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**INNOVATION PROCESS MANAGEMENT IN UKRAINE:
PROBLEMS IN COMMERCIALIZATION OF SCIENTIFIC AND
TECHNICAL DEVELOPMENTS**

MONOGRAPH

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Y 677 **Innovation Process Management in Ukraine: problems in commercialization of scientific and technical developments** : Monograph / Yurii Vovk, Oleh Karyy, Ihor Kulyniak, Yosyf Petrovych, and other / Edited by Yurii Vovk, Oleh Karyy. – Lviv : LLC «Rastr-7», 2018. – 266 p.

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The monograph uses the results of research work of the Department of Management of Organizations of Lviv Polytechnic National University – «Evaluation mechanism and efficiency improvement of innovation processes» (State Registration Number 0117U004469).

The monograph is intended for scientists, graduate students, entrepreneurs, managers, economists and all those who are interested in the problems in commercialization of scientific and technical developments of innovation process management in Ukraine.

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*The materials of the collective monograph are given in the author's wording.
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INTRODUCTION

The complex political and socio-economic situation in which Ukraine is today faces new challenges and challenges for the scientific community. The difficult factors, which are dictated by both political and international relations, make scholars, economists, scientists and specialists of various spheres of activity search for new landmarks and methods for the development of the innovation process in Ukraine. The orientation of the political course leads to changes in macroeconomic and microeconomic processes. It is now important to build the level of comprehensive cooperation among all participants in the innovation process, which will bring the country to a new European level.

Despite the large number of studies devoted to innovation process management in Ukraine, there is still a significant range of problems that require a thorough coverage of scientific works and will contribute to the development of the domestic economy at all levels of government and will help to increase the competitiveness of both the state and individual enterprises on world market. That is precisely what caused the relevance of the preparation of this collective monograph.

The monograph is devoted to problems of innovation process management in Ukraine. It presents scientific results and researches of scientists in the context of several areas of research: “Formation of effective company management system in the conditions of innovative development”, “Innovative principles for sustainable development in the global economic system”, “Regulation of branches of economy in the conditions of innovative changes”, “Modern approaches of increasing the innovation activity of enterprises”, “Problems in commercialization of intellectual property, scientific, and technical developments”.

In the first chapter of the monograph the actual state of the market based on monitoring of the state and change dynamics in supply and distribution networks is identified. The behaviour of partners and competitors as realistic as possible is predicted. Also it is maintained the dynamic balance of company development through capacity building in the most promising or critical directions of its activities.

Authors consider the features of a personality's behavior and analyze the factors of manifestation of a personality. The following main components of the personality state are specified, such as: the subject that makes the choice, the environment of the choice, the available ways of action and possible results. The functions of a personality are studied from the position of identifying such aspects as the function of habit, the function of knowledge, the function of simplification.

The first chapter deals with such groups of values as traditional / innovative, tangible / intangible, and the results indicate a strong link between innovative and

intangible values and the effectiveness of organizational interactions. The influence of values is also investigated by economic theory.

In the second chapter of the monograph the author describes the theoretic-methodological bases of the development of the regions within the global economic system. Other authors substantiate the concept of modern problems of ecologically safe use of transport lands and determine the main mechanisms of implementation and development of the ecologization system.

In this chapter it is analyzed the innovative potential of the development of global industrial infrastructure in the twentieth century and given the conclusions and proposals on the use of the potential of the innovative economy.

It is substantiated that under the current conditions of globalization and rising prices on fuel and energy resources, local authorities became essential stakeholders for the effective implementation of policy measures in energy sector. Improving the level of municipal energy efficiency within using project-oriented paradigm is one of the most powerful methods to increase the level of energy safety and effect on climate change conditions. It requires from local authorities the usage of innovative approaches to efficient policy implementation, focused on sustainable energy development, through actionable transformation of urban economic complex. The research considers forward-looking ways to activate the municipal potential of energy saving, based on the project-oriented management.

German Energiewende is arguably the very important historical phenomena in the current development of the energy industry. In times when the scientific consensus about climate change issues has been widely accepted amongst the World's leaders, as well as by the general public in individual national states, the Germans are spearheading the World's efforts to replace fossil fuels with renewable energy sources (RES) as a means of covering energy needs.

In the third chapter the authors focused on combining the concepts of "enterprise competitiveness" and "innovation strategy", on researching the system of internal and external criteria and indicators which provide an opportunity to comprehensively assess the competitiveness of trade enterprises (in particular retailers), and to make an informed choice of their strategic moves and managerial decisions. The authors were able to take a fresh look at the options for increasing the competitiveness of retailers through the algorithm for making strategic decisions to improve their competitive market position.

Scientific researches require annual large-scale financing and large-scale state support since the scientific level and quality of innovations depend on it. It is extremely important in the conditions of spreading on the Ukrainian market of scientific and technical products of competitive foreign firms, technologies and technologies that exceed technical and economic parameters of domestic analogues. Innovative activities in the field of agriculture should be aimed at the creating and the attracting from the external environment such innovations that

would promote competitiveness, strengthen market positions and provide a development perspective.

In the fourth chapter of the monograph the main aspects of increasing the innovation activity in industrial enterprises on the basis of their modernization in strict conditions of competition are given. The continuation of this topic is a study of the quantitative patterns of fixed assets renewal and a statistical assessment of the enterprise's development innovation.

Partnership development between IT enterprises and higher educational institutions in the conditions of innovative changes is described.

The fourth chapter of the monograph considers the theoretical and methodological foundations of the system organization of the functioning of logistics systems based on modern technologies. As the volume of outsourcing has increased, interestingly, the supply chain networks weaving the original manufacturers and the contractors are becoming increasingly complex. Firms may no longer outsource exclusively to specific contractors, and there may be contractors engaging with multiple firms, who are actually competitors. However, parallel to the dynamism of and growth in outsourcing, issues of quality have gradually emerged.

The last fifth chapter of the monograph is devoted to study the experience of managing the processes of intellectual property commercialization at Oxford University and to develop recommendations for improving the management of intellectual property commercialization for domestic universities.

The analysis of the indicators of innovative activities of enterprises of Ukraine and Lviv oblast during 2007-2017 is carried out in the fifth chapter of the monograph. To ensure and avoid mistakes in the monitoring of innovative processes, the authors propose to improve the methodical approach to evaluation of scientific and scientific and technical effects.

The monograph uses the results of research work performed by the authors of the Department of Management of Organizations of Lviv Polytechnic National University ("Evaluation mechanism and efficiency improvement of innovation processes ", State Registration Number 0117U004469).

The scientific publication will be useful for scholars, graduate students, entrepreneurs, managers, economists and all those who are interested in problems of innovation process management in Ukraine and the prospects for their solution.

CHAPTER 1

FORMATION OF EFFECTIVE COMPANY MANAGEMENT SYSTEM IN THE CONDITIONS OF INNOVATIVE DEVELOPMENT

1.1. Transformation of company management systems in the context of the formation of an information society

A hallmark of modern business is the fast response to the dynamic changes in all types of markets (the market of means of production, the financial market, the consumption market, etc.). Under such conditions, organizations have to dynamically upgrade their own management system to respond quickly to current or anticipated market changes. Therefore, the set of major tasks of company management system extends with such tasks as:

- to identify the actual state of the market based on monitoring of the state and change dynamics in supply and distribution networks;
- to predict the behaviour of partners and competitors as realistic as possible;
- to maintain the dynamic balance of company development through capacity building in the most promising or critical directions of its activities.

Globalization of the world economy has led to mass replication of advanced informational and communicational technologies (ICTs) into management systems of companies to ensure fast response to changes in the external environment. New ICTs have formed the foundation for significant transformations of modern company management system and continue to contribute to active development of new concepts of management that are massively spread virally. In such a way elements of new outlook in the management are formed, that become the sources of changes in organization of business-processes.

To manage these processes effectively, new concepts of social development are being developed in the field of information management. The most famous representatives of the scientific community who worked in this field of knowledge are: T. Andrianov [7], D. Bell [8], Z. Brzezinski [9], N. Winer [10], W. Glushkov [12], P. Druker [13], K. Arrow [19], N. Luman, R. Katz [32], M. Kastels [17], T. Kuhn [35], M. Maklue, Y. Masuda [36], M. Poniatovski, P. Cervan-Shrieber, J. Stigler, T. Stoner [22], O. Toffler [24, 25], A. Turen [26], M. Haidegger [27], and other. To manage effectively these processes new concepts of social development are being suggested in the field of information management. It is worth highlighting a weighty contribution into theoretical and methodological developments in the field of informatization of famous Ukrainian scientist V. M. Hlushkov [12]. All mentioned scientists acknowledged the inevitability of profound innovative changes in the field of enterprise management system. Summing up their achievements in the field of socio-economic development of the

society such terms as "information economy", "network economy", "knowledge economy", and "Internet-economy" should be presented.

Mass application of the term "information economy" is associated with the development of the information society, which started with advanced development of high-tech industries closely related to informational technologies (IT). In particular, such terms as "information economy", "knowledge economy", "network economy" and other became commonly used. The concept "information economy" was first used by M. Porat, the employee of the Stanford Interdisciplinary Centre, in his works [38] in 1976 regarding the growth of a cluster of high-tech information industries.

On the basis of the theory of sets essential relationships between basic terms reflecting economic component of the information society could be presented by the following system of dependencies (1)-(5):

$$P_{\text{New Economics}} \supset [P_{\text{Information Economics}} \cup P_{\text{Network Economics}} \cup P_{\text{Knowledge Economics}}] \quad (1)$$

$$P_{\text{Network Economics}} \cap P_{\text{Information Economics}} = \emptyset; \quad (2)$$

$$P_{\text{Information Economics}} \cap P_{\text{Knowledge Economics}} = \emptyset; \quad (3)$$

$$P_{\text{Network Economics}} \cap P_{\text{Knowledge Economics}} = \emptyset; \quad (4)$$

$$P_{\text{Internet Economics}} \subset P_{\text{Network Economics}} \quad (5)$$

where P_* - space of the concept of "*" Economics " \cup ", " \cap ", " \supset " – operations of combining, intersection and inclusion; " \emptyset " – empty set.

As we can see, the terms (1-5) are not identical. They reflect separate aspects of the development of the information society in general and its economic component in particular. On the content the term "new economy" is the broadest, and "Internet-economy" is the narrowest, it is a part of the "network economy". The transition from industrial to post-industrial and then to information society is seen as the main transformation of the 20th century. The process of formation of the information society effectively changes the structure of the world economy. Therefore, the broadest on the content is the term "new economy" that is formed by systematically organized special and temporal structure of relationship between economic agents [28].

The term "information economy" focuses attention on the issues of applying the information, whereas "knowledge economy" reflects the growing importance of artificial intelligence, and "network economy" explores the field of information communications, which became the basis of modern economy. In general these terms have a broad common basis and differ in the targeted use of ICT from the perspective of economic application. The concept of knowledge economy is developed on the basis of scientific thesis about the transition of the economy in the developed world to intensive use of knowledge and intensification of the

creative component. Knowledge economy as a fundamentally new structure gradually replaces the economy of consumption and exhausting exploitation of natural resources, most of which are non-renewable. While the 20th century was the era of industries based on use of natural resources and development of powerful technologies, in the 21st century artificial intelligent industries, the formation base of which are intellectual assets, will dominate. In context where the knowledge economy deploys the main factors of the development of companies will be the presence of an idea, a project and a programme. The knowledge economy contributes to transition from a model of non-renewable use of natural resources to sustainable development based on targeted economic and industrial cooperation as well as scientific and technical ones. It can be stated that this coursed significant changes of modernization of company management systems.

Competition between enterprises is transferred to the level of use of new knowledge. Such development of enterprises stimulates materialization of the knowledge economy ideas.

It is appropriate to emphasize that the most significant changes will influence the management system of companies. Consider the influence of ICT on the development of a global entrepreneurial space.

A fundamental role in the network economy is played by the means of cellular communication. The combination of mass distribution of personalized computer tools and providing access to the global information network first of all has ensured continuous connection to the global information space. Since the end of the 20th century a mass global involvement of cellular subscribers has occurred. Consider that in the late 20th century in the world approximately one thousand users connected to the network each second [34]. According to estimates of experts, at the end of 2016 there were 7.4 billion connections per 5 billion people. The evidence of the network economy development has become the trend of growth in the number of the Internet users, which is shown in Figure 1.

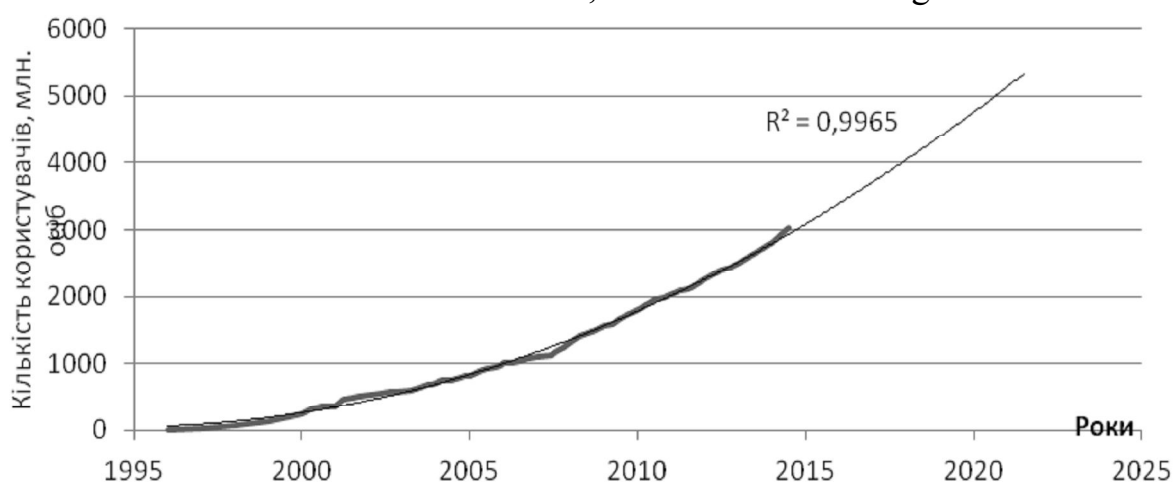


Figure 1. Growth of number of Internet users

Source: calculated by the data from [30]

While in 2000 a little bit more than 6 % of the world population has an access to the Internet, in 2015 this value exceeded 43 % (according to the UN). In many countries the number of cellular subscribers exceeds the total population. This is largely due to the presence of inactive connections, using of several SIM-cards or optimization for different types of devices. As Figure 1 shows in 2015 the number of Internet users was 3 billion people. It should be noted that by 2025 almost all of the world population will have access to the global information space. By 2020, 70 % of the Earth's population will have cellular devices, and mobile broadband networks will be available to 90 % of the inhabitants of our planet [15].

In general, modern ICTs for interpersonal communications eliminate the spatial limitations to communication and provide an opportunity to move from "one-to-one" to "many-to-many" communication formula.

Nowadays, the quantitative growth of the Internet is gradually taking fundamentally new quality features that reflect mass active influence on socio-economic development through various Web-technologies. Automated devices start to integrate successfully into the Internet, which is proved by the analysis of development trends since 2014, shown in Ericsson Mobility Report (it is provided in Figure 2).

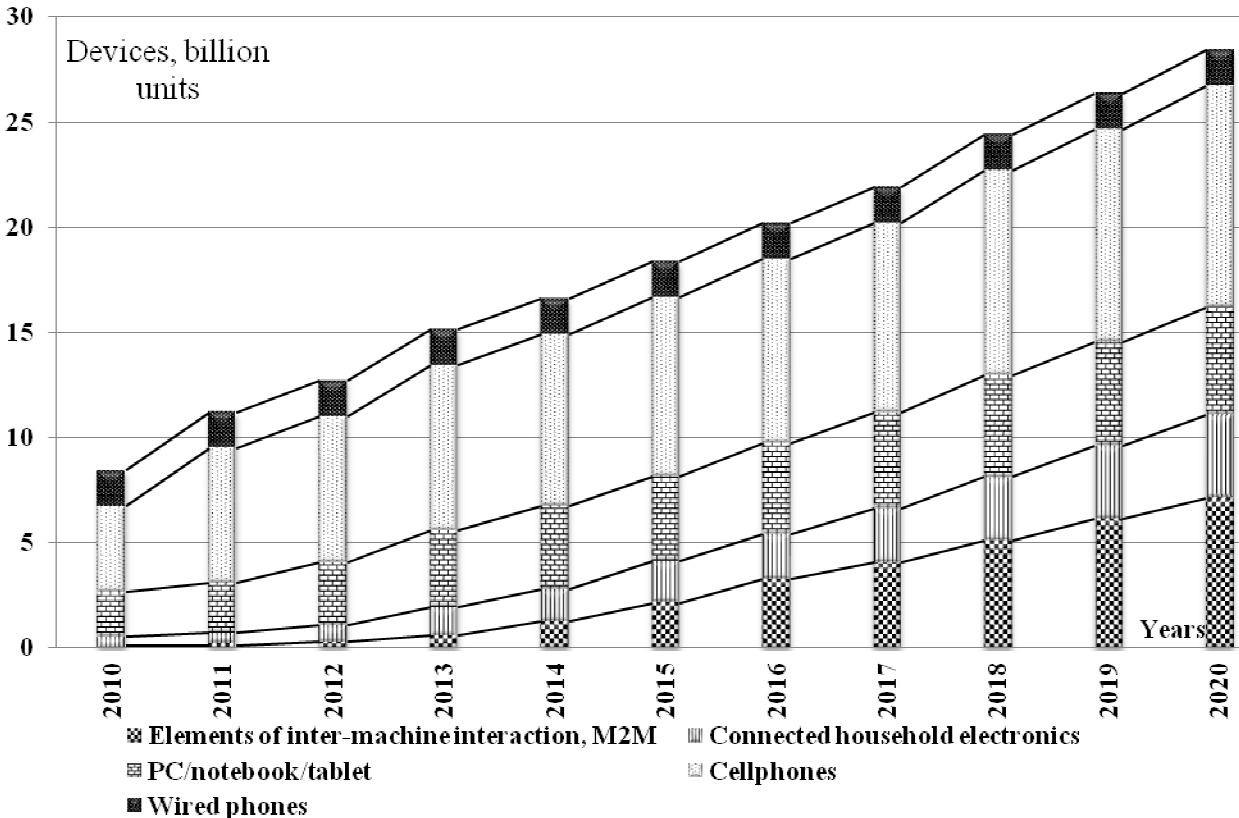


Figure 2. Dynamics of growth of ICTs in the world
 Source: calculated by the data from [31]

Since 2010 mass intensive introduction of automated Internet devices has started. Based on trends in Figure 2-3 we can assume that soon there are will be more autonomous Internet devices than people with mobile phones. It is estimated that by 2020 the overall number of Web connections of devices to the Internet will reach 26 billion units, approximately 15 billion of which will be cellular phones, tablets, laptops and other computers [29]. We note the increasing role of autonomous Internet devices, since they provide a qualitative change for the transition from the level of Internet formal logical models to the level of virtual Web applications representing the entire physical world. Therefore, in the near future it would be reasonable to expect the increase in the percentage of various specialized front-end applications to maintain professional communications via the Internet. Although paired interactions still play a significant role, they are replaced by group interactions when thanks to mass media resources, computer networks, advanced means of communication and transport dozens of managers can efficiently participate in the business processes management. Due to a qualitative change of communication many companies are not ready to move to such level of active communication in the market. They have to rapidly re-engineer their own management system or leave the market due to lack of knowledge and practical experience in order to make managerial decisions under conditions of uncertainty.

