets in the area of CO₂ emissions reduction and the development of renewable energy sources and the need to reserve non-controllable sources (wind, photovoltaic sources), have led to the recent lively debate regarding the implementation of capacity mechanisms in Europe in order to ensure supply security.

Classification of capacity mechanisms. The term “capacity mechanism” covers many types of detailed solutions. Generally speaking, under a capacity mechanism capacity is acquired in advance or subsidies to capacity are set, in order to ensure long-term supply security. The classification of capacity mechanisms is presented in Figure 1.

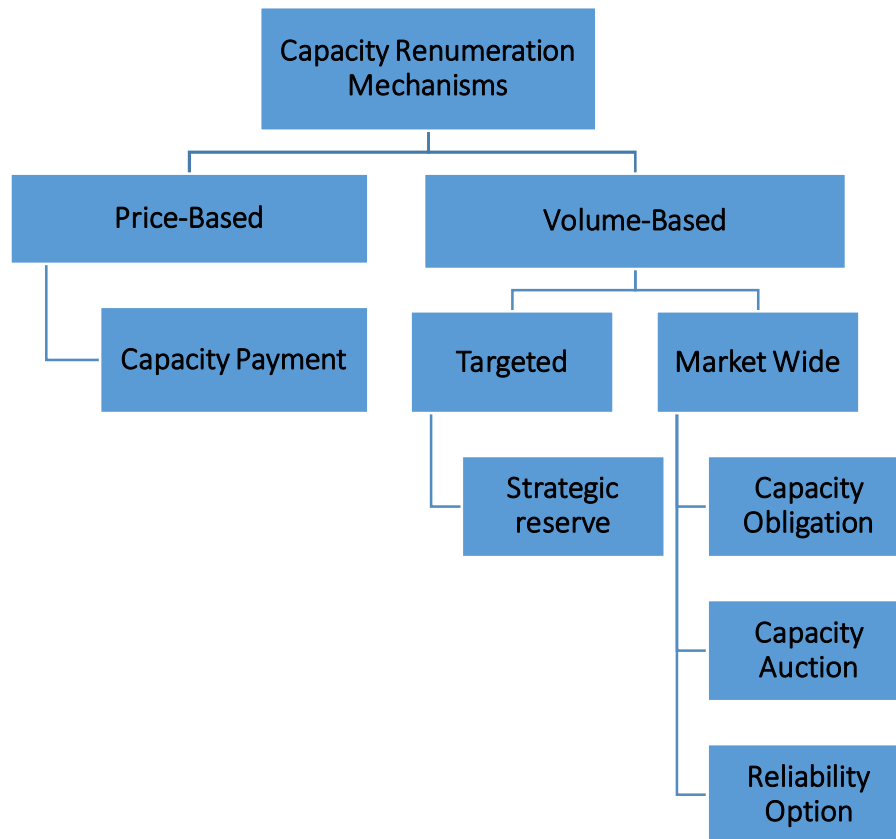


Figure 1 – Classification of capacity mechanisms [ACER 2013]

Source: elaborated by the authors

Capacity mechanisms are divided into mechanisms based on price and quantity, and in the case of the latter there is an additional discriminator based on their reach: (i) market-wide – all generation resources may participate in the mechanism and generation capacities chosen using the competition mechanism are subject to contracting, (ii) restricted – the mechanism is only dedicated to some generation resources, mostly new or older non-profitable sources necessary for ensuring energy supply security, excluded from participation in the energy market.

According to the classification presented in diagram 1 there are five types of capacity mechanisms:

Capacity payment is a mechanism based on price. The entity in charge of mechanism administration sets the price at which it buys capacity, and the volume is set by the capacity suppliers who are willing to deliver capacity for that price. This mechanism usually takes the form of capacity subsidy aimed at maintaining the available capacity in the system. Depending on the specific solution adopted, capacity payment may cover existing or only the new production capacities and the capacity price may differ depending on the production technology. The capacity payment mechanism is relatively simple to implement, but its functioning depends on the correctness of the capacity price set.

Strategic reserve belongs to a group of mechanisms based on volume, i.e. mechanisms where the object is contracting a specific volume of capacity and the price of this capacity is determined by the competition mechanism. Strategic reserve are generation resources excluded from participation in the energy market. They are kept ready for switching on exclusively under special circumstances, when meeting the demand of customers is impossible without these generation capacities or if they are needed for meeting the criteria of current safety of system operation, such as the permitted line load and the required level of operational capacity reserve. It is usually assumed that the period of use of the strategic reserve does not exceed several tens of hours per year. The strategic reserve usually comprises non-profitable sources: older with lower effectiveness and high CO₂ emission, as well as new sources of considerable flexibility but high production costs.

Capacity auction, capacity obligation and reliability options belong to a group of capacity mechanisms commonly called the **capacity market**. This market creates an additional source of meeting the fixed costs of the production resources. Generation capacities required for meeting the peak demand increased by the required surplus system capacity are acquired a few years in advance. The single commodity market (energy) is replaced with the two-commodity market (energy and capacity). The fixed costs of the generation resources are met in whole or in part in the capacity market, and the energy market is in practice reduced to competition based on variable costs.

Capacity auction is a **highly centralised market**, where one entity (usually the transmission system operator, TSO) contracts the required capacity in the system by way of a central auction. The capacity price is determined through an auction and the cost of capacity acquisition is met by the sellers of energy to the end customers, proportionately to their share in the capacity demand. The contracted capacity must be available during capacity supply, and a failure to perform the obligation is subject to a penalty specified in the capacity market rules.