Information society is characterized by the emergence of new ICTs. Each of them follows S-curve that schematically reflects the route from emergence of new item to maximum satisfaction of all potential customers. The diffusion of ICT is schematically shown in Figure 3 using examples of telephone, radio, Internet and smart-phones.

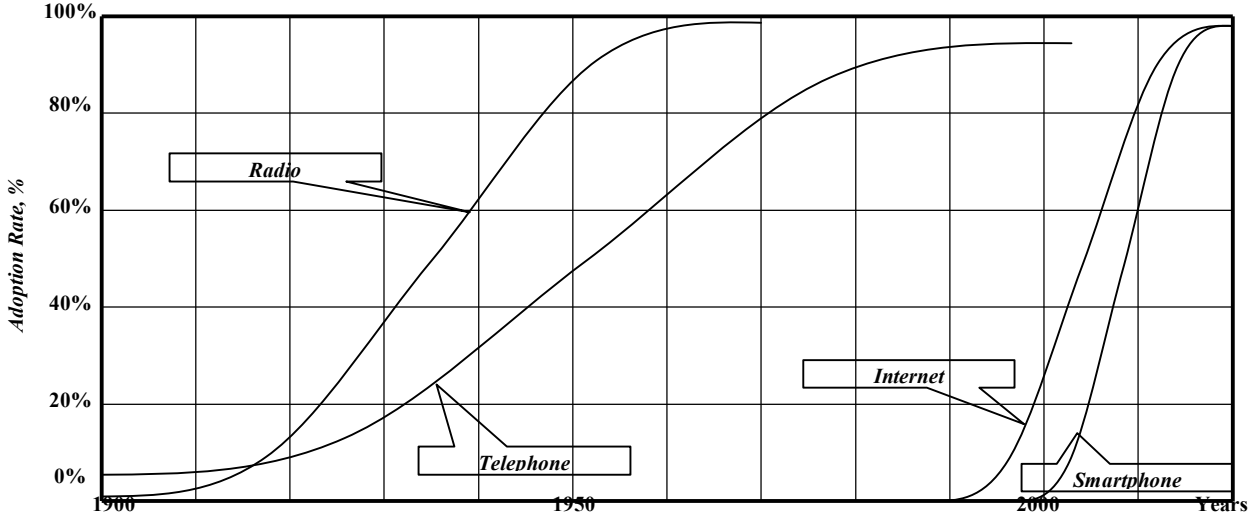


Figure 3. Diffusion of consumer technologies

Source: Asymco

Comparing the processes of diffusion of new ICTs in the early 20th and 21st centuries statements about significant reduction of duration of full coverage of potential consumers with new technologies can be made. In general fundamentally

new basic information technologies appear increasingly frequently in the society that directly or indirectly leads to major changes in the market environment. After a critical mass of consumers is formed the socio-economic process of using information products becomes irreversible and is developed in accordance with qualitatively new laws. For example, after reaching a certain number of nodes in a cellular company the further development of new functions are carried out automatically, without any need for additional stimulation of growth. As an example, consider systems of fibre-optic lines for data transmission to the Internet. Its technical and technological support is cyclically improved, and the network is moved to higher level of development: on one hand there is a threshold leap in main physical characteristics of the global network, on other hand – fundamentally new changes for business occur, which are of critical importance for introduction of new higher forms of information products transmission (from a short test message to continuous multi-channel information stream). Therefore, the descent to the top is possible, when dynamically updating targets of an enterprise suddenly become obsolete. The risk of critical obsolescence of company management system lies in the fact that it is impossible to identify the turning point in time, and the consequences of changes become obvious much later. It is therefore an important question of how the management system will integrate new technological possibilities in order to transform them in achieving advantages in the market. Figure 4 shows that the duration of products life cycles that periodically transfer to higher standards of data transmission is reduced.

In general new economy is dynamic, every day the old stuff disappears and the new one appears, today's competitor will become a main partner tomorrow, and the economic activity is associated with uncertainty, constant and often significant risks.

The introduction of modern standards for information transfer and processing enables the use of new automated analytical services that significantly expands the horizon for effective managerial decision making. The relevant processes can be also observed during development of a new software, etc.

In addition it is worth mentioning that the basic ICT is being improved during its existence, which leads to the appearance of several generations (for example, the generation of processors for PCs, iPhone smartphones, Windows operational system, etc.).

Schematically this process is represented in Figure 5.

A threshold accumulation of quantitative changes leads to a quantitative leap, which is manifested in the emergence of a new basic technology. The research of a number of basic ICTs suggests that the period before the emergence of more powerful ICT is reduced. As a result, the production cost has steadily decreased while improving its quality. As a result, the emphasis of the competitive struggle has moved to a plane of development and production of new generations (types)

products. Prices on the products in the network economy tend to decrease due to the growth of obsolescence factor influence: the more delayed is the purchase the lower will be the product price. Similar system of reverse pricing first of all extends mainly to microprocessors, telecommunications and other high-tech production. For given reasons the importance of advertising, the value of innovation and the role of intellectual capital increase in the network economy. To display this regularity it is worth bringing well-known laws of the information society.

Moore's law states that every 1.5-2 years the capability of a certain class of devices doubles at constant prices for products of this class [37].

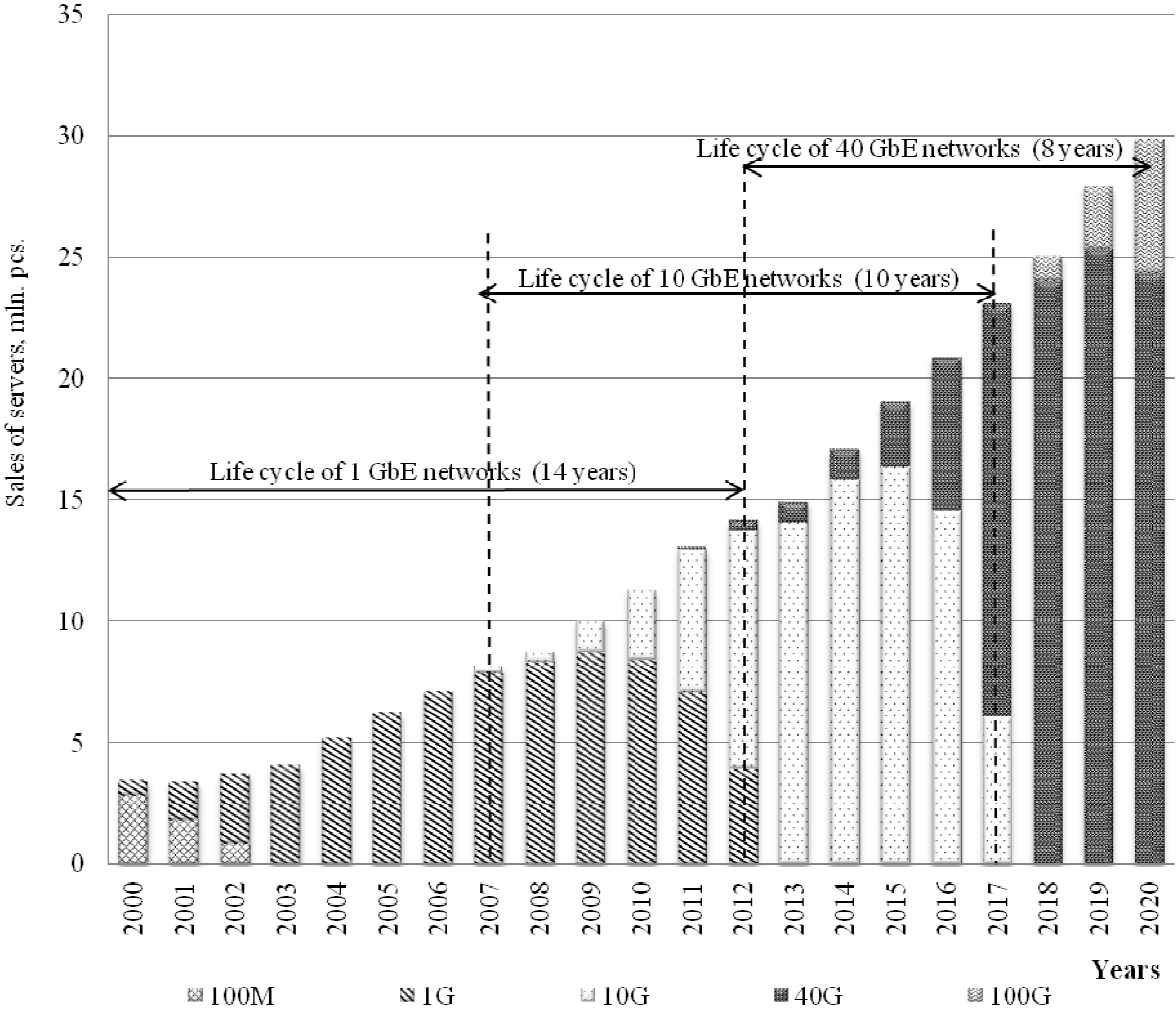


Figure 4. Changes in generations of fibre-optic networks

Source: developed by the authors based on the data from Ericsson Mobility Report: On the pulse of the networked society. URL: <http://www.ericsson.com/res/docs/2015/ericsson-mobility-report-june-2015.pdf>

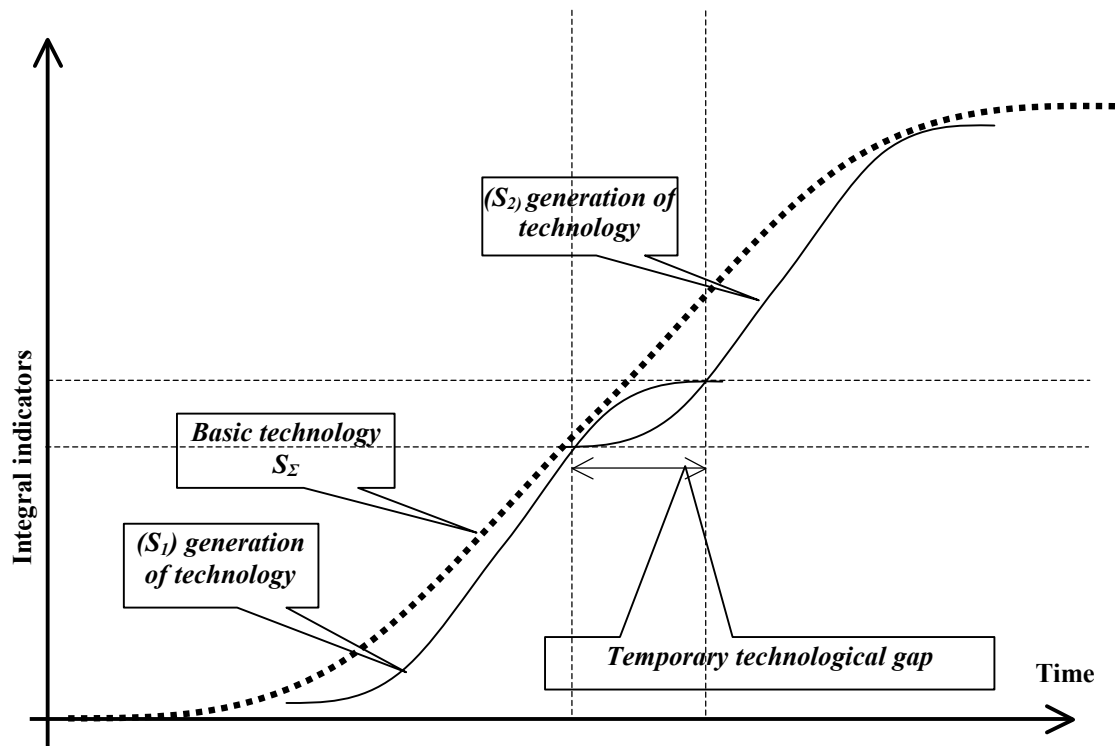


Figure 5. Schematic representation of the introduction of new technologies

Gilder's law for networks says that a scope for communication services triples annually, however in the meantime the prices for telecommunication services half reduced [14].

Based on the conducted analysis it can be stated about growth of change intensity that is evidenced by the emergence of fundamentally new basic managerial and production technologies as well as the time reduction of appearance of new generation of basic technologies. Intensification of scientific and technological progress has determined such driving forces as industrialization in the 19th-20th centuries and globalization in the 20th-21st centuries. As a result, the process of emergence of fundamentally new models of company management system has greatly accelerated, while the update time of internal organizational structures significantly decreased. Principle attitude toward changes is most clearly showed in the principles of training of experts, which is manifested in the transition from "Education for the whole life" to the principle of "Life-long learning". Computerized means of meta-data exchange via the Internet maximally change the management methods – place of work, type of activity, circle of partners. Computer networks give an opportunity to combine subjects of economic relations through the global electronic environment. As an example it is worth considering SWIFT international bank system, which fundamentally changed the conditions for banking operations in the world.

From the point of view of improvement of control system of companies since middle of 20th century there can be distinguished four quality changes of enterprise environment due to mass introduction of new ICTs. It was considered

that the main element of the management system will be an organizational structure of management, the traditional use of which significantly limited the use of existing potential of companies.

In the 1970s, due to the introduction of mainframes the tasks of increasing cost control and efficiency improvement of the organization of production processes were solved. Developed and time-proved methods of traditional management lost their analytical significance, ceased being a practical tool for development of effective economic policy of the enterprise. Companies started intensively to develop *production management structure* that ensured timely and minimum cost supply of materials and rational use of available production capacity. In particular, mass introduction of MRP II (Manufacture Resource Planning) computer technologies has made it possible to drastically reduce the time for engineering and technological works for the organization of production. The use of powerful computing centres gave a possibility to solve the most complex technical and process tasks of production management. In practice, these changes manifested themselves in formation of matrix organizational structures of management, which naturally connect administrative and functional methods of management. Matrix structure has appeared as a response to the need for rapid technological changes to use highly qualified labour force as effectively as possible. First, the matrix organizational structures of management were developed in the space industry, later they spread in the electronic industry and high-tech spheres. Flexible dynamic organizational structures are not focused on the stable in time production processes, but on range of dynamically changeable processes, making possible the achievement of synergies in production processes [14].

The development of personal computers in 1980s contributed to the extension of powerful management tools handed to managers. New management environment is characterized by the following features:

- amplification and diversity of interconnections between market participants;
- global organizational relationships;
- the growing importance of the market informational component.

These processes contributed to the development of *the structure of responsibility centres* (for example, project management teams, centres of financial responsibility, etc.). Use of personal computing resources (for example, PC) enhanced capability of specialists to control the activity of dedicated units and thus take effective regulatory measures within the delegated authority. Content processing at a high analytical level becomes the main competitive advantage of an enterprise, and therefore the target direction of the transformation of company management system. That is why at that time the full use of divisional approach to the formation of companies started. It happened through providing specific operational and production independence and profit liability shift to the allocated large autonomous production and economic units. It should be emphasized that in

the USA, by the mid 80s, the divisional approach was applied by 80% of all diversified and specialized companies, including 95% of the 500 largest. In general these opportunities have provided closer connection of production plans with consumer needs, substantially accelerating the company's response to changes in the external environment. During this period the saturation with the personal computer technology took place that in turn led to an increasing variety of software, depending on the needs of managers.

The main features of this economic development period are considered to be an outstripping growth rate in the information transmission volume relative to GDP, growth of the importance of information support for production and economic activities of subdivisions of an enterprise.

Wide use of specialized global networks at the end of the 20th century contributed to the development of efficient tools for entrepreneurial networking, in particular through the implementation of efficient transaction tools. Since the end of the 20th century there have been global evolutionary changes of the system engineering, information and communication, and ecological spaces of the enterprise activity in the world, primarily through rethinking of the problems of their activities with consideration of the higher information and communication level. The modern market development is related to the constant increase of intelligence degree of the proposed goods/services. Since that time, rationalization and technical progress are achieved mainly not due to progressive product and functional specialization, but through the integration and reintegration of individual production, economic, and transport processes. Production becomes digital, which allows to purposefully produce goods for a specific consumer in more economical and faster way, and flexibly use of available resources. It should be noted that in the near future new robotic production systems and 3D printers will allow to respond to change of the production range on an operational basis. This led to the transformation of enterprises into organizational and production systems, whose constitutive elements can be flexibly embedded in external production chains from raw material suppliers to end consumer. These changes have caused intensive development of *business structural framework* in companies, whose main task became to support network model of enterprise activity in the external environment. Thus, at the end of the 20th century the network forms of development of external interactions of enterprises have been significantly diversified due to scale expansion and growth of information exchange processes by means of the Internet. Under the new conditions, any enterprise or individual can organize joint team production, simplify and accelerate trading operations, support the exchange of promising commercial ideas. In this period, virtual organizations spread out, which were based on a marketing approach for the formation of market-oriented business processes. This effect provides exponential economy growth due to multiplicative effect of the

interaction between companies. The peculiarity of the network economy is the transnational character of the globalization of the world economy, which is as follows:

- firstly, if in the traditional economy the volume of the market of products increases according to the linear law, then in the network economy – due to the effect of replication – by exponential one;

- secondly, if in the traditional economy a separate enterprise benefits from the reduction of the production cost, then in the network economy – all participants of the chain "suppliers – producers – consumers" do.

The network economy activates the processes of consolidation of national information infrastructures, which support the development and use of new ICTs (telecommunication services, e-business, e-commerce, social networks, etc.). The network economy forms a manufacturing and technological environment in which organizational and production units can effectively coordinate joint activities in order to minimize costs. Due to the development of the company structural framework, the companies minimize their transaction costs, and generally optimize logistics costs.

With the beginning of the 21st century the entropy of information technologies significantly increases, which generates a lot of uncertainty and problems of harmonization of content details of information flows. This leads to the intensive formation of new models of doing business through the use of cloud technologies and Internet devices. Specifically, in the near future, experts predict huge orders for "smart devices" in the public sector, and soon the largest sales market will actually be the consumer segment. The main problems that need to be solved at this stage are the use of intelligent technologies to combine various standards and tools that can ensure the compatibility of different electronics and simplify its usage [23]. The leading place in the Internet will be inescapably taken by the corporate segment, whose interaction is based on artificial intelligence systems. The main beneficial effect of the knowledge economy has been the ability to massively distribute new discoveries and creative approaches, in particular to widely apply benchmarking techniques. It should be noted that today the value of successful companies is ten and more times higher than the value of their physical assets.

Each new high-quality technical and technological level of the network significantly extends management capabilities. Under such conditions the development of proper *information infrastructure* of companies has become quite natural. In the 21st century information subdivisions, as a rule, are transformed from service units into those that really create added value in companies. The analysis of new aspects of informational infrastructure development of a typical company is shown in Table 1.

Table 1

Main directions of development of information infrastructures of enterprise management system

Direction	Basic level	Tasks
Informational	Organizing large databases	Organize the collection and formation of information databases, applying the principles of "point-to-point" implementation of new ICTs
Systemic	Organizing information environment	Systemic use of ICTs in an enterprise, the transition to their integrated use, identification of ways of convergence with basic production technologies
Managerial	Information resources management	Moving the emphasis of the management system from static to dynamic approach. The basis of transformation is the constant development of ICTs, the ways of use of which is periodically updated, and the range of their capabilities expands
Production	Formation of information services	Formation of added value of products through the introduction of individual services with the use of basic products

Source: developed by authors

Collective interaction connects trillions of objects, which include people as well as computerized devices. Connection of household items to the Internet allows to instantly obtain various information needed by the client, and ensures continuous creation and distribution of new services. In the economic space new intelligent agents, let alone a man, appear – smart phones, computers, etc. This process is conditioned by the convergence effect and the subsequent positive singular effect due to increasing of the availability and practical applicability of Internet devices (size reduction, power improvement, price affordability), and multiplying of their number and connections between them.

Development of virtual models of production and economic activities of companies for management of their production and economic activities will bring managers and specialists maximally closer to managed structured business processes distributed in space and time (for example, with the benefit of cloud computing and Internet devices). Due to the high rate data transmission with minimum delays in the network, the controllability of business processes will increase significantly, which will enable to respond to perturbations in the daily activities of the enterprise on an operational basis, preventing the occurrence of critical situations.

Within formation of the information society companies are forced to constantly rebuild their own management system in order to survive and adapt to the dynamics of the external environment, with consideration of the scientific and

technological trends. As a result, companies management team is forced to distribute the efforts for development of a management system in the context of the following components: organizational structure of management, production structure of management, the structure of responsibility centres, the structural framework of business and their own information infrastructure. Peculiarities of using these structures are shown in Table 2.

Table 2

Characteristics of the main organizational structures of company management system (CMS)

Organizational structure of CMS	The object of management	Way to achieve the goal
1. Organizational structure of management (OSM)	Workforce	Rational organization of personnel for the rational use of fixed capital
2. Production management structure (PMS)	Production capacity and material flows	Rational exploitation of production potential and optimization of the material resources usage
3. Structure of responsibility centers (SRC)	Financial flows	Target definition of basic directions of production and economic activities in accordance with the state of the environment
4. Structural Business Shell (SBS)	Structure of interconnections of internal and external environments	Optimization of market presence through the development of private analytical centers for analysis of internal and external environments, as well as the formation of its own centers of interest in the external environment
5. Information infrastructure (II)	Technical, technological and intellectual support	Building a virtual information environment as similar as possible to the physical world to optimize interaction with the external environment

Source: developed by authors

Enterprise development in the general case comprehensively covers logically interconnected transformations in these structural units in order to fully comply with market conjuncture and requirements of the external environment.

The need to allocate the mentioned organizational structures in the management system of the company (Table 2) is confirmed by the statistical study carried out at the machine-building enterprises in Western Ukraine during 2016 at the regional leading specialized exhibitions. The statistical study was aimed at determination of the domestic enterprises status and vision of modernization tasks

from their managers point of view regarding the modernization in conditions of intensification of production and trade relations with the European Union. The questionnaire was carried out by efforts of the Department of Organizational Management of the Lviv Polytechnic National University and the editorial department of the advertising and analytical Internet-publication "Innovative Technologies & Equipment", established at the H.B. Karpenko Physics and Mechanics Institute, within the framework of the activities on popularization of the ready for implementation developments of leading Ukrainian scientists. The information base of the undertaken study is the results of questionnaire of 49 industrial enterprises of the Western region of Ukraine concerning the effectiveness of their management systems. A considerable proportion of the questionnaire questions was devoted to rating score.

Dispersion analysis methods were used to confirm the adequacy of the obtained results. The core of the problem lied in the fact that in multi-factor experiments, besides the variation due to the action of each factor, there is nearly always a variation due to the interaction of factors. The essence of such interaction lies in the fact that the organizational structures of the management system of the company are closely interrelated. Therefore, it is necessary to prove that these organizational structures are chosen not by coincidence. By means of the dispersion analysis method, a statistical hypothesis is tested for homogeneity of averages over several general populations with a normal distribution.

Let us put forward the null hypothesis H_0 on the absence of differences between the selected organizational structures, in other words, all organizational structures belong to the same general population and, accordingly, the averages are equal, that is:

$$\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5.$$

An alternative hypothesis makes an assumption that there is a significant difference between these organizational structures of the company management system.

To test this hypothesis, an extended Excel package was used. The initial data for the research are given in Table 2.

To assess the significance of the differences between the averages and to formulate the conclusions of the verification of the null hypothesis H_0 a peculiar norm is used – Fischer F-test – in the dispersion analysis.

The results of the dispersion analysis using the extended Excel package are shown in Table 3.

Table 2

Results of the survey of managers of industrial enterprises of the Western region of Ukraine

#	OSM	PMS	SRC	SBS	II	#	OSM	PMS	SRC	SBS	II	#	OSM	PMS	SRC	SBS	II
1	2	3	4	5	2	18	3	5	4	2	2	35	2	4	1	4	3
2	2	4	3	4	2	19	5	4	2	1	2	36	2	5	2	4	3
3	2	2	4	5	2	20	3	4	2	2	3	37	2	3	3	4	3
4	2	1	5	4	3	21	5	4	3	1	2	38	3	3	5	4	4
5	2	3	4	4	2	22	4	3	4	5	4	39	3	2	3	4	2
6	2	1	4	4	2	23	5	4	5	2	2	40	2	1	5	4	2
7	3	4	3	3	2	24	2	4	3	5	2	41	2	1	5	4	2
8	2	1	5	2	2	25	2	3	4	2	2	42	2	1	5	4	2
9	3	2	3	3	3	26	4	4	3	2	1	43	1	3	4	5	2
10	2	3	4	5	1	27	5	4	4	2	2	44	2	3	4	5	3
11	3	4	2	1	4	28	2	1	5	4	3	45	1	3	4	5	2
12	4	4	1	2	3	29	3	5	2	4	4	46	3	1	5	4	2
13	3	4	5	2	2	30	3	4	1	5	2	47	3	2	5	4	1
14	1	5	4	2	3	31	2	2	5	4	2	48	3	3	5	4	2
15	2	4	2	5	3	32	2	2	5	4	2	49	3	1	5	3	2
16	3	4	5	1	2	33	2	2	5	4	2						
17	4	5	2	1	3	34	2	1	5	4	2						

Source: developed by authors

Table 3

Results of application of the method Anova: Single Factor for the analysis of the hypothesis of the interdependence of organizational structures

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	49	130	2.653061	1.022959
Column 2	49	146	2.979592	1.728741
Column 3	49	183	3.734694	1.615646
Column 4	49	168	3.428571	1.708333
Column 5	49	115	2.346939	0.522959

ANOVA

Source of Variation	SS	df	MS	F	P-value	F critical
Between Groups	62.06531	4	15.51633	11.75722	9.76E-09	2.409257
Within Groups	316.7347	240	1.319728			
Total	378.8	244				

Source: developed by authors

$$F = 11.75722, F_{critical} = 2.409257 \text{ at } \alpha = 0.05;$$

$$F > F_{critical}$$

We conclude that there are statistically significant differences between the organizational structures of the management system of the company, since the calculated F value is higher than critical value for a given number of observations and number of groups, in other words, the intergroup dispersion is larger than the intra-group one.

For further elaboration of the obtained research data, an analytical and graphical analysis was used in the form of diagrams (Figure 6).

To rank the weight of alternative solutions (weight of organizational structures), the following approach was used to calculate the consolidated score. A weighting coefficient was assigned to each qualitative assessment of the questionnaire as follows: to the most important rating index score is assigned the weighting coefficient of 1, and to each of the following indexes it is reduced twice. Integrated index is the sum of products of the index score (shares among surveyed enterprises) and its weight rating coefficient:

$$P_j = \frac{I}{n} \sum_{i=1}^n (2^{l-i} \cdot p_{ij}) \quad (6)$$

where p_j is the integrated index of j alternative; 2^{l-i} – weight rating coefficient of j alternative; p_{ij} – assessment ratio of i level for j alternative.

Integrated assessment of the weight of the organizational structures of the company management system based on the collected statistical data is shown in Figure 6.

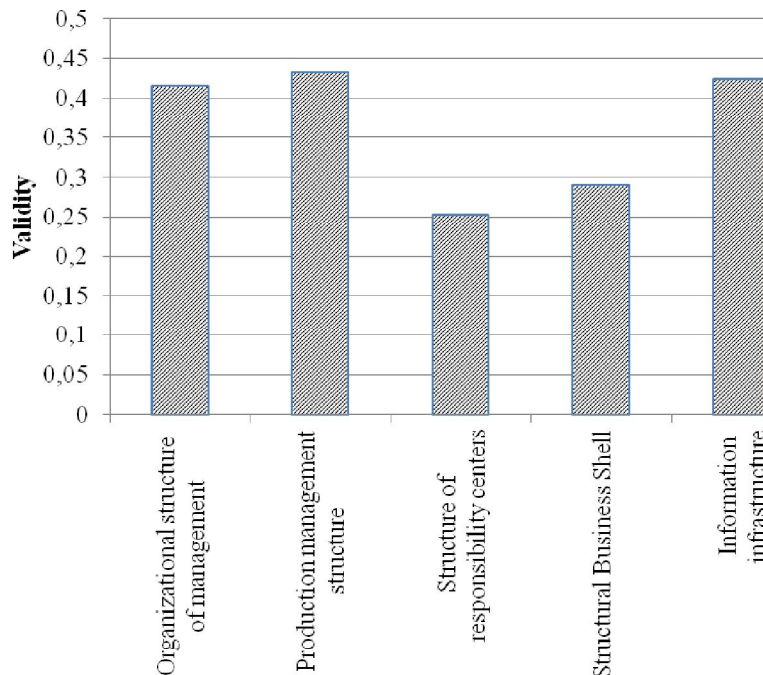


Figure 6. Integrated estimation of importance of organizational structures of management systems of machine-building enterprises according to the survey data

Source: developed by authors

At the same time it is worth mentioning the insufficient level of the information infrastructure development, which, in turn, understates expectations of the need to develop their information infrastructures.

Considering the above, let us name the main reasons for the need to revise the traditional vision of the company management system:

- unification and standardization of business processes enables the company to develop a strategy of operational interaction with partners or consumers, engaging them into the management of selected business processes with delegated rights;

- the personification of the consumer requests processing enhances the reliability of interconnections and the confidence in the company in the external environment;

- the deployment of artificial intelligence technologies forms ample opportunities for the formation of subject specialized models of multi-parametric support in distributed manner for material, industrial or human resources;

- cloud technologies and artificial intelligence techniques make it possible to form the closest to reality functional model of the company in the physical space;

- the use of specialized analytical and intellectual software that can calculate the effect of even subtle disturbances and, within specified authorities, can independently initiate the decision-making process.

Selection of directions for the modernization of the company's management system depends on the involved mechanisms of capital utilization, engaging of personnel into management, development of relations with consumers and partners. It is stated that the modernization of the company management system is characterized by continuous changes, which have significant inertia and a focus on the fullest appliance of promising management information technologies in the areas of management of capital in general, development of production and economic processes, development of marketing activities and management of logistics. The appliance of the conceptual approach concerning the totality of organizational structures of the management system of the company will become the theoretical basis for substantiation of the directions for improvement of the management system and is recommended as the basis for periodic structural and functional analysis/synthesis of the company's activities in order to select the most appropriate vectors for modernizing its management system.

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1.2. Innovative approaches to the formation of a system view of the personality management process

In solving administrative tasks related to economic or cognitive problems a personality steps forward as a subject of this process. Since the process of acceptance and execution of a management decision includes its behavior as a manifestation of personality activity, then one of the steps we need to do is to analyze the forms of activity of the personality, to consider the behavior of the individual. This problem was intensively studied by Heider, Abelson, and Rosenberg [5]. Our proposed analysis will be based on the use of a system approach and it allows us to develop an approach to considering the behavior of a personality as a system of purposeful actions.

Psychologists, social psychologists, anthropologists, sociologists, political scientists, economists, philosophers study behavior of the personality, and in each of the field of knowledge there may be different points of view on this problem. For example, some psychologists study only one of such phenomena as perception, imagination, mindset, learning, communication, and in most cases, do not connect their own work with research in other branches of science. As a result, instead of a complete picture of the behavior of the personality as a psychological aspect of the economic problem, fragmentary ideas on this problem are being formed.

For example, communication, apart from being a form of personality activity, communication also carries a psychological aspect aimed at solving a particular economic task. Communication can be divided into smaller subsystems: such as, encoding, transmission, data processing, accumulation and transmission of information, etc. That is, to develop a system of concepts that bind different approaches to learning communication, it is necessary to include the whole system in a more general system that covers various aspects of purposeful behavior.

All this will be attributed to the study of conflict, cooperation, competition, as factors of manifestation of personality in the context of the formation of market relations. This problem was studied by Alfred Smith (1966), Raven (1963), as well as by several other authors, who considered the problems of the interaction of social groups in economic situations [3].

The nature of the proposed constructive definitions of functional concepts proposed in the analysis suggests general assumptions regarding the behavior of the personality. In addition, such definitions provide a basis for assumptions and correlation of results.

The proposed analysis can also be attributed to the development of social systems, including the human-machine ones. The models of such systems are found in the theory of systems, the science of economic management, the study of operations, system engineering and other disciplines with system orientation, which include variables of behavior.

When certain concepts such as goal, communication begin to play an important role in many fields of science and technology, it is necessary that they should go beyond one branch of science and take into account the interests of many related parties. That is, the system of notions must be sufficiently general to cover the research of many types of phenomena. In addition, this system of concepts should provide interdisciplinary research. Firstly, they should study the mechanisms, the concept of purposeful activity, which is realized in certain systems of Rosenbluth and Wiener Evali. The development of such a system was carried out by R. Akoped and F. Emery [7].

One of the initial concepts, on which such notions as function and purposefulness are based, is the notion of purpose, which makes it possible to conceptually present the so-called individual systems.

Psychologists were engaged in the problem of determining the individuality of the psychological system. Some researchers, like Engislu (1965), used system concepts, others, Lewin (1938) and Heider (1946) recognized the need for a mathematical approach [9].

However, none of the concepts of personality can satisfy the criterion of uniqueness, if the psychological individual does not appear in it as a target individual, and also if, in accordance with this concept, the personality is not characterized by the responses of the individual to his environment.

The essential characteristics of purposeful behavior consist in the fact that it is conditioned by the choice, which in turn is determined by the purposeful state. This condition consists of four components:

1. The subject who reveals his choice.
2. Environment of choice.
3. Available ways of action.
4. Possible in this environment results [1].