Capacity obligation is a **highly decentralised market** where the obligation to acquire capacity is imposed on sellers of energy to the end customers. The magnitude of the capacity obligation is determined independently on the basis of future demand for capacity among customers represented by the seller. Thus determined capacity is increased administratively to ensure the required system capacity surplus over and above the demand reported by customers. The capacity obligation may be performed by own certified capacity sources or by acquiring capacity certificates from other entities. Just as in the centralised market, here too the contracted capacity must be available during capacity supply, and a failure to perform the obligation or contracting too little capacity is subject to a penalty specified in the capacity market rules.

Reliability options are an instrument very similar to the “*call*” options. A producer who sold a reliability option receives a fixed charge for issuing the

option and at the same time undertakes to pay the positive difference between the wholesale market price (usually the spot market price) and the performance price specified in the contract. Settlement of the reliability option introduces an incentive for the producer (issuer of the option) to remain available and to produce energy during hours when market prices are high. This mechanism may appear in the form of a centralised market, but usually adopts the decentralised form where the sellers of energy to the end customers are obligated to acquire the required number of options (proportionately to the demand registered by the customers represented by them). At the same time, by acquiring these options they protect themselves against high energy prices in the wholesale market. Thus, the reliability options guarantee customers the required generation resources and a reasonable price of energy.

Capacity mechanism and security of energy supply. An implemented capacity mechanism contributes to ensuring the required number of generation resources in the system, and consequently to improving security of energy supply to the end customers. However, the effectiveness of ensuring security of supply by individual capacity mechanisms is not identical and largely depends on detailed solutions.

Capacity payment is potentially the simplest to implement capacity mechanism, but at the same time it does not guarantee the achievement of generation resources sufficiency. Capacity payment reduces the problem of the missing money in a single commodity energy market, thus contributing to the maintenance and/or development of generation capacities, but its effectiveness depends on the correctness of the capacity price set. A capacity price that is too low may be insufficient to meet the costs of the peak units, while a price that is too high may lead to excessive remuneration of producers, excessive expansion of generation resources, resulting in excessive burdens placed on customers. The main disadvantage of this mechanism is the inability to clearly set and consequently enforce a goal in the form of ensuring the required number of generation resources in the system. According to ACER, in the case of capacity payment it is not completely clear what the customers are paying for and what they are receiving in return [ACER 2013]. In view of the complexity of setting the capacity price and the simplicity of implementation a price-based mechanism should be treated as an ad hoc solution rather than a long-term method of ensuring security of energy supply.

Strategic reserve and capacity markets, being capacity mechanisms based on volume, precisely define the quantity of energy to be acquired, thus clearly contributing to ensuring sufficiency of production capacities and security of energy supply.

Within the frame of **strategic reserve** non-profitable production capacities are acquired in a quantity necessary for ensuring the required capacity surplus in the system. The strategic reserve mechanism, with regard to the production capacities covered by the mechanism, resolves the problem of the missing money

in the single commodity energy market, ensuring payments necessary for maintaining peak capacities. However, this mechanism cannot extend to all capacities in the system. The volume of these capacities should be small, so as not to disrupt the functioning of the single commodity energy market. Strategic reserve activated during peak demand hours may effectively reduce energy prices and dampen investment signals. This is why it is important to correctly reflect the costs of strategic reserve in the prices of energy and capacity reserves. Achieving long-term security of energy supply requires ensuring correct energy and capacity reserves prices in order to resolve the missing money problem affecting generation capacities not covered by the strategic reserve mechanism. Otherwise, with the passage of time it may become necessary to contract increasingly large capacity volumes as strategic reserve, thus increasing the cost of this solution and undermining its sense.

The capacity market introduces remuneration for capacity for the generation resources taking part in ensuring energy supply security. The capacity price set under competition conditions reflects the additional cost of maintaining capacity in relation to the cost not covered by energy sales, thus effectively contributing to resolving the missing money problem in the single commodity energy market and ensuring security of supply. The capacity market is an instrument which by defining the required capacity volume in the system and clear price signals enables co-ordinating decisions regarding building new generation capacities and decommissioning specific generation resources. The investment cycle phenomenon, visible in the prices for end consumers, is limited because investment and decommissioning decisions are co-ordinated by the capacity market. The capacity market, both in the form of capacity auctions, capacity obligations and reliability options, ensures supply security, provided the market parameters regarding, among others, the required system capacity volume, have been correctly defined, and makes it possible to implement effective tools for enforcing supply of the capacity contracted in the capacity market.

As a rule, capacity mechanisms based on volume rather than price are more effective in terms of ensuring supply security. Among the volume-based mechanisms strategic reserve is potentially perceived as a simpler mechanism which additionally minimises disruptions in the functioning of the single European energy market [EC 2013]. However, this simplicity may turn out to be ostensible, since achieving energy supply security targets and resolving the missing money problem for the generation capacities remaining in the market (not covered by the reserve) introduces considerable complexity. The strategic reserve mechanism creates a less conducive investment climate compared with capacity market, because there still remain the standard investment risks typical of the single commodity energy market, such as uncertainty of future energy prices and the frequency of the occurrence of high prices. These are, after all, the preconditions on which decisions to build base-load or mid-merit plants are based. The capacity market protects customers from a shortage of capacity in the market

and the risk of no energy supply. It limits the investment cycle phenomenon ensuring more stable prices for customers, and contracting capacity in advance guarantees the required capacity surplus in the power system.

Summary. Capacity mechanisms undoubtedly contribute to improving electrical energy supply security. The use of diverse capacity mechanisms in the European Union may constitute a barrier hampering the unification of the European energy market. Work currently undertaken aimed at integrating national electrical energy markets are a priority for the European Commission (EC). Actions taken by the Member States designed to ensure supply security through capacity mechanisms are perceived by the EC as State intervention which may disrupt / delay the integration process in the European market understood as a single commodity energy market.

Under present social and economic conditions prevailing in the European Union, in particular, taking into account the targets adopted by the Union in the area of CO₂ emissions reduction and development of renewable energy, until the implementation at an industrial scale of energy warehouses, capacity mechanisms may be an effective instrument for ensuring energy security in the European Union, including stability of electrical energy prices necessary for economic development. The market aspect of the capacity mechanism will contribute to increasing the effectiveness of electrical energy use, which is particularly important in the context of improving certainty of deliveries of energy raw materials in the European Union, due to the deteriorating geo-political situation.

Therefore, one should support the development of capacity market mechanisms both domestic and regional, while considering the creation of solid foundations for a pan-European capacity mechanism in the future.

References

1. Agency for the Cooperation of Energy Regulators (ACER): Report on capacity remuneration mechanisms and the internal market for electricity, 30.07.2013.
2. Bodio M., *Polityka energetyczna w stosunkach między Unią Europejską a Federacją Rosyjską w latach 2000-2008 (Energy policy in the relations between the European Union and the Russian Federation in the years 2000-2008)*, Oficyna Wydawnicza ASPRA-JR, Warszawa 2009.
3. European Commission C(2013) 7243, *Delivering the internal electricity market and making the most of public intervention*, 05.11.2013 r.
4. European Commission, State aid SA.35980 (2014/N-2) – United Kingdom Electricity market reform – Capacity market, 23.07.2014.
5. Hogan William W., *Electricity Scarcity Pricing Through Operating Reserves*, 25.04.2013 r.
6. Leszczyński T., *Państwa bałkańskie i Turcja w polityce bezpieczeństwa energetycznego Unii Europejskiej 2001-2010, (The Balkan States and Turkey in*

the 2001-2010 energy security policy of the European Union) WSIZiA, Warszawa 2013.

7. Majchrzak H., Midera A., Sikorski T., Rynkowe mechanizmy zapewniania długoterminowego bezpieczeństwa dostaw energii, (Market mechanisms ensuring long-term energy supply security) Konferencja REE 2015, 11.05.2015.

8. Motowidlak T., Istota ciągłości dostaw energii elektrycznej w Unii Europejskiej, Polityka Energetyczna 2007, vol. 10, book 1.

9. Ney R., Perspektywy energetyczne Polski w świetle tendencji światowych, (Energy prospects of Poland in the light of global trends) Polityka Energetyczna 2000, vol. 3, book 1.

10. Paska J., Ekonomiczny wymiar bezpieczeństwa elektroenergetycznego i niezawodności zasilania, (Economic dimension of power and energy security and reliability of power supply) Rynek Energii No 2, 2013.

11. Przybojewska J., Próba definicji bezpieczeństwa energetycznego, (An attempt to define energy security) in: Bezpieczeństwo energetyczne. Rynek surowców i energii, (Energy Security. Raw Materials and Energy Market.) Editors: P. Kwiatkiewicz, R. Szczerbowski, Clean Energy Foundation, Poznań 2015.

12. Réseau de transport d'électricité (RTE), French Capacity Market Report accompanying the draft rules, 09.04.2014.

Viktor Kovalov
Sergii Burlutskiy
Svetlana Burlutska

THE “RESOURCES CURSE” PHENOMENON IN CONTEXT OF SOCIO-ECONOMIC TRANSFORMATION OF UKRAINIAN ECONOMY

Ukrainian natural resources have played an important role in strategy of socio-economic development. Ukraine has significantly strong natural resources potential, that is visibly reflected on the industrial agglomerates formation process: fuel and energy, metallurgical and chemical. At the same time, not only are the economic growth rates in this country unsatisfactory, but there are certain displays of regress and socio-economic system degradations as well. In this aspect we have returned to the question of whether there is any relationship between a Ukrainian endowment of natural resources and its rate of economic growth.

An actual for today conception of steady development assumes the obligatory taking into account natural capital when a deep estimation of the efficiency of the socio-economic system is being considered. The quantitative indexes that have been worked out within the framework of this conception allow estimating the degree to which natural resources contribute in the process of the national product creation. The economic system, in which added value is created mostly due to the labor and capital resources exploitation, carries an intensive character, as it mortgages possibilities for the further recreation and balanced development. The more considerable is the contribution of natural capital in the national income receipt process, the more economic activity carries an extensive character of growing consumption, abbreviating possibilities for future development. The unevenness of natural capital territorial allocation, its structure and degree of bringing in in reproductive processes directly influence the model of separate region and even the whole country social and economic development.