And then the parameters of the purposeful state can be:

1) *Probability of a choice* that relates to a particular subject whose essential characteristics may change over time. Through learning, the probability of choosing any mode of action may increase or decrease. Therefore, it is necessary to correct possible changes, understanding what the kinds of corrections are necessary for this.

Further, this is the efficiency of the mode of action, that is, the probability that some action will produce a certain result. And, finally, it is the question of the value of the result for the subject.

2) *The way of action* cannot be considered only as a mechanical or physical action. This concept is also manifested in the analysis of economic, cognitive situation. The probability of choosing a certain possible mode of action by a particular subject may be zero, and then for such a subject, this method does not represent a potential choice. But every potential way of action is possible. It is also

necessary to note the relativity of ways of action and results. Ways of action and results – these are conceptual constructions by an observer of the behavior of another subject; they can change places depending on the interests of the observer. The way of action manifests itself as a means to achieve the goal, and in such a case, the results serve as outcome. An important concept that determines the cost of achieving a particular result is the notion of efficiency.

3) *The specific value of the result.* For the specific value of the result, as well as for efficiency, there is no single commonly accepted measure. It is expedient to use a certain standard measure in this case. The minimum specific value (0) is obtained only when the absolute value is "0", the maximum value (1) – when all the results, except one, have a zero absolute value. In addition, in order to determine the target state, it will be necessary to use the notion of a possible result, as an opportunity to choose at least one mode of action, the efficiency of which on this result is greater than zero; as well as the potential outcome as a consequence of choosing a mode of action in a defined environment, which efficiency is greater than zero.

From this perspective, the subject is in a purposeful state if he intends to obtain the result, and has several alternative ways with different efficiency, which he will try to use to achieve the result.

4) *Definition of personality (individuality).* By analyzing the purposeful stage, we used such concepts as the subject of possible ways of action, possible results, environment, probability of the subject's choice of the efficiency of each possible way of action for each possible result, the specific value of the result for the subject. The ways of action and results depend on the environment, as well as on the subject. Probability of choice, efficiency and specific value are determined by the subject, however, they may also be affected by the situation. For this reason, the individuality of the subject, his personality must be determined as his probability of choice, efficiency and specific value depend on the properties of the situation.

In principle, the probability of choice, efficiency and specific value of the subject can be represented as a function of the characteristics of the situation of choice. That is, the defined three functions can be regarded as a kind of three dimensions of a personality.

The contribution of the target personality to the situation of choice should be manifested in the extent to which the personality influences the given situation, in other words, on the result, then the personality (individuality) of the subject should be regarded as a function that relates the expected specific value in any situation of choice with the properties of possible ways of action, their possible outcomes and the environment.

That is, in the proposed sense, personality (individuality) can be regarded as a monitored function, which shows either an individual or a system, transforms the parameters of the selected situation into the expected value.

In order to create a complete picture of a personality (individuality), it is necessary to introduce yet another measure of the probability of choice on the basis of observation of choices realistically reproduced in a controlled situation [2].

To do this, the following concepts have been introduced:

1. Measures of habit, deduced from the effect of different properties of methods of action on the probability of choice, reproduced in a situation where the choice of mode of action does not affect the result.

2. Measures of knowledge, deduced from the effect of different choices of efficiency on the probability of choice in the constant questions of the value of the results.

3. Measures of direction, deduced from the effect of the difference in the results on the probability of choice, when each possible way of action can produce only one possible result and each possible result can be obtained.

Probability of choice: regularity. The next step of the proposed analysis is the need to determine, which effect the properties of available methods of action and environment have on the probability of choice of an individual, that is, the properties of available ways of action and environment, the properties on which the efficiency of alternatives does not depend on. For this purpose, the situation is determined by the habit (choice) – the degree of habit, and the function of habit. The situation of habit (choice) – is a situation in which there is no choice of result, there remains only a choice of way of action. The specific values of the results are kept constant in all the series of observations [8].

The degree of habit for the subject of the mode of action is that the results do not depend on the choice of the subject in the environment of habit and the very modes of action are the results. That is, the benefits to the subject among these methods reflect their intrinsic value unlike their external value. In a habitual situation, alternative ways of action are equally effective for obtaining the desired result, if it is additionally required that the subject consider them equally effective, then degrees of regularity will be measures of a particular internal value, which has for the subject different ways of action.

The function of commonality for the subject of the mode of action in relation to the results and the range of available ways of action takes into account the following factors of the personality, which are associated with the style of the individual, as well as the features of the personality, that is, the characteristic features of its reaction to the functional changes in it and in the environment of its choice. A degree of habit can step forward as the measure of the feature of an individual.

Other important aspects of the individuality of the system are its ability, or the tendency to feedback, in connection with which the concepts of knowledge, understanding and intelligence are used [1].

The term knowledge we can use in two different contents:

- 1) knowledge of the state of affairs, or the possession of facts;
- 2) possession of practical skills. Then in the first case, knowledge consists of real representations of the individual, or from what he has been notified.

Knowledge of the ways of action, and in this context, knowledge will be related to the efficiency with which an individual can use the way of action to achieve the goal.

Understanding is a deeper concept of content than knowledge, and according to [10], it involves comprehending the content or meaning of what is known. Therefore, understanding can be seen as the ability to effectively adapt behavior to changing conditions that affect its efficiency. This implies the ability to explain the impact of changes on the subject's environment and the efficiency of his choice. Then skills can be considered as the achieved result of the desired intention in this particular situation with the use of all available means.

5) *Intellect*. Developing a degree of knowledge and understanding allows us to move on to the next aspect of the functioning of systems, namely, intellect. Moreover, the measures of knowledge are: the situation of knowledge, as a situation of choice in the environment, when there are many possible subordinates of actions; the degree of knowledge possessed by the subject of the mode of action relative to the desired result; function of knowledge – as the knowledge of the way the subject acts in relation to the result in a particular environment; generalized function of knowledge, which determines the dependence of the subject's efficiency on many environmental factors.

Along with this, understanding as the ability to respond to everything that affects performance is determined by the degree of understanding.

Similarly, considerable attention has been given to the development of measures of intellect. The intellect, undoubtedly, is connected with the tempo with which a subject can study [4].

6) *Learning*: increasing level of knowledge or understanding over time. This definition implies the need for two measures of intellect: K – is the intellect function and O – is a function of intellect that in turn is integrated into the general intellect function, however, the mentioned functions can not be represented by one single parameter, and then the intellect function must be defined as a complex function, similar to the personality function.

In the analysis above, the concept of specific value in relation to the results was used. This is determined by such concepts as the situation of orientation: a situation in which:

- 1) There is an identical number of ways of action and results;
- 2) Each action has the maximum efficiency for one of the results and zero efficiency for all other results;
- 3) Each result corresponds to one method of action that has the maximum effect on this result;

4). This subject has a similar habit, knowledge and understanding of alternative ways of action with respect to possible results. In this situation, the objective basis for choosing the mode of action forms the orientation on the result [6].

The degree of orientation is a probability and determines the advantage given to one of many results in relation to others. This measure is determined in relation to the situation of choice. Thus, the degree of orientation of the subject to the result depends on many alternatives, as well as from place and time. Along with the measure of usefulness, the degree of orientation is a measure of specific value.

Of particular interest is the following aspect of the *orientation* function. Being surrounded by orientation, each result can be obtained with certainty: Each way of action leads to the result associated with it. But, what if we assume that the efficiency of one of the methods of action on the result to which he leads will decrease, leaving no change in other efficiencies. How will this affect the probability of choosing a method, and hence the orientation of the subject to the result? If he quickly rejects the result, the receipt of which becomes more complex, or if he quickly switches to getting the result, the achievement of which becomes more accessible, then we are talking about the variability of orientation.

7. And finally, *the results*. What does this concept define in our analysis? Firstly, the result can be a summary, that is, the immediate desired result, to which the subject is striving the most in a certain environment and at a certain time. Next, this task is an intermediate desired result, that is, the result to which the subject most longs for the particular time for a certain set of environments.

The goal is a desirable result that cannot be achieved over the period considered, but is available in the future.

One can also mention the ideal – that is, the results that can never be obtained, but to which you can strive unlimitedly.

A personality function determines the expected value for the individual, in the context of the choice, depending on the available methods of action of the possible results and variables of this environment. That is, the personality function has been defined in the three aspects:

1) function of habit, which relates the probability of choice with other parameters of the situation of choice;

2) knowledge function that imposes the efficiency of the choice with other parameters of the situation of choice,

3) simplification function that relates the specific value of the result with other parameters of the situation of choice.

In turn, a definite system of concepts makes it possible to analyze the actions carried out by the subject of choice related to obtaining a certain result. Having selected and considered certain parameters of purposeful behavior, we take the next step – we consider the process, through which the purposeful behavior is

realized, with the individual steps of this process – sub-processes – forming the system. One of the issues in this regard, which needs to be addressed, is the views on the processes of obtaining information, which in turn characterizes the situation of the environment, including the information from other people. In this, three processes play the main role: perception, awareness, and memory. In their totality, they make a model of the situation.

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1.3. Values in the system of innovation management as factors of improving the competitiveness of organizations

Values are useful resources. Since information is also a useful resource, some of the values are intangible in nature. Effective ways of maximizing values, eventually, turn into established norms of behavior and traditional forms of interactions, which form a useful basic of the organization – a corporate culture. Culture and rules of interaction are "common knowledge" [1] of the participants of the organization, which is intended to reduce the cost of exchanging [2]. Thus, values and rules based on their interaction play the role of a "common denominator" which parties seek while interacting.

According to the World Values Survey (www.worldvaluessurvey.org), conducted in 64 countries of the world, developed countries differ from the developing countries, according to values shared by citizens of these countries. This study deals with such groups of values as traditional / innovative, tangible / intangible, and the results indicate a strong link between innovative and intangible values and the effectiveness of organizational interactions. The influence of values is also investigated by economic theory. The conclusions made by scientists coincide with the results of World Values Survey, as can be seen by the classification of values as social capital [3, 4].

The peculiarity of the concept "innovation of value" lies in the fact that it reflects the same emphasis on both components – values and innovations. The value without innovation, as a rule, is to create an added value in the growing trend. For example, when a product improves its quality, but it does not allow the producer to stand out from competitors or when innovations are related to new technologies. Therefore, it is important to distinguish this technological innovation from the innovation of value as a "market pioneer" [5].

Innovation of value is the result of a new way of thinking and a strategy implementing that leads to the creation of a new product, which obtains a new market niche and a way out of the competition. It is important, that innovation of value ignores one of the most common dogmas based on the "compromise: value – cost" competition strategy. The objects of the attention of the creators' free market niches are two aspects of production: value and innovation. The new way of thinking involves a refusal from the standard postulate about the need for a compromise between value and cost, according to which value can be increased only due to the increase of expenses. A new strategy can both increase value and reduce costs. The creation of new products is carried out simultaneously with the reduction of costs and the increase of value for the buyer. This is the way to achieve a leap of product value both for the company and for buyers. Since value for buyers is based on the utility and price of the product (services) offered by the company, and the price for the company is generated from the price and cost

structure, innovation of value requires coordination of the company's business activities in the field of utility, price and costs. Such a systematic approach makes creating a new market niche a sustainable strategy. It integrates the company's functional and operational activities [5, p. 123].

With regard to innovation of production, they can be implemented at the subsystem level, without destroying the company's overall strategy. For example, innovation of production process can reduce the costs of the company by supporting the chosen leadership strategy in the field of cost without changing the utility of the product offered by the company. Although such innovations can help the company strengthen its position, a similar subsystem approach does not often create a productive niche in the new market space. In this sense, innovation of value is more than innovation. This is a strategy that covers the whole system of company activity. Innovation of value requires that companies integrate the whole system of enterprises to realize the leap of value for buyers and for themselves. Without such an integral approach, this strategy loses its essence [5, p. 2].

Exchange is the basis of interaction not only organizations with consumers, but also with organizations with their participants. The exchange begins with the definition of a list of values as subjectively useful resources that their exchange partners help each other maximize. Maximization of values – the purpose of exchange, and rules of maximization acceptable to the parties – a way to achieve the goal [6]. When creating rules, it is necessary to scrutinize the motivational incentives that are followed from the rules as ways to maximize values. The study of motivational incentives should be as objective as possible with respect to incentives for honest completion of exchange and incentives for abuse. Let's consider the following example.

The market mechanism of the exchange is connected with the results of participants' work and the size of rewards, by creating motivational incentives for productivity increasing. For comparison, the wage system is related to a reward process, since the underlying contract item is a monthly, payment but not according to the result as in the case of the market. The relationship with the process becomes the basis for the "no-ticket" effect [7], creating motivational incentives for the productivity reduction, in terms of obtaining the same salary. In order to correct motivational disadvantages of the salary system, the organization must spend significant managerial efforts to maintain motivation and broad control.

In addition, the very rules of interaction within organizations, in the form of a salary system, are the reason for the low productivity of innovation activity. The current innovation activity of a hired participant is a rare exception, not an ordinary practice, although this form of value creation is gaining importance in the conditions of increased competition. The reason is that the process of operational activities of the participants is subject to control, unlike the process of innovation

activities. The peculiarity of the innovation process lies in the fact that it arises as a result of the internal information and analytical efforts of the participant. In the real absence of means of controls, the question arises of creating effective motivational incentives for the participant's interest in improving the productivity of the innovation process.

There are several ways to achieve this, one of which is to continue improving the existing wage system by supplementing it with the traditional system of additional incentives, with the provision of additional benefits to participants by the organization, such as a gym or dining room. However, this process is usually complex and costly. Another way is to use a time-tested experience of market relations for the exchange of innovative solutions with employees. This process is based on the perception about each participant as an enterprise of value creation, and the organizational environment is a market where managers and participants converge as an innovation demand and supply. Taking into account that each individual innovation transaction is consistent, the efficiency of using the innovative fund of the organization is increasing, and this additional incentive system remains an affordable alternative to more expensive counterparts.

The market is a set of rules for interaction to maximize the value of participants through exchange. In order to achieve the most significant results through market management of innovation activities, it is necessary to keep in mind the greatest value that underlies the functioning of market rules of interaction, the value of property rights.

The value of property rights

In order to evaluate properly the meaning of this value, let's imagine the world without property rights. It is clear that in such world, the exchange is practically impossible. After all, why the surplus resulting from additional efforts and increase productivity, should be exchanged if you can simply proclaim your property rights to the desired object. So the value of strength is established. The existence of the property rights restricts the arbitrary redistribution of benefits, which stimulates the increase of labor productivity, which, due to the exchange of surpluses, increases the living standards of the participants' exchange. Thus, mechanisms are being introduced that encourage constructive interaction.

The interest of organizations in the innovation search of their participants should find expression in recognizing the participants' intellectual property rights to their innovative ideas. This will include positive effects from the possibility of sharing innovative ideas with innovation incentives. The formation of the value of intellectual property rights to the participants' innovative idea directs them to achieve result that can be used for exchange. The development of market relations in Europe, which began with the industrial revolution in England in the XVII century, is connected with the recognition of the inviolability of property rights [8].

Consequently, the recognition of property rights in exchange creates

incentives for increasing the productivity of activity, which led to the creation of an object of exchange, by guaranteeing the possibility of its useful exchange.

Information values

Everything that surrounds us today existed 1000 years ago, in the form of resources. Since then, only the ways of combining resources with the work of people have changed. The presence of new ways of combining is directly related to the emergence of new knowledge. The importance of knowledge has led to the emergence of technology of the exchange and storage of knowledge, which in itself is a valuable informational resource. New ways of a useful combination of resources exist in the field of view of each participant in the organization. The challenge of effective management is to create motivational incentives and information technologies that best suit the search and knowledge sharing needs.

Innovative ideas arise as information units – thoughts or feelings of optimality, which eventually fall into the organization's information environment. The development of innovative ideas depends on the values that are really maximized by the system of interaction of the participants' organization. The following sections refer to such values.

The value of information units

The unit of information is the unit of content that exists in the information environment. This definition allows to recognize the information units of thought and feeling. Possibilities of useful application of the information unit form its current cost.

The participant through of the attitude towards it determines the value of the information unit. The attitude is the information about the priority of the information unit, which determines the possibilities of perception and processing. Attitudes cannot be controlled from the outside, but only directed from the inside. That is why, the system of motivational incentives is an extremely important tool for ensuring high productivity of the organization's innovation activity, combining the rules of its exchange of resources on the results of the participants' innovative actions.

The system of motivation is an integral part of the decision-making system, and it is also a set of rules for maximizing the values of the “if X, then Y” type, on the basis of which participants form expectations and visions of organizational interactions. The system of decision-making determines the existence of a system of motivation and the effectiveness of allocation of resources of the organization as a whole. In order to make organizational decisions, this system relies on the exchange of information with the participants of the organization. In most cases, the selection of information is carried out by the participants themselves, taking a certain number of current decisions in the process of exchange. This is natural, since if most of the current decisions are given to the managers themselves, then, the amount of information that needs to be processed in order to make important

organizational decisions will increase unbelievably. The existence of such large organizational institution as a corporation, in general, is possible only providing the delegation of decision-making powers [9].

Since the current decisions taken by the participants can be very different, one can assume that their influence on the organization's efficiency will have a normal statistical distribution [10]: a small part is little influence, the majority – moderate, and the other part is large. Taking into account the great influence of the part of the decisions taken already after their adoption, otherwise they would be delegated to a group of experts, it is important that the participant himself makes sufficient analytical efforts to the current decisions. One of the solutions to this issue, which has a systemic character, is the increasing of the participant's interest in his current activities, by increasing his self-realization and job satisfaction.