The results of the recent researches dedicated to the process of an effective socio-economic development model forming are rather contradictory. Thus, the World Bank research group under the direction of D. Lederman and J. Maloney (2007) has come to the conclusion, that a so-called phenomenon as "the resources curse" does not exist at all. Accordingly, the natural capital concentration has positive correlation with the rates of the economic growth. However, an outstanding research held by Professor J. Sachs illustrates a negative influence of the natural resources surplus on long-term tendencies on national economies development all over the world. In addition to that, several convincing proofs of the existence of "the resources curse" were studied in the work of P. Collier (2007) and points out that only countries with effective market institutes can avoid a resources surplus negative influence. An ineffective institutional structure of the

transforming economies, high level of public and private consumption, not significant or irrational investments and several trials to replace productive activity by easily achievable margins are all these sources of "the resources curse".

Within the considered problems framework, the interrelations between "natural resources - transforming economy - an economic growth" are the most interesting for a national researcher. The main goal of the article is a deep research of the "resources curse" phenomenon in the context of the world economic system development and determination of the features that reflect in the Ukrainian economy.

One of the most detailed natural capital descriptions is provided in the studies of R. Costanza and G. Daly (1992) where it is seen as a stream of natural services source and real natural resources. This term embraces both physical resources and environment. The main natural capital components are the following: depletable natural capital (non-renewable energy resources), recyclable or cyclically used natural capital (non-energy mineral resources), renewable or potentially renewable natural capital (soil and environment in general).

A natural capital (NC) being the factor of the economic growth finds the display only in totality with other types of capital. Within the limits of conception of national wealth, offered by the World Bank, a strong intercommunication is formed between three capital types: natural, produced and intangible capital. A produced capital (PC) includes a supply of machineries, equipment, raw materials and buildings that can be used for a further production. It is a natural capital which has been transformed by a human labor into physical assets that is able to continue generating goods and services. An intangible capital (IC) in practice is settled as the remains or, in other words, as a difference between the general national wealth volume and the sum of natural and produced capitals.

According to the World Bank recommendations, the (W_t) gross value at the moment of time (t) may be calculated in the following way (World Bank 2006: 144):

$$W_t = \int_t^{25} C(s)e^{-r(s-t)} ds \quad (1)$$

Where $C(s)$ — the gross level of consumption at the moment, R — a social investments' profitability rate, that represents the alternative costs that are charged to the society and which are constrained with abandonment from investing in a private sector in favor of the public one. The constituents of this index are: a net sentinel profits rate (p); a product of utility elasticity goes in accordance to the consumption level (μ) and the growth of consumption (Δc) rate. In the following calculations the 25-year period and the corresponding social rate of 1.5 percent are used (Pearce and Ulph 1999).

An intangible capital (IC) is the most ponderable constituent of national wealth regardless the level of the proceeds. Specific gravity of this index increases

simultaneously with the national wealth increase. An increase in the intangible capital absolute size and a respective fall in its specific gravity in countries with the income below the average is the display of «the middle income trap» effect (Canuto and Cavallary 2012). High rates of wealth increase in the lower middle income sector are conditioned by investment streams repressing aspiration in a produced capital. The cheap labor force presence and subzero production charges are allowed by an extensive way to support the GDP increase and a welfare promotion. However, the potential of such increase that is settled exceptionally in the real capital may deteriorate very quickly: the increase of salary and living standards does not allow the national producers to compete on export markets with countries that experience higher production subzero charges. A competition becomes impossible both with low-income countries and with the most developing economy. Overcoming this "trap" is stipulated only by an intangible capital. A future improvement in the human capital quality, institutional structures perfection and innovative alteration will form several additional factors of the economic growth and will definitely provide the increase in the intangible capital productivity.

The results of the conducted analysis do not allow to simply effect on positive or negative natural capital influence on the economic growth, coinciding with some international specialist's viewpoints. At the same time, there is a possibility to complement the conclusions set by Professor P. Collier (2007). In countries with the low level of incomes and a weak institutional structures a certain form of "resources curse" undoubtedly finds the display the insufficient level of the intangible capital provision and, consequently, in its insignificant cost estimation. The countries of this group are only theoretically, but not yet actually able to realize a potential that is located in the natural capital. In countries with the higher level of incomes the effect of "resources curse" is almost absent, and too high natural capital efficiency is mostly conditioned by the efficiency of the intangible capital. At the third group of countries (with incomes that are higher than average) the influence of resources on national welfare should be considered as neutral, that is conditioned by a repressing orientation on the innovative economics sector development. The national wealth structure mostly depends on the states starting positions in the moment of their transitional period formal beginning. For example, substantial socio-economic changes in Ukraine began only after the Soviet Union disintegration, and in the former countries of socialistic camp in Central and East Europe — have been formed within few years or even decades before the event, that defined their leadership in the process of market reforms realization.

Regarding this aspect, it would be quite interesting to compare Ukraine with the state of the Visegrad Four countries: the Czech Republic, Poland, Slovakia and Hungary. It is clear that these countries have far passed Ukraine on the way to the market transformation and to the process of assimilation to European socio-economic community. Also, a very high economic, sociocultural

and, in a certain understanding, paternalist influence of Russia on the choice of priority directions of the development of Ukraine deserves to be taken into account. During 2000-2005, it was possible to establish a considerable break between the levels of national wealth in Ukraine and in the Visegrad Four (table. 1). The natural capital volume in 2000 almost coincided with the level of the Czech Republic, Slovakia and Ukraine, 7440 USD, 7797 USD and 7235 USD per capita respectively. During a five-year period, the use of natural capital in reference countries decreased at about 34 – 36 percent, and in Ukraine — only at 4.7 percent. A substitution for the natural capital took place due to the increase in both produced and intangible capital - on the average in the Visegrad group at 12.4 percent and 33.7 percent. For the same period, the use of the produced capital in Ukraine fell down almost at 8 percent or 626 USD per capita. The national increase of the intangible capital laid down at almost 203 percent.

Table 1 - The National Wealth structure according to the types of capital (Visegrad group and Ukraine)*

Country	Wt, USD	Part, percent			
		IC	NFA	PC	NC
<i>Basic dataset</i>					
Czech Republic	152 942	70,35	-0,60	25,38	4,86
Hungary	134 456	74,31	-4,54	23,54	6,70
Poland	113 350	76,72	-1,95	15,74	9,49
Slovakia	112 471	68,51	-1,22	25,78	6,93
Ukraine	19 693	25,88	-2,62	40,00	36,74
<i>Current dataset</i>					
Czech Republic	180 820	74,83	-1,85	24,47	2,54
Hungary	173 007	81,67	-5,45	20,32	3,45
Poland	135 941	80,87	-2,51	15,10	6,54
Slovakia	142 373	77,45	-3,39	22,44	3,50
Ukraine	29 322	52,81	-1,06	24,73	23,53

* This dataset is no longer updated. Latest data is available as part of the Wealth Accounting Source: <http://data.worldbank.org/data-catalog/wealth-accounting>

On one hand, such results can be interpreted as the tendencies to overcoming "the middle income trap", passing to the intensive economic growth. But on the other hand, it is evident from the figures that in 2005 the GDP level per capita in Ukraine amounted to only 1828 USD, that is far fewer than the limits of origin of the primitive and the secondary "trap" (11.0 thousand USD and 15.0 thousand USD (Eichengreen et al. 2013: 4).

Second, the intangible capital increase is accompanied by the absolute fall in volume of natural and produced capitals. Thus, infrastructural and institutional changes in Ukraine, that found the reflection in the increase of non-material

capital during 2000-2005, are the certificate of the real capital "eating" away. The economic growth in Ukraine carries "artificial" character, and the authenticity of economic collapse rises in a long-term period (after the produced and natural capitals resources exhaustion).

If the recyclable natural capital (minerals) use does not provide forming the other types of wealth and spend only for consumption, then we will have its complete exhaustion without any alternative assets that would be able to generate income. The inefficient administrative mode and ineffective specification of ownership rights can stipulate the recyclable part of natural capital exhaustion.

In obedience to international classification, Ukraine is attributed to the countries with the lower middle income level. The domestic structure of national wealth is very near to the world average indexes of a corresponding group. However, the pattern of the use of capital has substantial differences. The elasticity in national wealth increase according to the level of natural capital is 10.52 units (every additional percent of wealth abbreviates natural capital on 10.52 percent). A corresponding index is calculated for the volume of produced capital – 6.14 percent. And all this is accompanied by the national wealth increase on 48.89 percent. Such nonsense may be explained by two main factors. First, the national wealth logic settlement as totalities of the discounted consumer charges, but not of the real material and non-material assets cost estimation could be a reason. Thus, a growing Ukrainian intangible capital is a synthetic and conditional index. Second, the exhaustion and capital assets recreation in Ukrainian national economy are the sources of such "increase" as well. Expansion of current consumption exists due to the conscious leading out of money from an investment sphere. Correlation between the degree of assets depreciation and the GDP level in Ukraine could serve as a bright illustration of this process.

In a period from 2001 to 2013 assets depreciation degree in national economy grew from 4 percent to 77 percent. At the same time, GDP in settling per capita increased from 796 USD to 3862 USD. However, already in 2013 the falling of GDP (according to the official sources) amount to 0.13 percent. The process of produced and natural capital "eating" has a certain limit and the Ukrainian economy attained it. Thus, the use of the economic growth formed model in the future is not only inefficient, but it is simply not possible.

One might argue that within the Ukrainian economy it's observed a good example of irrational and wasteful natural resources use. We have found the relationship between a country's rate of economic growth and the relative abundance of its natural resources depends on each country's national wealth structure. This thesis considered several explanations for the perceived poor performance of resource-intensive Ukrainian economy. We find evidence of a possible negative impact of natural resource abundance on long-term growth (Burlutski, 2015).

In the terms of "the resource curse phenomenon" the development of rent-seeking economic behaviour becomes possible: the economy is operating only in the interests of particular elite, and public interests are secondary importance.

Traditional political economy understanding the definition of rent due with full reimbursement from the gross income of current costs and the distribution results to normal profits and rents (the surplus of the owner's a production factor). Formal entry of this definition (Smith interpretation) has the form:

$$R = S - (W+M+A+i \times K), \quad (2)$$

where R - the gross rent; S – gross national product in cash equivalent (value); W – cost of labour; M – material and equivalent costs; K – produced capital; A – capital consumption; i – the average rate of return.

Rational public policy should be aimed at increasing the national product volume and increasing its quality. In our case this is illustrated, at first, by growth element (S), and as a consequence increasing government revenue and increasing social welfare. At second, if the resources owner (mostly natural) is the government, the formation and withdrawal of rent will promote an economic growth. Everything is changing for the existence of the situation where the rent is not given by the government, but individual economic agent. If the marginal cost of increasing the product (S) exceeds the marginal costs of rent retention, the cost-normal orientation of entrepreneurs to maximize (S) will be replaced by priority maximize (R), and hence will be the rent-seeking behaviour basis. The greatest risks of occurrence of such situation are inherent to the transformational type economies, including Ukraine.