Having the participant got interested, it is important to realize that when making a decision, the participant relies on his own thoughts and feelings. That is why, in the interests of the organization, it is the participant's compliance with the way of a consistent and well-grounded change in his own thoughts and feelings. The affirmation of the value of thought and feeling is intended to add the evolutionary character to the nature of their change. After all, those that we value – are not thrown back thoughtlessly, but changed gradually after careful examination.

The value of self-realization and participation in the decision-making system

As the experience of post-industrial countries shows, in the future, the value of self-realization of a participant in the workplace will increase significantly [3]. The interest of the organization in improving the self-realization of its participants in the workplace is not only in increasing the productivity of their work, but also in improving the quality of the current decisions, as a consequence of the participants' interest in their activities. So, when organizing the interaction of participants it is necessary to take into account what the person likes to do. In an effort to bring people's work closer to their favorite activities, the organization cares about maximum qualitative approach to solving current problems and decision-making.

As noted, the implementation of decisions by participants cannot be controlled. Participants themselves may justify hopes for the implementation of these decisions only in the case of internal agreement and acceptance. Therefore, when organizing the effective placement of the creative potential of the participants, the adoption by participants of organizational decisions will be a value, the maximization of which will reflect the interests of the entire organization. The application of collective decision-making technology, as an effective rule for maximizing the value of adoption, allows us to expand the possibilities of information interaction and to take into account the most interests, thoughts, visions. Expanding the range of participants, which are responsible for

the quality of the decision, is an important consequence of collective decision-making. Indeed, by advocating some kind of thought in making a decision, the participant responds with his future reputation for the success of the solution concept.

The collective decision-making allows participants to reach more open arrangements, which by definition have higher levels of acceptance than legislative orders. This technology helps managers to interest their subordinates in the information exchange through the possibility of self-realization, and reduces the motivational incentives for lobbying decisions by participants who had no previous influence on their adoption [11].

The value of information stream

Information stream is the movement of an information unit between parts of one or several information environments.

The movement of information units from the internal to the interpersonal information environment is especially important for the establishment of effective information interaction of the organization's participants. The implementation of such a movement is based on the property of the internal environment to reproduce information units. How is this reproduction carried out? The environment places an information unit in the part of its spatial organization that has the ability to transform the pure meaning of thought or feelings into the language of communication. The availability and potential value of the information unit increases according to the amount of energy that is productively spent on the authenticity and accessibility of content communication.

Thus, participants have the opportunity to exchange valuable information units. These informational units, as ideas, can take different branches of 'evolution'. The organization gets a special interest from the difference in the choice of 'evolution' ideas ways by participants, whereas it may contain significant innovation potential. Researching of the different branches of 'evolution' by participants reduces the uncertainty factor in the activities and development of organizations [12].

Efforts to move information units are distributed by the participant through the internal decision-making system and are not controlled. To create effective incentives for effective information interaction, it is necessary to link the remuneration of the participants with the results of their information interaction. Ensuring this lies within the competence of the motivation system.

Consequently, it is necessary to link the results of the participant's efforts with their reward in order to create incentives for increasing the productivity of information interactions [13]. The market mechanism for the exchange of property rights is best suited for this task, because it coordinates reward with the value of the results of labor. Information flows represent or directly form objects of exchange between the participants and the organization. In the interests of the

participants – creating the most comprehensible and meaningful streams. In the interests of the organization – an objective assessment of the value of content links of the information flows.

The organization of information exchange with the help of a market mechanism will allow linking the results of participants' information activities and rewards, which will create real motivational incentives for innovation. After all, the demand for innovative ideas from the organization exists. There is also a proposal, based on the perfect 'internal' knowledge of the process of creating value for the members of the organization. It is only necessary to combine demand and supply within the database, using a market mechanism for the exchange of transactions. Through negotiations, the market allows for the values of partners to be taken into account, and as a result of useful exchange creates effective incentives for productive innovation interaction [14].

The most important condition for using a market mechanism for innovation exchange is the recognition of intellectual property rights. Of course, this implies the inability to innovate without the consent of the author. After all, the main value of the interaction of the organization with the participants, creating innovative solutions, is not in the concrete unit innovation, after the abduction of which the organization loses all the future trust of partners, and the possibility of access to the constantly updated set of innovative solutions.

The value of equity and competition of information stream

Equality – equal opportunities of information interaction of participants with the decision-making system.

Confirmation of the value of information units and information flows, gives grounds for the tolerant coexistence of different opinions and feelings. The existence of a variety of information flows and a finite amount of organizational resources leads to competition among information flows. Compared to its monopoly counterparts, such a competitive environment more accurately reflects the possible ways of innovative development of the organization. Also the efficiency of resource allocation increases.

However, according to the modern organizational tradition, part of the participants focus on decision making and resource allocation on an ongoing basis, regardless of the nature of the tasks. Obviously, competition for resources between the ideas of two participants with different levels of authority concentration over the allocation of resources takes place under the conditions of constant advantages of the party having higher powers. In addition, often, empowerment becomes an end in itself for the participants, who see no additional functional responsibilities for them, but the expansion of privileges and the reduction of control. This creates preconditions for backstage power struggle, lobbying and ineffective use of participants' efforts.

That is why it is prudent to allocate powers between the participants, trying, if possible, to avoid extending the list of authorized representatives, instead, to expand the practice of applying collective decision-making technology, which will help to improve the quality of exchange and competition of ideas.

The value of information environment

The information environment is an environment of existence of information units, which integrates structured information space and decision-making system, which has the authority to move information units in the space.

The decision-making system consists of a set of information units of the “if X, then Y” type, which coordinate the movement of information. The components of the information space are spatial parts that differ in properties, which, due to different properties of placement, processing and reproduction, have a different effect on the information units placed therein. The reason for combining space and decision-making system in one concept of the information environment is the high degree of their integration at the level of the individual participant.

The organization's information environment is divided into the internal environment of the participant and the interpersonal environment of the organization. Organization of the internal environment of the participant is carried out by its own decision-making system, built on internal values. The interpersonal environment is organized in accordance with the organizational decision-making system and organizational values. At the organizational level, the information environment can be seen as two interrelated values – the value of the information space and the value of the decision-making system. Such conditional classification facilitates the modeling of information collaboration in creating new mechanisms of interaction. The internal information environment of a participant is the source of new ideas that carry a useful value. The development and implementation of ideas depends on the existence of motivational incentives for information exchange and existing technologies of information cooperation.

The value of the information environment is the ability to process, accommodate and reproduce information units. The use of the potential of the internal information environment cannot be controlled, since the placement of information and analytical resources takes place at the internal-personal level. However, the participant's decision-making system is open to information on new ways to maximize its values, such as market-based ideas exchange, based on the recognition of intellectual property rights.

The value of freedom

Freedom is the ability of the participant to choose the values and algorithms of their maximization at their own discretion.

The lack of freedom of action among participants within traditional organizations results from their willingness to process and appropriate construction of motivation system – with payment per hour. Focusing on time, a formally

defined sequence of actions that must be performed in that time is required. This sequence is defined 'top', is considered optimal, and deviations are undesirable. It does not give any incentive or opportunities for an innovative experiment.

By definition, the interaction of the participant with the information, as well as the creation of new ideas, takes place in his own information environment, through his own decision-making system. Independently choosing values and algorithms for their maximization, the participant acts on the basis of the value of freedom. An important prerequisite for the participant's responsibility for the results of free actions is the linkage of the outcome of the action and reward. Taking the value of freedom as the basis of the system of organizational interactions, the authority to compile and improve the algorithm of value creation is passed on to the participant himself, as the party that knows best the advantages and disadvantages of this algorithm.

The assertion of the value of freedom helps the party to realize a new role, which involves an innovative initiative to improve the algorithm of value creation. The value of freedom is in creating on its basis the conditions for an innovative experiment. Linking the same result with reward, harmoniously balances the freedom of action with responsibility for the result.

The value of information symmetry

Information symmetry is the identity of the content of the relevant information units and streams in the internal and external information environment. This property of information is important in decision making by the organization, since information that is taken as a basis for decision-making must be reliable. Otherwise, the low effectiveness of organizational decisions will reduce the potential benefits of hosting valuable resources.

One of the reasons for the difference between the relevant information units is ordinary human error. There are errors in any organization. They need to be corrected in a timely manner, until the elimination of their consequences has become an expensive occupation. Exchange of information about errors between the participants of the organization is a precondition for timely response. Nevertheless, the participants have incentives to hide the error, because of inability to assess the value of this information flow, organizations practice punishment for an error. While punishing those who are wrong, the organization creates incentives to distort information. In order to avoid suspicion and distrust among the participants, the organization should encourage the exchange of information only about its own mistakes, otherwise it will affect the trust of the participants and the productivity of their information co-operation.

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CHAPTER 2

INNOVATIVE PRINCIPLES FOR SUSTAINABLE DEVELOPMENT IN THE GLOBAL ECONOMIC SYSTEM

2.1. The theoretic-methodological bases of the development of the regions within the global economic system

The development of the modern global processes was reflected on the increase of the scales and the dynamics of the international movement of the capitals, the goods, and the services, the production factors, the information and the technology.

On the one hand, it calls forth the maximum of the national economies convergence, their interlacement, the intergrowth and the interdependency upon the regional, the macro regional and the global levels, and on the other hand, it calls forth the reinforcement of the competitive struggle between the subjects of the international economic relations, among which the modern region takes the rightful position.

The stipulation of the above-mentioned processes not so much concerns the peculiarity of the part of the regional foundations within the development of the global economic system, as the features of the application of the principles of the oriental organization of the regional economy.

The oriental organization of the economy of the region covers all the questions concern the territorial division of the work, the arrangement of the productive powers, the place of the region in the national and the international division of the work, the regional divergences in the economic relations, the regional social-economic policy, the settling of people, the mutual relations of the society and the surrounding.

For the solution of questions concern the economic, the ecological and the social development of the territory, the modern region has the opportunity, except the use of the inner regional resources, the potentials of the regional subject of the economy and the institutions, to mobilize the resources of the economic increase that are behind the 'limits' of the region in the scales of the interregional, the international, the macro regional and the global ranges.

The matter of the notion 'the oriental development' and 'the oriental system' became approved in the west economic science at the beginning of the 70s of the XX century and since then it got sufficiently broad range of the notions. The modern scientists distinguish the notions of 'the system', 'the interplay', 'the space' between their following identification and development. Within the context of the research that is conducting, the content of the oriental order is interesting as well as its systematical features and the hierarchy of the formation.

The notion 'space' (orient) has different interpretation according to the sphere of the scientific application. 'The economic orient' means the complex of the labour, the financial, the industrial and the other economic institutions and the relations between them that function and implement on the certain conventional territory within the scales of the interregional, the national, the macroregional and the global levels. Nowadays the main approaches to the studying and the analysis of the economic space are the territorial, the resource and the information approaches.

Though at the modern stage of the global processes development and the settling of the post-industrial society during the observing of the economic orient, the factor of 'the time' is getting the most important that changed considerably the interpretation of 'the competitiveness', particularly for the region.

Now the main approaches to the studying of the analysis of the economic space are [36]:

- the territorial approach interprets the economic orient as the informative territory that includes a lot of objects and connections between them: the settlements, the industrial enterprises, the settled economic and recreational areas, the transport and the engineering networks [1, p. 78-80]. Territorial approach to the economic space is topical one in the pre-industrial and the industrial eras of the development, so long as the evolutional development of the society determined the independency of the established connections that forms the economic orient in the certain territorial limits from the factor of the economic subjects territorial arrangement;

- the resource approach determines the content and the character of the re-distribution of the resources that are accessible for the subjects of the economy. The change of the paradigm of the development from the effective means of the accessible resources conversion to the condition of the effective use of the human capital, the accumulation of the knowledge changed the attitude to resources as to the immediate and the necessary one;

- the information approach regards the economic orient through the information component of the economic process as the form of the exchange within the interplay of the economy subject with the economical orient. This approach to the determination of the economical orient is characterized by the absence of the enough clear alternative positions in the surrounding of this direction, since its appearance is typical in the last decades.

Upon the modern step of the development of the global processes and the settling of the postindustrial society by observing the economic orient, the factor of 'the time' becomes the most significant one that changed substantially the interpretation of 'the competitiveness', including for the region.

The concentration of the economical orient is one of its characteristic, which is defined by the correlation of the quantity of the separate economic processes that

form the all-embracing process to the general quantity of the separate processes that are realized by the subjects of the economy. From the standpoint of the inner characteristics with the increase of the concentration of the economic orient, the time needed for the ending of the transaction is decreasing. The level of the concentration of the economic space influences on the competitiveness of the subject of the economy: the last one is increasing as to the similar subject that is not the component of the given space – from the point of view of the inner characteristics with the increasing of the concentration of the economic space the time is decreasing, needed for the fulfillment of the transaction.

E. B. Alaev [2, p.50] emphasizes first of all the notion of the territory that is the bearer of the production factors and the different production resources. Such territory forms the oriental base of the social activity, the orient where the processes of the reproduction take place and the economic, social and other functions are introduced.

The oriental system, as the category, is the notion that in own content is much broader than the notion ‘the territorial system’. N. V. Pavlikha [7; p. 21] gives the definition of the oriental system in the context of the oriental interplay and the oriental connection of the different character of the elements that function purposefully in the real space. She gives to the oriental system the character of the integrity and the interplay. Especially interesting is her emphasis upon the character of the integrity of the oriental system that in the author’s opinion is the synthetical and the organic.

V. A. Popovkin [8; p. 19] presents the oriental system as ‘the functional-complex, the structural-branch integrity that foresees the certain arrangement of the components of the natural, the social and the economic surrounding in the space, its oriental unity.’

A. Ph. Melnyk [9] regards the oriental system in the aspect of the globalization as the oriental-functional unity that is guided and organized.

From the perspective of the development of such state of the oriental systems V. I. Chuzhykov [5; p.64] emphasizes the acquisition of the special integral paradigm of the regional development, in the base of which lie the complicated united complexes of the different taxonomic level.

O. A. Biiakov states the distinct character of the institution of the oriental-economical systems. To the elements that form the economic space he attributes: the combined economic process, the economic time, the economic competitiveness [6, p.33-35].

Dwelling upon the definition of the separate characteristics of the regional oriental-economical system: ‘the synthetical characteristic’, ‘the integrity’, we can affirm that they concern the content of the artificial supply or the creating of the necessary (exogenous and endogenous) conditions that would guarantee the integral character of the oriental system.

The very notion 'the integrity' concerning the regional oriental-economical system applies as not to the object, and to the process that takes place inside the region.

The application of the content of the integrity emphasizes the fact of the sufficient complexity of the subject under study, in our case – the regional oriental-economical system. It indicates the necessity of the detection of the inner determination of the characteristics of the oriental system institutions and the inadequacy of the explanation of the peculiarity of the oriental systems from the viewpoint of the similar systems influence that surround them on the outside or the processes that take place in the course of any connections of the system under investigation as the component of the other, more complicated oriental system.

Previously mentioned connections and the influences can bear the vertical, the horizontal, the functional or the time character, and their system-forming character form the regional orient. In our opinion, such connection and the influence carry the mutual content. It is characterized by the process of the mutual influence of the oriental-economical systems the one to another that stipulates for the universal form of the dynamic development. Such interaction determines the existence and the structural organization of the regional oriental-economical system, its integration, equally with the other systems, into the oriental systems of the higher level and the acquisition of the characteristics of the other oriental-economical systems and the phenomena.

The character of the interaction of the regional oriental-economical systems is such correlation in the course of which the cause and the consequences of the economic processes are in the constant dynamic change the one by the other. This causal connection determines such important feature as the cyclicity of their development, and the period of the fluctuation has the proportional dependence on the scales of the oriental institutions.

The cyclicity of the development stipulates for such following important gradual inherent feature of the oriental-economical systems as the dynamism that is the constant development and the transformation. As we see the dynamism and the transformation of the regional oriental-economical systems can take place only within the limits of the steady development, the supply of the needed economic, social and other standards for the separately distinguished oriental system.

The dynamism of the regional oriental-economical systems development takes place under the conditions of its relative invariability, the conservation of the proper structure, the steady functioning within the limits of the certain time period and the ability to remain invariable, stable concerning the outer pressure without the necessity of the transition into the new other static condition. That is, in our opinion, the endurance of the oriental-economical systems is the necessity and the possibility of the preservation of the static condition of the development within the limits of the certain time interval under the conditions of the direct exogenous

influence.

The clear mechanism of the regional oriental-economical system elements interplay determine the steady character if the inner surrounding of the system. This feature of the oriental system is distinguished as the smergen [7, p.38]. The emergence of any unregulated connections inside of the oriental-economical system or their chaotic accumulation or the disappearance forms the appearance of the endogenous inner factors that lead to the destabilization of the inner situation in the system.

V. N. Sadovski [8, p.44-46] is prone to affirm about the opportunity of the manageability of any system institution, including the oriental system. That is the processes of the oriental systems development can be planned and stipulated.

Summing up the afore-cited, we can assert that any oriental-economical systems are characterized by the following features: the cyclicity, the cyclic dynamic development under the condition of the steadiness concerning the exogenous and endogenous influences, the complicated character of the outer and the inner connections, their constant character and the clear mechanism of the interplay, the ability to be manageable and planned.

The cited features are interrelated and mutually dependent. Really, the dynamism, peculiar to the oriental system, by M. M. Gabrel's definition [9] characterizes the changes of the states of the connections elements and the relations in time and is connected with the existent in the oriental system the opportunities concerning the changes of the roper parameters and the state in the certain time interval with the purpose of passing the stages of the development: the origin, the formation, the development, the transformations, the decline and so on. Thus, the dynamism of the oriental-economical system lies in the space of its constant improvement and takes place under the conditions of its relative invariability, the preservation of the proper structure, the steady functioning within the limits of the certain time period and the ability to stay invariable and stable concerning the inner pressure without the necessity of the passing into the new static condition. Ipso facto, the endurance of the regional oriental-economical system is the necessity and the possibility of the preservation of the static condition of the development in the limits of the certain time interval under the conditions of the direct exogenous influence.