The elements of capital and capital consumption significantly correlated with each other (equation 2). The amount of capital consumption (A) depends on the existing depreciation policy and the sum involved fixed capital (K). Therefore the capital reduction leads to the depreciation decrease and further leads to greater loss of fixed assets. The result of the loss and the capital depreciation (physical and moral) will be a loss of product competitiveness. But, if we accept a priori the minimum product quality that can be maintained without significant investments, and the use period of fixed assets is significant, we will formulate **Hypothesis 1**: *the source of rents in the short run is not complete recovery of fixed capital*.

The rent formation is possible as a result of recovery absent of fixed capital. Consequently, gross fixed capital formation in Ukraine will be significantly different from the reference Visegrad four. For the analyzed period this indicator had a tendency to increase in all countries of the analyzed sample (Fig. 1)

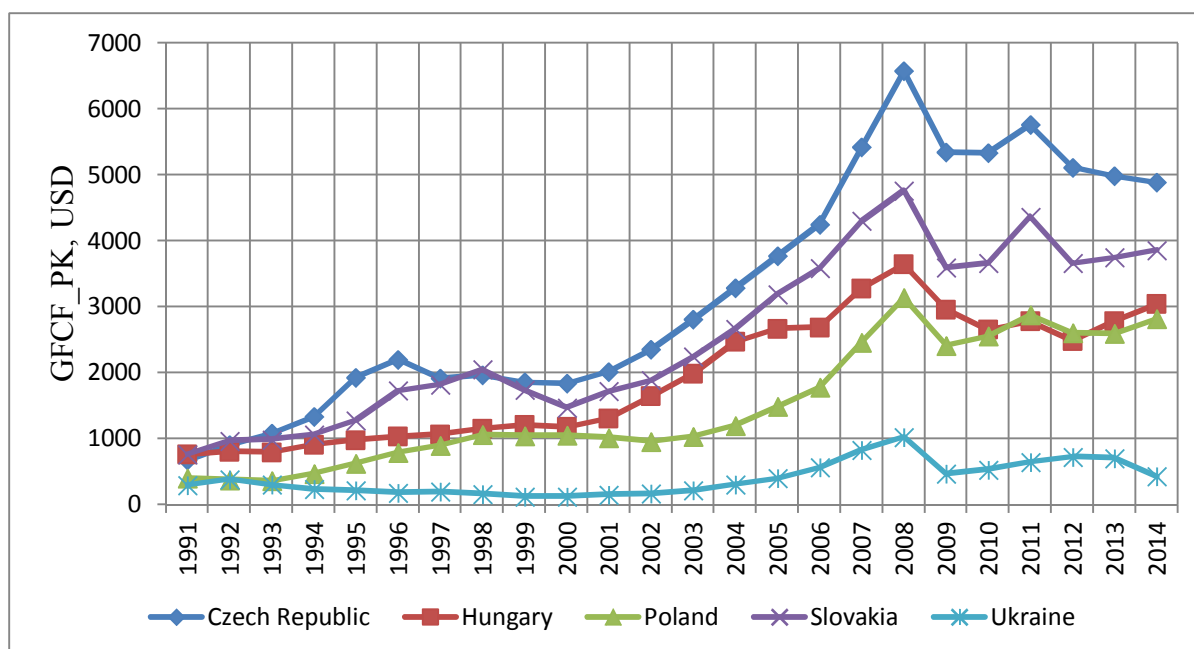


Figure 1 – Gross fixed capital formation

Source: composed by the authors according to Word Bank data

But the backlog of Ukraine from other countries every year increased and reached a maximum value in the pre-crisis 2008. Minimum rate of growth of gross fixed capital formation in 353 % was observed in Hungary and a maximum in Poland – 728 %. It should be noted that in 1992 the rate of accumulation in Poland and Ukraine is almost identical and accounted 384,8 and 379,1 USD respectively. But in 2014, the ratio was 431,5 and 2816,1 USD. Identified rate of growth almost equal to the rate of GDP growth in respective countries.

As a result of the regression analysis of the dependence GDP (GDP_PC) of the degree of produced capital accumulation (GFCF_PC) obtained according to (3), (4):

$$\text{GDP_PK}_{\text{POL}} = 4,6767 \text{GFCF_PC} + 355,22; \quad (3)$$

$$\text{GDP_PK}_{\text{UKR}} = 4,1609 \text{GFCF_PC} + 165,8. \quad (4)$$

The regression coefficients indicate the relative growth of the gross domestic product at 4,6767 USD and at 4,1609 USD as a result of additional investments in fixed capital of 1,0 USD.

The elasticity of GDP by capacity investments is almost the same in Poland and Ukraine, and consequently, ceteris paribus, the efficient capital's use is also equivalent. At the beginning of the period the GDP of Poland and Ukraine are almost matched, in 2012 differed in 3.28 times. Therefore, there are other factors that contribute to this difference.

The institutional forms of the market type, developing under the influence of the international economic integration process and globalization induce the instability of the transformational economies. In terms of imbalances in the

international distribution of production factors it is the combination of internal economic, institutional instability and the possibility to integrate into the world market system may create an adverse impact on economic growth. Foreign trade in transition economies can be designed to obtain international economic rent.