The development of the regional oriental-economical system takes place according to the conception of the economic cycles theory and is the process of the interplay and the oriental connection of the production elements, the financial and economic, the infrastructural, the institutional and the social characters that have the complex endogenous character, function purposefully in the real space in the sizes, the proportions, the scales with the purpose of the supply of the constant advancing development both the separate key elements and in general – the oriental system.

Dwelling upon the determination of the space as the interplay between the objects and the phenomena of the oriental-economical system, it is necessary to notice that this space doesn't limit only the geographical space. It can be explained, in our opinion, by the fast development of the oriental connections that nowadays acquire the different shapes and the content. Until quite recently it was asserted that the oriental connections have the look of the complex of the interrelated objects for which the oriental characteristics have the decisive significance.

Taking into account the fast development of the information technologies and the influence of the global processes the oriental connections acquire the shape of the interrelated objects of the exchange of the products, the energy, the information, the assets and the passives that have the purpose of the supply of the vitality and the functioning of the oriental system. Thus, the oriental interplay acquires the endogenous and the exogenous character.

The process of the interplay and the oriental connection of the elements of the oriental system has not only the endogenous and the exogenous character as it was approved earlier, but also the direct and the reverse character.

The direct vector of such interplay bears the positive character as creates behind the limits of the oriental system the outer competitive surrounding for the activity of the very system.

The forms of such institution behind the limits of the oriental system can be any political, financial and economic, institutional and social institutions.

The reverse vector of the interplay, in our opinion, bears both positive and negative character. In the positive aspect it can further the filling of the additional characteristics of the content of the elements of the oriental-economical system. On the other hand, the negative character of the reverse vector of the interplay can cause the changes in its certain part and this surely breaks the general order of the elements of the oriental system and directly influences the cyclicity.

The violation of the integrity of the oriental system can change the structure and the functional peculiarities, within the certain time interval it will negatively influence the endurance of the oriental-economical system and its smerging.

The analyzed characteristics of the oriental-economical system elements indicate their close direct and reverse interrelation and their complex character. The complex character of the interplay of the elements of the oriental-economical system supplies the advancing development of the oriental-economical system.

In our opinion the diverse character of the complexity cause the formation and the functioning of the oriental-economical systems of the different aspect and the hierarchy. It means the regional oriental-economical system can be not only the region but also the interregional, the transboundary, the macroregional institution.

Dwelling upon the highest section of the oriental-system institution we can emphasize its supernational character that acquired the features of the global scale. Yu. N. Gladki [10, p.129] basing on the definition that was put into circulation by

K. Schmidt in the work 'The space and the Great space in the matter of nations' gives the following definition for 'the Great space' – not only for the economic potential but also the complex of the similarity of the state ideologies, the common conception about the way of life, the correlation of its material and spiritual values. The integration of the separate countries occurs not so much on the base of the natural-geographic unity of the place of location and the development, the unity of the cultural, the ethnic, and the religious principles as it bases on the economic component. This fact stipulated for the appearance of the definition 'the economics of the Great space'.

The conception of 'the economics of the Great space' lies in the development of states as their aspirations for the attainment of the greatest oriental possibilities that spread on the whole complex of the spheres of the human life. The present time demands the other interpretation of the content of 'the economics of the Great space'. In our opinion, 'the Great Economic Space' is the result of the economic integration of the oriental systems of the macro level with the purpose of the dominance within the limits of the system of the international economics. Such form of the supernational association set the purpose of the supply of the constant dynamic development for the participants that form such oriental institution.

'The Great Europe' [11], the USA and Japan are members of the defined great economic space. Though, the formation of the United Europe from 15 to 27 countries is the positive fact, but in the author's opinion EU only acquires the features of the element of the great economic space and is not quite formed center of this oriental-economical system. That's why in the given investigation we consider EU as the element of the great economic space that hypothetically is forming and doesn't take up all qualities and the peculiarities till the end. At the same time the development of the regional oriental-economical systems as the elements of the great economic space depends on the influences of the macrosystems both positive and negative ones, and under the conditions of the direct influence of the administrative levers (the macroregional, the international and the regional levels) has the capacity to reach the stable dynamic development.

V. Semenov-Tian-Shanski [12] in 1929 promulgated the own conception of 'the anthropography', where he put the basic directions of the formation of the theory of the oriental way. In particular, he proposed the economic-geographic zoning on the base of the selection of the integral locations in the economic-geographic relation of the locations: the examination of the administrative-economic territorial systems as the combined result of the action of the natural, the historic, the economic and the cultural factors of the development of the territories; the examination of the human economic activity as the important chain in the formation of the territorial systems on the base of the geographic factors. The peculiarity of the approach of Semenov-Tian-Shanski to the oriental system way was that it was based on the combination of the natural-geographic, the biological,

the historic, the racial, the ethnic and other factors as the basic causes of the development of the territorial systems.

S. P. Sanko, V. V. Kulishov, V. I. Mustafin put into the content of the oriental organization the conception of the territorial-industrial complexes on the base of the theory of the economic zoning with the strict regulation of the economics [13, p.9].

The supporters of the theory of the economic zoning were examining the selection of the ways of the best usage of the regional possibilities, the detection of the priorities of the development, the aims and the tasks of the regional policy ingenuously in view of the processes of the zoning of the country's territory [14; 15; 16]. In the basis of the theory of the economic zoning the conception of the territorial-industrial complexes was put, that was developed on the base of the geo-economics problems of the regions' development [17]. The development of the theory of the economic zoning caused the appearance of the new scheme of the social-economic zoning of Ukraine [18].

The new approach to the oriental system was provoked by the sharpening of the structural and the financial-sectoral problems in the infrastructure and was demanding the clear prompt response from the state administration. Really, D. M. Dolishi's approach to the direct connection of the oriental system with the character of the state administration indicates the manageability of the oriental-economical system, its ability to reach the stable dynamic development under the conditions of the direct influence of the administrative levers.

In the author's opinion, such administrative influence can be examined as the supply of the stable development of the oriental-economical systems. Actually that's why Ph. Ratzel [19] calls the orient 'the important component of the statehood' and in the base of such interpretation he puts 'the oriental conception' where 'each community' possesses the own idea about the boundaries and the possibilities of their economic and political usage. But Ratzel doesn't stop only on the connection of the oriental-economical system and the statehood, though he offers to examine a state as the biological organism with the cycle character of the development, on the base of this fact he grounds the necessity of the expansion of the living space of the economic systems.

In our opinion, such expansion of the living space is not connected with the content of the expansion of the economic system geographically. In the oriental aspect it acquires the shape of the exogenous influences due to which the creation of the necessary conditions for the expansion of the space takes place but in the limits of the other oriental-economical system that responds such exogenous influence.

N. V. Pavlikha [20, p.28] examines the expansion of the living space of the oriental-economical systems as the basis of the formation of the theory of the stable oriental development. The geopolitics is examined by one of such directions

concerning the dynamism of the organization of the oriental system. Though, the orient is examined as the dominant element in the geopolitics but it is not examined as the result formed due to the interplay of the system of the neopolitical factors with the regularities of the political and the social-economic development of the regions.

It is necessary to dwell upon the fact that to the factors of the economic and the social development of the regions as the oriental-economical systems and the more enlarged systems are attributed: the economic and the technical development, the financial system, the level of the social integration, the politic stability [21]. But the above mentioned factors of the social-economic development of the regional oriental-economical systems are proposed by the American economist and the scientist, N. Speakman, are not quite urgent today.

Since, in our opinion, the character of the use of the content of the notion ‘the geopolitics’ as ‘the geographical mind’ of the state [22, p.13] with the change of the industrial society to the postindustrial one and the information society caused the appearance of the notion ‘the geoeconomics’. In the following chapters of the investigation we will dwell in detail upon the change of the approach concerning the achievement of the purposes by means of the solution of the political tasks by the economic methods especially as because to our mind, in the outer surrounding the geoeconomic interests have the greater priority than then the geopolitical ones. It is confirmed also by the fact that the appearance of attempts of the stipulation of the theoretic subsurface in the economic science according to the modern processes of the enlargement of the oriental systems [23] is the incontestable fact of the attainment of the geoeconomics in the foreground within the context of the oriental system.

The content of the development of the conception ‘Nomos’ as the main theoretic foundation of the geoeconomics is the display of the peculiar synthetic combination of the different factors that are stipulated by the creation of the economic systems that have to be kept by the political and the legal systems that ensure. Though, in the modern science the geopolitics is examined as the independent scientific direction but a lot of the scientists interpret it as the political aspect of the geoeconomics.

To our mind, interesting is the notion of the geoeconomics, presented by V. A. Dergachov, which is inclined to assert that the geoeconomics is the strategy of the economic development in the multioriental communication space under the influence of the inner and the outer factors that ensures the high quality of life in the given place and the social time [24, p.12].

Returning to K. Schmidt’s approach [25] concerning the theory of ‘The great spaces’ and the synthesis of the content of the geoeconomics, above presented by V. A. Dergachov, we can assert that the main content of the enlargement of the oriental development that is the preface of the development of the oriental systems

is the supply of the high quality of life within the limits of the proper oriental-economical system due to the exogenous and the endogenous factors. Properly E. G. Kochetov [26, p.12] presents the world economic space as the synthesis of the most important processes of the international economic activity, its going into the dominant positions.

If taking into account the theory of 'The great space', it means that the going of the economic orient into the dominant positions, the character of the formation and the dynamism of its development are stipulated by the general tendency of the globalization of the social-economic processes [27, p.38-39].

The content and the problem of the oriental organization and the development lie in the plane of the development of the oriental economics. A. Veber and G. F. Tiunen [28, p.53-54] grounded the necessity of the oriental approach in the economics, presented the content of the oriental factor and the expenses for the oriental equipment.

The industrial era of the development put the problems of the oriental system in the context of the economic orient dependence on the availability of the strategic resources within the limits of the oriental system. That's why the determinant factors that influence the placing, A. Veber calls the transport expenses, the labour expenses and agglomeration.

The development of the theory of the oriental system stipulated the appearance of the definition of the notion of the economic field of regions or the field of the economic gravity of regions [29, p.111-115]. In our opinion, J. Keynes [29, p.44-47] put the content of the creation of the self-sufficient oriental-economical system into the notion of the economic field of the region. Only under the conditions of the self-sufficiency the significance of the content of the investment projects for the regional oriental institution increases abruptly. Such J. Keynes' treatment of the oriental system, to our mind, found the proper reflection in the spontaneous formation of the centers of the exogenous influence (the competitive centers) both the strategic and the self-sufficient oriental-economical systems.

With the development of the society the approaches of the scientists to the explanation of the oriental system economic order were changing. For example, the main necessary element of the economic and the oriental integral process G. Rudolf, K. Kosutski, J. Atkinson were examining the capital.

It is necessary to take notice of that the majority of researchers of the oriental system economic order development problem, including the regions, in the central place of their theory put the certain center that is the motivation factor of the oriental dynamism. For example, F. Brodel [30] calls such centers as 'the world of the empire' or 'the world of the economics' that during the long years were exploiting intensively their peripheral regions-colonies. But the founders of this theory that is also called the economic world system oriental-time theory, come to

the conclusion that in the case of the lack of the dynamic development of the peripheral regions-colonies, they firstly acquired the shapes of the depressed ones and in the consequences acquired the political and the economic independence.

Skochpole, J. Modelski to the centers of the motivation factors refer the powerful transnational companies (PTC) that are situated in the certain oriental territory (to our mind, the author meant the placing not of the departments, but the central offices). In this case such oriental-economical system acquires the new qualitative competitive advantages.

Friedman, J. Scott as the centers proposed to examine the megalopolises of the world level for which they give the dominant role in the content of the globalization of the world economics.

Especially uncompromising is the approach of S. Unter, R. Nelson, V. L. Makarov in the context of the evolutionary economic theory, in the base of which is the action of the competitiveness that has the global and the frankly aggressive character concerning the resources, the product markets and the capitals.

The self-sufficient and the active development of the regional oriental systems due to the stimulation and the consolidation of the inter-branch connections with taking into account infrastructural projects underlay the base of theory of growth poles of F. Perrou [31] and W. Aloto. To our mind, the economic views of F. Perrou the most closely approached to grounded interpretation of theoretical bases of development of oriental-economical systems that will be examined in detail in the following parts of this book.

A.P. Dubnov [32, p.126] dwells upon the character of change of geo-economics systems and referring to theories of I. Wallerstein and F. Braudel asserts their cyclic character of development. Meanwhile the period of their fluctuation is long-term and is characterized by processes of formation, expansion, compression, rupture, differentiation, integration, disintegration, breakup of geo-economic spaces.

Thus, in our opinion, each oriental-economical system is characterized cyclic content of development meanwhile the period of fluctuation directly depends on scales of oriental formation and the stable development consists in the base of any cyclic fluctuation of oriental formation.

In 1992 in Rio de Janeiro in world conference the sustainable development was considered as the creation of social oriented economics that is based on reasonable usage of resource base and preservation of the environment that doesn't endanger the existence of prospective generations and corresponding satisfaction of their needs. Thus, the notion of over durable inter generation dimension is introduced into economic policy that has acyclic character.

In modern science the notion of sustainable development was examined in the light of ecology but it directly concerns and has to do with general economic and

social criteria. Nowadays the definition of 'sustainable development' is explained as the sustainability of biochemical cycles and reduction of disparities by all levels: from global to local on the base of new pattern of development that should balance economic, social and ecological criteria.

The economic aspect of sustainable development is connected with the transition from modern 'economics of resources' using' to economics of their system usage. Nowadays we deal with the first type of economics that in practice means the advantage of short-term assets. This tendency is especially intensified under the conditions of formation and development of virtualization of economics. But resources are things human finds in the environment. Therefore there is a necessity to put question concerning this sphere: bio, techno, and social spheres as the basic context of development.

From methodological viewpoint it means the recognition of leading role of long term and structural and technological factors in economic development. That is, the sustainable development is the new interpretation of already known method of reproductive process according to its content.

Under the conditions when in modern literature the notions of social and economic balance of economic development was become consolidated the notion of reproductive process didn't bear the new content load for economists. It should be marked that the negative reaction of deviation of this term is also concerned with this fact. However it is important to determine the content of question, to support the motion of world science and practice of administration behind this terminological cover accordingly to right chosen direction. Although some economists express themselves that the phrase 'sustainable development' is put into circulation of economic terms and undoubtedly moves with resolute step to necessary direction [33].

The content we understand as the formation of economic system of sustainable development as the process of development and improvement of 'reproductive economics'. The strategy of economic development corresponds to that system that is based on the normalization of resource cycles that expects the establishment and common control upon the processes of reproduction of labor, capital and natural resources.

In developed economics of sustainable development is filled with new content. The west economists assert that way to sustainable development is made by market and only by market. But new order that is in the system of world economics doesn't have anything common with transition to sustainable development in reality according to assessment of many observers.

The sustainable development can be interpreted as expansion of the notion of complex regional development, the transition from inter branch peg of separate manufactures to system management of all complex of economic social and demographic and ecological processes in certain territory, concentrated solution of

questions of arrangement of production and formation of population.

The necessity of transition to sustainable development is conditioned by deep imbalance of reproductive mechanisms. The following directions of reproductive processes are examined: reproduction of population, reproduction of capital resources.

The following factor that dictates the necessity of transition to sustainable development is the intensification of interregional differentiation. The growth of variation of individual incomes per capita of population or non-conditioned high concentration of finance resources in certain territories can be included into positions of interregional differentiation.

The third factor that conditions the process of sustainable development is the institutional one. It is conditioned by the fact that imagination about automatism of market is just only with using of resources. And vice versa, the reproductive processes become complicated under the conditions of market economics. They occur more often out the limits of market, in particular:

- the reproduction of manpower resources – in the family and systems of education, public health and recreation;
- the reproduction of biological resources in corresponding subsystems of biospheres; reproduction of knowledge and business skills occur in such non-commercial spheres of activity as science and culture.

That is, as we can see the solution of problem of reproduction needs the creation of own institutional structure the base of which the regions should be as the specialized reproductive systems.

The modern regional economic science asserts that nowadays the question concerning institutional supply of sustainable development is not only solved but isn't raised.

The regions should become the basic organizers of institutional supply of 'transition of subjects to sustainable development' [34, p.18]. It is determined by objective place of bases of reproduction:

- of the space of interaction of resources subsystems [35] and existence of certain set of subjective signs such as experience of arrangement of territory;
- of an opportunity of support to corresponding scientific and project institutions.

Thus, if sustainable development is the transition from 'economics of resources' using' to economics of their system reproduction than the role of leading link in this process should be played not by industrial structures – enterprises, but by reproductive ones – regions.

With this purpose they should not only react to propositions of enterprises but also appear as leaders of economic development, singling out complete complexes of environment and separate parts of territory that are specially conditioned for commercial activity.

The subjects of reproductive process are regional and local administrations that are from economic viewpoint:

- The non-commercial structures oriented to political aims.
- The monopolists as in one region there cannot be two administrations [35].

We can see in above-mentioned information the non-commercial structures are leading link in economic sustainable development.

The very content of regional space changes because to the content of regional formations participation in oriental order, their sustainable development. N. V. Pavlikha [36, p.17] gives the following definition of regional orient as ‘multilateral formation of human, industrial, natural, functional and informational components where on the base of usage of existing resource supply the living cycle of region is realized that gives a possibility to solve certain social, economic and ecological problems. This notion covers all regional systems within the limits of which the certain community of people (society) and that have concrete aims of development’.