It is advisable to distinguish two main channels of export influence on the country GDP. Firstly, the export is a direct calculation element of GDP. Secondly, the income export component stimulates domestic demand. Significant revenues from exports, potentially aimed at renewal of production and innovation development, is the economic growth source. And therefore these revenues can be cause of found differences in equations (3) and (4).

Hypothesis 2. *The amalgamation of capital into financial-industrial group provides the rent getting in high cost of debt capital.*

The high credit risks such as change in national currency exchange rate, political instability, nationalization, etc. inherent to the transformational economies. But the threat level of the real existence of such risks is not very significant, but interest rates are on the verge of maximum acceptable level. The analysis results of the relation between changes in interest rates on loans in foreign currency (EUR) granted to legal entities for a one year period in Poland and Ukraine indicate a nearly fourfold excess of the cost of debt capital for Ukrainian business. In 2011, the average rate on credits in Poland was 3.6 percent, and in Ukraine - 15 percent. The interest rate has reached 23 percent for credits in UAH to legal entities.

Rental income arises as a result of evasion of income tax. Hence the use of offshore financing schemes (direct investments in shareholders' equity, loans) allows you to get a similar result.

Hypothesis 3. *The condition for the economic rent's genesis is a lack of national recaptured and the lack of extended human capital reproduction.*

The analysis results of the labour productivity (per capita ratio of gross domestic product to employed person) indicate trends similar capital accumulation conditions. In 1990 the labour productivity in Hungary, Poland and Ukraine overlapped (from 12088 USD to 12576 USD), but in 2011 the Ukrainian economy backlog amounted to more than 200 percent. Over the last decade the rate of the labour productivity growth in Ukraine amounted to 144 percent. Average level of remuneration for 2001-2011 it reached to almost 560 percent (from 708,15 USD to 3972,16 USD per year).

Hypothesis 4. *The condition of getting of the economic rent absolute form is relatively low the capital's organic structure (the hypotheses 1,3 consequence).*

In the first approach selling price of the product "SP" is a cost reflection of capital (variable "v" and constant "c") that generates a cost and profit on this capital "p" (margin on cost):

$$SP = c + v + p = c + v + (c + v)p'; \quad SP = (c + v)\left(1 + \frac{m'}{1 + (c/v)}\right). \quad (5)$$

Rate of return "p'" is directly proportional to the rate of surplus value "m'" and opposite to the rate of capital organic composition "c/v". Hence the trend to reduce the organic structure will determine the increase in profit margins and absolute profits. The differences in the capital's organic structure can be significant both in industry and within national economies. This is a consequence of variation in the real economy from the conditions of perfect economy. The more the economic structure is approaching a monopoly or oligopoly type (and this is inherent in the Ukrainian economy), the more possibilities of obtaining absolute rent.

Thus, the hypothesis about the ability and opportunities of subjects of the Ukrainian economy to charge an economic rent received appropriate empirical evidence. The analysis results of the of parameters of the national economy functioning indicate that the presence of significant resource potential creates the opportunity to obtain rental income, and rent-seeking behaviour, in turn, slows down economic growth. The Ukrainian phenomenon of "resource curse" reflected in general economic stagnation and the resource potential loss. The overcoming of institutional traps rent-seeking behaviour is only possible through a radical change in the investment and financial policy, produced and human capital recovery.

References

1. Burlutski, S., Burlutski, SV. (2015). The "resources curse" and special features of the economic growth in Ukraine. *Journal of Life Economics*. Istanbul.
2. Burlutski, S., Burlutski, SV. (2016). The Socio-economic Development of Ukrainian Economy: "Resources Curse" Phenomenon. Formation Strategy of Economic Structures: the Tools and Practices. Riga: "Landmark" SIA., pp. 25-35.
3. Canuto, O., Cavallari, M. (2012). *Natural Capital and the Resource Curse*. World Bank, Washington, DC.
4. Collier, P., Goderis, B. (2007). *Commodity Prices, Growth and the Natural Resources Curse: Reconciling a Conundrum*. Working Paper 276, Centre for the Study of African Economies, Oxford.
5. Costanza, R., Daly H. E. (1992). *Natural Capital and Sustainable Development Conservation Biology*, Vol. 6, No. 1., pp. 37-46.
6. Eichengreen, B., Park D., Shin K. (2013). *Growth Slowdowns Redux: New Evidence on the Middle-Income Trap* NBER Working Paper No. 18673.
7. Lederman, D., Maloney, W. F. (2007). *Natural Resources: Neither Curse nor Destiny*. Washington, DC: World Bank; and Stanford, CA: Stanford University Press.
8. Pearce, D. W., Ulph D. (1999). *A Social Discount Rate for the United Kingdom*, In *Environmental Economics: Essays in Ecological Economics and Sustainable Development*.
9. World Bank. (2006). *Where is the Wealth of Nations? Measuring Capital for the 21st Century*. Washington.

About authors

Amosha Oleksandr, Dr. Sc. (Economics), Professor, Academician of the National Academy of Sciences of Ukraine, Director, Institute of the Industrial Economics of the National Academy of Sciences of Ukraine (Kyiv, Ukraine)

Burlutskiy Sergii, Dr. Sc. (Economics), Professor, Chief of Chair of Enterprise Economy, Donbass State Engineering Academy (Kramatorsk, Ukraine)

Burlutska Svetlana, PhD (Economics), Associate Professor, Department of Accounting and Audit, Donbass State Engineering Academy (Kramatorsk, Ukraine)

Cherevatskyi Danilo, PhD, Institute of the Industrial Economics of the National Academy of Sciences of Ukraine (Kyiv, Ukraine)

Dalevska Nataliya, PhD (Economics), Associate Professor, Donetsk National Technical University, (Pokrovsk, Ukraine)

Drożdż Wojciech, Dr. Sc. (Economics), Professor, University of Szczecin (Szczecin, Poland), Vice President of ENEA Operator LLC (Poznań, Poland)

Głowski Piotr, PhD (Economics), Mayor of Piła (Piła, Poland)

Havrysh Valerii, Dr. Sc. (Economics), Professor, Mykolayiv National Agrarian University, Engineering and Energy Department, head of Chair of Tractors and Farm Machines, Maintenance and Technical Services (Mykolayiv, Ukraine)

Ivanov Sergii, Dr. Sc. (Economics), Professor, Academician of Academy of Economic Sciences of Ukraine, Scientific Director, International Research Center Socio-Economic Problems of Socio-Economic Problems in Modernization and Cooperation Development (Poltava, Ukraine)

Kamińska Bożena, Vice Chairman of the Board of Polish-Ukrainian Parliamentary Group, Member of Parliament of the Republic of Poland (Warsaw, Poland)

Khmelyarchuk Mariya, Dr. Sc. (Economics), Professor, Head of Chair of Economic Theory, Lviv Institute of HSEI “Banking University” (Lviv, Ukraine)

Kinelski Grzegorz, PhD (Economics), Poznań University of Economics and Business (Poznań, Poland)

Kovalov Viktor, Dr. Sc. (Engineering), Professor, Rector, Donbass State Engineering Academy (Kramatorsk, Ukraine)

Kravchenko Sergey, PhD (Economics), Associate Professor, Professor at the Department of Business Economics, Donetsk National Technical University (Pokrovsk, Ukraine), Vice President of the Institute for International Cooperation Development (Poznań, Poland)

Kvilinskyi Oleksii, PhD (Economics), President, Institute for International Cooperation Development (Poznań, Poland), Associate Professor, Poznań University of Economics and Business (Poznań, Poland), Corresponding Member of Academy of Economic Sciences of Ukraine (Kyiv, Ukraine), Expert of the Parliamentary Team for Eastern Poland (Warsaw, Poland)

Lazarenko Dmitry, Dr. Sc. (Economics), Professor, Academician of Academy of Economic Sciences of Ukraine, Dean of the Faculty of Psychology, Economics and Management, SHEI “Donbas State Pedagogical University” (Slavyansk, Ukraine)

Liashenko Viacheslav, Dr. Sc. (Economics), Professor, Academician of the Academy of Economic Sciences of Ukraine, Scientific Secretary, International Researching Center of Socio-Economic Problems in Modernization and Cooperation Development (Poltava, Ukraine), Institute of the Industrial Economics of the National Academy of Sciences of Ukraine (Kyiv, Ukraine)

Melnychenko Oleksandr, Dr. Sc. (Economics), Professor of Banking University (Kyiv, Ukraine), Chairman of the Board, CONSILIUM LLC (Warsaw, Poland)

Midera Andrzej, PhD (Economics), University of Szczecin (Szczecin, Poland)

Pawlicki Marcin, PhD (Economics), University of Szczecin, Vice President of Szczecin (Szczecin, Poland)

Perebyynis Vasyl, Dr. Sc. (Economics), Professor, Poltava University of Economics and Trade, Institute of Economics, Management and Information Technologies, Head of Chair of Business Administration and Management of Foreign Economic Activity (Poltava, Ukraine)

Perebyynis Yuliya, Poltava Law Institute of Yaroslav the Wise National Law University, lecturer of Chair of Humanities and Social Economic Subjects (Poltava, Ukraine)

Pivnyak Gennadiy, Dr. Sc. (Economics), Professor, Academician of the National Academy of Sciences of Ukraine, Rector, National Mining University (Dnipro, Ukraine)

Popova Olga, Dr. Sc. (Economics), Professor, Head, Department of International Economy and Marketing, Donetsk National Technical University (Pokrovsk, Ukraine)

Popova Svitlana, Student of the Chair in Enterprises Economics, National University of Water Management and Environmental Engineering (Rivne, Ukraine)

Tomashevskaya Olena, PhD (Economics), Docent, Department of Economic Theory, State Governance and Administration, Donetsk National Technical University (Pokrovsk, Ukraine)

Shmygol Nadiia, Dr. Sc. (Economics), Professor, Academician of Academy of Economic Sciences of Ukraine, Head, Department of Accounting and Taxation, Zaporizhzhya National University (Zaporizhzhya, Ukraine)

Shvets Vasyl, Dr. Sc. (Economics), Professor, Honored Economist of Ukraine, Academician of Academy of Economic Sciences of Ukraine, Director, Institute of Economics of National Mining University (Dnipro, Ukraine)

Yakubovskiy Mykola, Dr. Sc. (Economics), Professor, Academician of the Academy of Economic Sciences of Ukraine, Institute of the Industrial Economics of the National Academy of Sciences of Ukraine (Kyiv, Ukraine)