Summing up the mentioned information we can assert that regional oriental-economical system is an element of state, macro regional and global economic spaces that has distinctly expressed hierarchical structure the development of which corresponds to cyclic law and undergoes to different influences. The main problem of oriental regional development is the supply of competitiveness of regions with taking into consideration of global influences and with the purpose of supply of oriental unity, sustainability and management.

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2.2. Analysis of contemporary ecologization problems use of transport land

The realities of the twenty-first century characterize the present anthropogenic activity as a way of generating profit, which at the same time ought not to be too costly in monetary terms. This fact means that entrepreneurs and manufacturers are ready to consume and exhaust natural resources without damages and measures to protect them.

Sustainable economic development of the world community is impossible without solving environmental problems, and if political or economic interests have conflict with environmental ones, preserving the integrity of the ecosystem ought to dominate.

Transport is one of the most important infrastructural branches of material production, which ensures the production and non-productive needs of the national economy and the population in all types of transportation. The transport system is one of the basic branches of the economy, the stable functioning of which provides the necessary conditions for defense, national security, the integrity of the state, and raising the living standard of the population.

Today, the transport sector of Ukraine is a significant and important segment for the country's economy, because efficient and coordinated work of the whole transport system is a moving force for the overall development of the country. The development of integration processes and the growth of the market competitiveness of transport services requires new approaches to the development of transport relations and the creation of new technologies and the improvement of service quality.

The development and issue of the formation of the mechanism of ecologically safe use of land transport and issues of environmental impacts are considered in the scientific works of I. Bistryakova, V. Golyana, S. Ibatullina, A. Martin, I. Novakovskaya, A. Sokhnycha, M. Stephenya, M. Khvesika ., D. Dobryaka, O. Budzyak, N. Bondarchuk, I. Zaporozhets, V. Boychenko, V. Boychuk, F. Goncharenko, I. Yevgenyev, D. Prusenko, V. Skorchenko, A. Slavutsky, N. Solenkov, N. Ornatsky, Y. Khomyaka and others. However, a critical analysis of literary sources has shown that many issues that determine the development of an ecologically safe land use system are not legally regulated. Problems, risks and risks in this area, which affect the level of its efficiency, are also unresolved, and measures are being taken to continually restore soil fertility, protect land from degradation, and so on. Therefore, the study of the effectiveness of ecologically safe land use in Ukraine will have a significant scientific and practical significance [7].

The main purpose of research is the substantiation the concept of modern problems of ecologically safe use of transport lands and determination of the main mechanisms of implementation and development of the ecologization system.

At the present stage, the integration of domestic transport infrastructure into the European one, which creates conditions for the progressive country development, strengthening the economic security of the state, increasing the competitiveness of the transport network to increase transit traffic and tourism development. Therefore, the necessary attention should be paid to comprehensive measures to eliminate the harmful effects of vehicles on the environment, in particular on human livelihoods [13].

There are the main facts about the influence of harmful substances on human health as a result of the operation of any transport modes:

- pollution of the atmosphere with the formation of acid rain, highly poisonous and destructive substances as a result of secondary chemical reactions, including photochemicals;

- climate change in the Earth on the basis of increasing the greenhouse effect, methane emissions and other low-concentration gases, aerosols, light radioactive gases, changes in the concentration of ozone in the troposphere and stratosphere;

- pollution of the ocean, burial of toxic and radioactive substances in it, saturation of its water with carbon dioxide from the atmosphere, exposure to anthropogenic petroleum products, heavy metals and complex organic compounds, acidification of shallow water due to pollution of SO_x and NO_x in the atmosphere, breaking of normal environmental bonds between the ocean and the waters of the land due to the construction of dams on the rivers;

- prolonged accumulation of poisonous and radioactive substances, household rubbish and industrial wastes on the surface of the earth, practically not decomposable and very stable, such as polyethylene products, other plastics;

- deterioration of the living environment in cities and rural areas, increased noise exposure, air pollution by industry, vehicles, human visual impairment of high buildings, tensions in urban life and the loss of social ties between people;

- absolute overpopulation of the Earth and relative demographic recession in its individual regions;

- reduction of the area of tropical and northern forests, which leads to an imbalance of oxygen and an increase in the disappearance of species of animals and plants;

- formation of ecological niches during the above-mentioned process and filling them with pests, parasites, pathogens of new diseases of plants and animals, including humans [11].

Non-compliance with environmental safety requirements leads to the emergence of new incurable diseases and the possible reduction of human populations. The mechanism of regulation of these populations may become epidemics. In nature, this is a habitual process that relates to environmental factors that depend on population density. Naturally, there must be new, still non-existent diseases, such as "illness of the legionnaires" (it is the bacterial infection, which is

characterized by severe pneumonia, severe intoxication, as well as disorders of the central nervous system and kidneys).

To compare the effects of harmful substances, authors have considered the most common and popular types of transport: automobile and aviation.

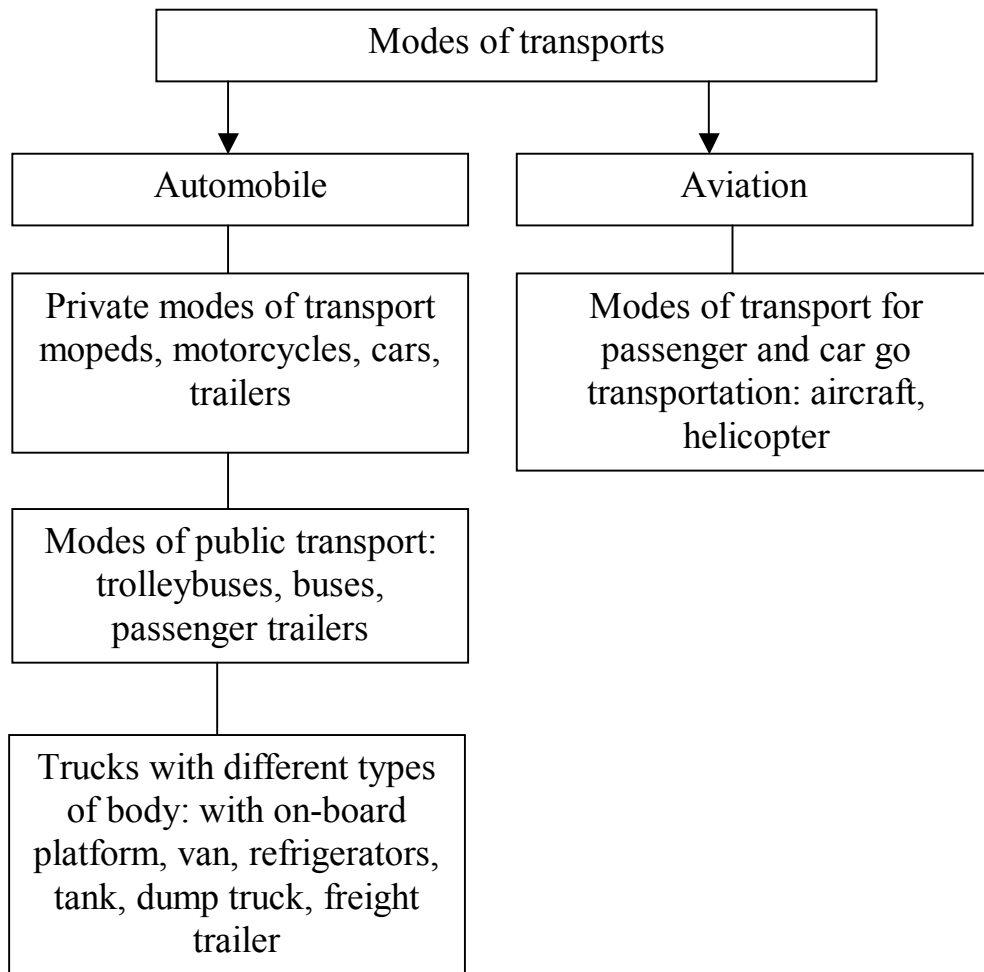


Figure 1. Varieties of modes transport in the aviation and automobile transport systems [21]

So why, nonetheless, do the international community choose automobile and aviation transport services? Information in Table 1 shows the advantages and disadvantages of their work.

Consequently, the main advantage of aviation mode of transport is the speed of transportation and accessibility to distant corners of the world, in contrast to road transport. For example: automobile transportation at a distance of 1,700 km takes 1 day, while the aviation transportation at a distance of 13,000 km takes again about 1 day.

In turn, the advantages of road transport are high maneuverability, mobility and regularity of transportation and small capital investments compared to costly financially aviation transport.

Table 1

Comparative analysis of the advantages and disadvantages of using automobile and aviation modes

N	Mode of transport	Advantages	Disadvantages
1.	Automobile	High maneuverability and mobility; • Ability to ensure regular delivery; • Delivery of products without intermediate congestion and directly from the consignor to the consignees; • Less stringent requirements for product packaging; • Small capital investments in the development of small cargo turnover for short distances	Relatively high transportation costs; Emergency state of the Ukrainian road network; Urgency of unloading (high cost of downtime); Dangerous effect from emissions of harmful substances into the environment
2.	Aviation	The speed of delivery of goods; Shortages in comparison with other modes of transport; Ability to reach distant and hard-to-reach areas	The speed of delivery of goods; Short routes compared to other modes of transport; Ability to reach distant and hard-to-reach areas

At this stage scientific and technological progress, which got the unprecedented and huge scale today, and characterized by the continuous creation of new and improved existing technologies and modes of production, the aviation and automobile industries in turn, are the realization of new achievements and success in the practical aspect of application. There are the development of new ground and airborne equipment; creation of powerful engines; fleet and vehicle fleet renewal, also designing new modes of transport. But along with such positive achievements at the first glance, aviation and automobile transport remain a large source of harmful factors for the environment, the first of which is usually in the vicinity of large cities, and the latter, in turn, within large cities. Therefore, the current situation leads to the need to develop and implement a comprehensive program of environmental safety in air transport activities [12].

Consequently, now it is very important to study and research the existing problem, which depends with implementation of the functioning mechanism and development of the ecologization system. So, let's first look at what are the most ecologically dangerous factors from the operation of aircraft and ground vehicles

that have a direct impact on the environment, including the vital functions of living organisms, human health, and what harmful effects might be observed as a result of such influence.

Table 2

Ecologically dangerous factors at work of aviation and motor vehicles having an impact on the environment

N	Factors	Consequences
Aviation modes of transport		
1.	Emission	Respiratory disease (human) Toxic symptoms (human, animal, other living organisms) Discomfort in the normal development and functioning of living organisms
2.	Emissions of combustion gases	Global warming Changes in climatic characteristics of different regions
3.	Environmental condition within and outside the airport	Contamination of the surrounding territories of the land fund and the environment in as a whole
Automobile modes of transport		
4	Emissions (CO ₂ (carbon dioxide) C (soot), C _m H _n NO _x)	Violation of soil cover, roadside pollution, respiratory diseases, oncology, life expectancy reduction

Pollution by the transport of the environment happens in consequence to emissions into the atmosphere of products of fuel combustion, weathering of bulk cargoes during transportation, evaporation of petroleum products, etc. Thus, when transporting oil cargo by rail, the amount of carbohydrate compounds entering the atmosphere is twice that of cars [3].

As a result, of the process of combustion of fuel is the formation of new environmental-dangerous, gaseous, liquid and solid substances, which are derivatives from chemical elements, combinations and formations contained in the original fuel, as well as in the composition of the original fuel, and already as a result in the composition atmospheric air entering the combustion. Chemical elements that combine fuel and air substances interact with each other, and undergo a certain thermal treatment, turn into emissions of combustion products into the environment.

Table 3

Harmful emission of automobile transport mode

[According to the researchers of the Chemotology Center of the National Aviation University]

Kind of engine	Waste gas, %			Crankcase gases, %			Fuel evaporation, %		
	CO	CH	NO _x	CO	CH	NO _x	CO	CH	NO _x
Benzine	95	55	98	5	5	2	0	40	0
Diesel	98	90	98	2	2	2	0	8	0

Fuel pairs are harmful and poisonous. Their accumulation in the air and on the surface layer of the soil is a danger to humans and the environment, and it can lead to fires.

But still the greatest dangers in this case are:

- changes in the physical, chemical and biological characteristics of the ecosystem;
- violation of the course of natural biological processes;
- the formation of microbiological cleavage resistant even more toxic compounds that contain carcinogenic and mutagenic qualities [3].

There are spills, sewage and emissions, which are the main sources of soil pollution by hydrocarbons. The penetration of such harmful substances into the soil leads to an active change in the chemical composition and soil structure. It is impossible not to notice that in the first turn such influence is reflected on the humus horizon, that is, with the increase the amount of hydrocarbons in it, the quality of the soil sharply deteriorates as a nutrient substrate for plants. Consequently, contamination of soil with hydrocarbons of oil and petroleum products leads to a sharp violation of soil microbiocenosis, and a long-term negative effect on soil animals, causing elimination in the intensive pollution zone.

Table 4

Degrees of soil pollution by oil products [According to the researchers of the Chemotology Center of the National Aviation University]

N	Degrees of pollution	Value, mg/kg
1	Non-Subsurface Resources	Before 400
2	Slack	3000-6000
3	Medium	6000-12000
4	Strong	12000-25000
5	Strongest	<25000

Table 2 clearly shows that for the back soils, which are concentrated in the center of Ukraine in most cases, the lower limit of weak pollution of hydrocarbons is 3000 mg / kg, which is considered like a relatively acceptable level. At the same time, special measures are required to rehabilitate soils that are contaminated above the permissible level, which is 10,000 mg / kg [6, p. 373].

In some cities, the specific gravity due to vehicle contamination in general contamination exceeds 50%. As a result more than 200 dangerous toxic substances form. These substances include carbon monoxide, sulfur, nitrogen, lead and its compounds, soot, polycyclic aromatic hydrocarbons complex (SAWs)) and separately benz (a) pyrene. Exhaust gases, products of wear of mechanical parts and tires of vehicles, as well as road cover, account for about half of the atmospheric emissions of anthropogenic origin. In accordance with the differences in the quantities and types of pollutant emissions it is expedient to consider separate internal combustion engines (especially two-and four-stroke) and diesel engines.

Table 5

Influence of exhaust gases of cars on human health [16]

Harmful substances	Consequences of impact to the human body
Carbon monoxide	This substance prevents the absorption of oxygen by blood, which weakens mental faculties, affects reflexes, causes drowsiness and may cause loss of consciousness and death.
Lead	This substance influences on the circulatory, nervous and genitourinary system and causes decrease of mental abilities in children, deposited in bones and other tissues, therefore dangerous during the day
Nitrogen oxides	These substances might increase the body's ability to viral diseases (such as flu), irritate the lungs, and cause bronchitis and pneumonia
Ozone	This substance irritates the mucous membrane of the respiratory system, causes coughing, asthma, bronchitis, disrupts the lungs, reduces resistance to colds, and also might exacerbate chronic illness, causes
Toxic emissions (heavy metals)	These substances cause cancer, break function of the reproductive system and defects in infants
Toxicity of air pollutants for plants	
Dioxide of substances	It is the main pollutant and a poison for assimilation organs of plants, which operates at a distance of up to 30 km
Fluoride hydrogen and tetrafluoride silicon	These substances are toxic even in small quantities, prone to the formation of aerosols, operate at a distance of up to 5 km
Chlorine, hydrogen chloride	These substances prevent mostly at a close distance
Lead compounds, hydrocarbons, carbon monoxide, nitrogen oxides	These substances infect plants in areas of high concentration of industry and transport
Hydrogen sulfide	It is cell and enzyme poisons
Ammonia	It prevents plants mostly at a close distance

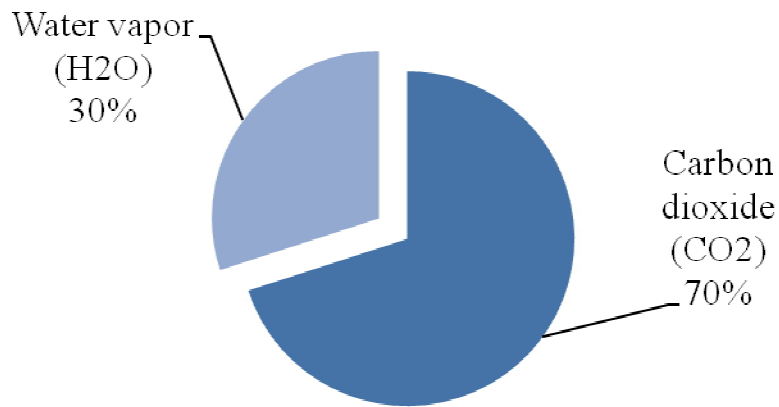


Figure 2. Total amount of aviation engines emissions and their types

So, figure was depicted that about 70% of emissions from aviation engines is carbon dioxide (CO₂), 30% of emissions from aviation engines – water vapor (H₂O). The listed harmful substances are got into the atmosphere as a result of combustion of fuel by evaporation, leakage and emissions [6, p. 365].

Obsolescence or the destitution of norms and standards for the allocation of land for construction are important facts that back off the organization and further development of the ecologization system of aviation transport land use. In turn, international environmental norms and ISSO standards, which are used by domestic producers and entrepreneurs, do not respond with the conditions under which these standards have been drawn up. Only until 2017 the norms of land allocation for airports SN457-74, which were approved in January 1974 by the State Building of the former Soviet Union, were valid. For this period, airlines use norms DBN45.2-4.01-98, which are also obsolescence [14].

Reducing the impact of transport modes on the environment and humans is possible due to thorough study of the problem, adherence to environmental principles of designing roads and runways, because level of transport impact on the environment depends from the correctness of these works. Herewith the level of transport impact on the environment depends from the environmental factors attached to designing roads, aerodromes, airport and automobile canvas.

In the countries of Western Europe, North America and Japan, environmental problems, which include the using of hydrocarbon fuel, have begun to be solved since the 1960s.

To date, International Civil Aviation Organization (ICAO) remains the active and most powerful research organization in the field of research aimed at creating environmentally sustainable programs to reduce the harmful effects of the aviation transport system on the integrity and acceptable functioning of the ecosystem. In turn, The International Road and Transport Union (IRU), which plays an important role in establishing an international legal framework, developing trade and security

of the population, also solving the environmental problems, regulate the work of automobile transport at the international level [3].

The international organization IRU carries out the next actions for the reduction of harmful substances emissions and noise influence into the atmospheric air, soils, water objects:

- control over the exact observance of the works implementation;
- concentration of construction machinery and mechanisms that are not involved in a single continuous process in the work time;
- restoration of disturbed during repair and construction works and creation of new forest protection plantations;
- installation of noise protection screens when the projected roads cross the residential building;
- prohibition of work in residential areas at night;
- exclusion of untreated discharges into the aquatic environment and adjacent territory;
- the establishment of boundaries of water protection zones;
- removal and storage of plant soil on specially designated areas, which will be used at the next reclamation;
- removal of surface water from the construction site, construction of culverts and purification of the existing drainage system for prevention waterlogging and flooding of the territory;
- prohibition of the construction waste storage outside specially designated places of temporary storage with subsequent removal from the territory of the area under development;
- technical and technological reclamation of disturbed lands.

The international organization IRU carries out the next actions for the reduction of harmful substances emissions and noise influence into flora and fauna:

- exclusion of tree felling outside the land strip;
- protection root crests and trunks of trees from the soil embankments, which are situated near the building;
- installation of a mesh fence along the road sections where penetration of animals into the ancillary part is possible;
- ensuring the migration of animals in places of passageways, bridges, overpasses, culverts, etc.

In addition, land legislation is not allow the using of such design decisions that might influence the changes of hydrological and hydrogeological regimes, the emergence and activation of endogenous geological, geodynamic and physico-geological processes, changes in flora and fauna. Design technological solutions ought to provide for minimal impact on the natural environment and the preservation of a stable natural balance in the performance of works violations of which might cause changes in geological or environmental conditions [12].

The ICAO organization imposes restrictions on noise impact and maximum permissible standards for the emission of harmful substances the consequence of the operation of aviation engines. These actions carry out for the protection of land masses within the framework of the operation of air companies, as well as in the territories beyond its borders, the distances of which are established in accordance with the requirements of standards and standards for the allocation of land for construction. As you know, the fuel of hydrocarbon nature is more or less ecologically dangerous.

At present, the ICAO carries out the emissions normalization of unburnt hydrocarbons (CnHm), carbon monoxide (CO), nitrogen oxides (NOx) and smoke from turbo-propellers and turboprop engines in the airport area, as well as the emissions of fuel residues after engine stops. The requirements for international standards for subsonic aviation are distributed by smoke to engines that were manufactured after 1982.

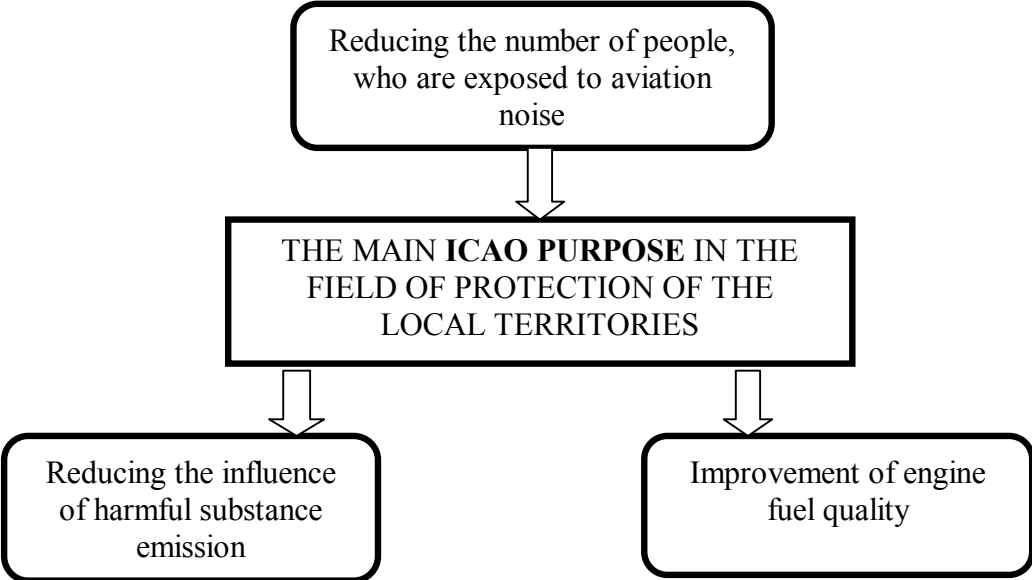


Figure 3. The main ICAO purpose in the field of protection of the local territories

Scientists` researches are an important point, which is aimed at producing environmentally friendly fuel. Under this notion ought to be understood as the state in which at all stages of the life cycle fuel does not provide or has the minimum permissible negative impact on the environment and does not pose a threat to the life and functioning of living organisms.

Therefore, after researching and analyzing a number of problems in the functioning of the transport system, namely automobile and aviation modes, we will consider potential ways of solving and improving the ecologization system.

Table 6

Potential improvement ways of the ecologization system of aviation and automobile transport land use

N	Mode of transport	Potential improvement ways
1	Automobile	Development Strategy of the automobile transport
		Development and improvement of the normative-legal base on issues of environmental
		Development and improvement of the methodological base on environmental protection issues
		Application of the latest materials for the construction of highways and adhere to the main principles of architectural and landscape planning
2	Aviation	Development Strategy of the airports and airfields networks Ukraine
		Ecologization of warehouses of fuel and lubricants at airports
		Using of aviation alternative kinds of engine
		Implementation of the environmental management system at the airline enterprises
		Provision of mandatory certification of aviation objects for compliance with regulatory requirements and environmental expertise

There are potential ways for improvement the ecologization system of land use of aviation and automobile transport, as well as mechanisms for their implementation.

1. Strategy for the development of automobile transport [21]

According to the determined scales, the adoption of the program for the development of public roads of national importance for 2018-2022 will enable:

- the restoration and development a public network of automobile roads, which have state status, and bridges along the route principle, completion of unfinished construction facilities with a high degree of readiness with the highest indicator of socio-economic efficiency;
- the phased introduction of long-term contracts (for five to seven years) on the maintenance of roads of general use of state importance (especially international ones) using a new system of evaluating the results of the contractor's work based on quantitative indicators of the transport and operational condition, correlated with the level of safety and consumer the qualities of highways;
- application of scientifically grounded methods and norms during the

financing planning of road economy and transition to medium-term budget planning;

- intensification of cooperation with international financial organizations for the increasing of the expenditures volume of previously attracted credit funds for the development of highways;

- creation of favorable legislative and organizational conditions for attracting investors during construction and maintenance of automobile roads under concession conditions;

- ensuring the phased transition to the organization of road construction works in accordance with international standards, which are called FIDIC, with the involvement of independent engineer consultants for control the quality of work;

- improvement of the material and technical basis of the road economy;

- promotion of innovative scientific and technical activities in the road sector, the introduction of modern, efficient and energy-saving materials and technologies, that ensure high quality and durability of road and bridge construction;

- prohibition of the harmful effects of road construction on the environment (installing anti-noise structures, conservation the ways of migration of animals, the regime of protection of territories and objects of the nature reserve fund and other environmental protection purposes);

- implementation of geographic information system of public roadways of national importance and development of the existing basic information-analytical system (system of state coverage, analytical and expert system of bridges, a database of accidents);

- ensuring of ecological safety and processing of alternative variants of accommodation of objects of the road economy in order to preserve the territories and objects of the nature reserve fund, lands, which are reserved for the bequest, forests, protective plantings and other components of the national ecological network;

- using of ash-slag wastes as a substitute for material (natural) resources in order to reduce the cost of construction, repair and maintenance of roads. [concept]

2. Development and improvement of the regulatory framework on environmental protection in road transport:

- continuous state control over observance of the requirements of environmental legislation by enterprises of the road sector;

- state control over the implementation of environmental measures in the implementation of construction, reconstruction, repair and operation of highways;

- formation of motivational levers in the innovative activity of enterprises of the road economy;

- involvement of local governments to ensure the implementation of Ukravtodor programs on environmental protection on the ground [11].

3. Development and improvement of the methodological base on protection

issues of the environment and observance of ecological safety conditions:

- resource-saving (application of modern composite, astringent, impurities during reconstruction of the highway, savings of water resources in the processes of construction and repair of the road, placement of mounds and strengthening of slopes of the earth's cloth);

- protective (road works must be carrying out within the strip; creating a system of surface drainage in order to prevent blurring, observance of technologies of road works, removal of soil layer within the reserve and technological strip, installation of coverage of the advanced type);

- nature protection (monitoring the timeliness and correctness of the implementation of recultivation works);

- regenerative (recultivation of disturbed lands);

- compensation (placement of road bio transport to ensure the migration of animals)

4. Application of the latest materials for the construction of automobile roads and observance to the main principles of architectural and landscape planning.

Italian firm "Ital Sements" after ten years of research has developed a road surface that cleans the air from automobile exhaust gases. These are asphalt concrete with an admixture of titanium dioxide nanoparticles. Under the influence of sunrays, the chemically active impurity converts unburnt hydrocarbons, carbon monoxide, nitrogen and sulfur oxides into water, carbon dioxide and solid salts.

During the design and construction of the highway, engineers must adhere to the main principles of architectural and landscape planning to maximize the natural landscape. They ought to implement at the stage of planning the options of the road. Unfortunately, the current practice of land allocation is unsatisfactory: the benefit is usually given to natural areas while preserving land occupied for industrial or agricultural production [12].

Engineers need to be guided by the principles of conservation and disclosure of nature at using the techniques of landscape design in the organization of the road environment. The modern theory of landscape design defines a flexible approach to selecting a highway path depending on the shape of the landscape. For a mostly plain natural landscape, it is expedient to have a clothoid – a trail consisting of curves of variable curvature with alternating angles of rotation, or a trail consisting of splines (cubic polynomials). Such tracks visually represent a line of smooth outlines. These forms of trails most closely approach the "primary", natural contours of the landscape, which has a mainly curvilinear outline.

It is necessary to take into account the impact on the environment due to the following aspects, when automobile road are reconstructed:

- changing the mode of planar flushing by removing the top layer of soil, strengthening new slopes and side ditches, arranging drainage systems, cutting out roadside plantations;

- surface water (during precipitation or snow melting) and wind erosion as a result of removal of the upper layer and changes in the engineering and geological properties of soils in the zone of temporary land allocation;
- chemical pollution of the soil surface with fuel and lubricants and construction debris within the territory of temporary land allocation;
- the inflow of solid and aerosol pollutants into the air, on the surface of the soil and on vegetation;
- temporary influence on the air environment at the expense of exhaust gases, noise and dust from working mechanisms;
- cuttings of green plantations;
- temporary inconvenience for local residents and transit vehicles.

5. Development strategy of the airports and airfields network in Ukraine

The purpose of the development of the strategy of development of the network of aviation connections is to meet the needs of the state in ensuring the stable development of the aviation industry, bringing the infrastructure of aviation transport in line with international standards and standards, ensuring the acquisition of Ukraine status of a transit state, taking into account its unique geographical location, improving the efficiency of management of state property [2].

6. Ekologization warehouses fuel and lubricants materials in airports

Composition fuel and lubricants materials in airports is a source of danger for the population, surrounding objects and the environment. There are the main pollution factors, like fire hazards, explosive hazards, the threat of chemical poisoning and pollution.

The major environmental works include installation and testing on pipelines and tanks, cleaning tanks, fuel drain from vehicles, welding and various repairs [3].

Researchers recommend the following measures in order to limit the impact of warehouses fuel and lubricants materials in airports:

- It is necessary to conduct a separate valuation of the objects impact on the environment and propose measures to reduce them when the relevant projects are designed;
- introduction of modern certified technological equipment, which allows the maximum reduction of harmful substances emissions in the air, pollution of soil and water;
- rain drains from the territory of the warehouses fuel and lubricants materials are harvested and disposed of on local treatment plants, the effectiveness of which is subject to quarterly control through the determination of the content of priority substances in the treated sewage;
- all warehouses fuel and lubricants materials must undergo an examination of the conditions for the generation, placement and utilization of waste;

Table 7

Strategy of development of the network of airports and airfields of Ukraine

Strategic aim	Events
Integration with the system of leading European transfer airports	To encourage airlines to open new routes and save existing routes
	Cooperation with airlines in order to increase transfer passenger traffic
	Creation of infrastructure for servicing transfer passengers
	Introduction of new services to increase revenues
	Conducting benchmarking among the airports in Europe
	Compliance of airline and passenger service standards operating at the enterprise
Infrastructure development to provide airport customer satisfaction	Improvement of passenger comfort due to the development of commercial areas (shops, catering, etc.)
	Ensuring operational readiness of equipment and equipment
	Parking construction and commissioning
Increasing the cost of services Increase productivity	Increasing labor productivity
	Implementation of outsourcing
	Reducing procurement costs and establishing transparent bidding conditions, implementing a transparent electronic procurement system
	Avoid duplication of functions of structural subdivisions
Increasing the level of corporate culture, creating conditions for the development and professional growth of each employee.	Corporate training
	Improvement of the professional level of employees through the passage of compulsory vocational training
Increasing the harmful effects on the environment	Implementation of energy-saving technologies
	Constant monitoring of the environmental impact and taking appropriate measures.

- engineers must adhere to certain technical requirements, that are fixed by the relevant norms and standard, at the design stage of the warehouses fuel and lubricants materials,
- measures of prevention accidents in technological reservoirs and bottling of petroleum products;
- installation of a solid waterproof coating with a coating and installation of collectors of rainwater and runoff in the event of oil spill in the territory where operations with petroleum products are carried out;
- effective removal of rain and thawed waters from the territory of warehouses fuel and lubricants materials by a closed system of rainwater drainage;
- effective waterproofing during the construction of networks and structures;
- landscaping and landscaping of the territory (creation of lawns with

perennial plantations).

7. Application of aviation alternative fuels

Modern aviation is one of the main consumers of fuel oil of both aviation gasoline and fuels for air jet engines, which are fully equipped with most of the fleet of aircraft. Today, Ukraine needs only one refinery in the fuel of this type, and in spite of all the insufficient quantities. In connection with this, most of the fuel has to be imported. Therefore, it is expedient to develop and implement alternative fuels to reduce the volume of purchases and preserve the balanced functioning of the ecosystem.

Some countries with a high level of economic development have already developed the first steps in this direction. Many of the world's reputable airlines have been flying planes powered by alternative fuels. A number of national programs are aimed at the production and using of biological fuels, which have also been created. Therefore, in the USA, the share of biological fuels in the market of fuel and lubricants in 2010 was 5%, and it will have reached 15% by 2030. As for the EU countries, according to the European Parliament Directive 2009/28 / EC, the share of biological fuels in the overall balance of motor fuel consumption will have reached 20% by 2020.

Today the main ways of research in many countries include the development of technology for the production of aviation biological fuels and synthetic paraffinic gas by hydrogenation of oils and animal fats. This type of fuel is a mixture of traditional petroleum gas and biocomponent in regulatory concentrations. As a biological component, methyl / ethyl esters of essential fatty acids of essential oils are used. The use of oils in pure form as a biocomponent is impossible, since their physical and chemical properties are significantly different from the properties of traditional kerosene.

Raw material for the production of biocomponents can be varied high-altitude plants, the choice of which depends on geographical and climatic conditions. For Ukraine, such characteristic and expedient processing of rapeseed oil, as well as the use of sunflower and soybean oil [6].

Experimental-industrial prototypes of synthetic fuel complying with the requirements of the ASTM D7566-09 certification for synthetic fuel have been created abroad.

Raw material for the production of biological components might be varied high-altitude plants, the choice of which depends on geographical and climatic conditions. For Ukraine, such a characteristic and expedient processing of rapeseed oil, as well as the use of sunflower and soybean oil.

8. Implementation of the environmental management system at Airline Company

The main ecologization mode of the industrial enterprises activities is the introduction of environmental management system. This fact gives the opportunity

to the company not only to limit the negative environmental impacts and to improve its image, but also to obtain a certain economic effect: reduce pollution charges, reduce resource losses, reduce waste volumes and thereby save costs associated with transportation and storage of products and waste.

So why should aviation companies implement a system of environmental management?

The initial ecological situation is assessed in the form of an internal environmental audit, the methods of which are:

- identification of environmental aspects of airline activities in normal, freelance, emergency situations;
- analysis of all cases of freelance and emergency situations;
- an analysis of existing practices or elements of the environmental management system operating within other airline companies in Ukraine and their application in the practice of airline companies;
- establishing other national, international or partner environmental requirements that the company is prepared to perform.

At the same time, it is very important evaluation the real situation and the official data, which involves visiting each facility and working personally with the airport staff. The result of the audit is the actual level of environmental activity, the majory problems, the valuation and the economic effect of the introduction of the environmental management system.

The functioning of the environmental management system is not limited to the implementation of the guidelines. The ideology and purpose of this system is constant active practice. There are permanent evaluation of the effectiveness and improvement of existing practices, programs and setting of new higher goals. It is extremely important to carry out regular audits and monitor the environmental performance of airlines, from successfully achievement higher standards of work quality and limitation of environmental impact. The implementation of measures for the protection of the environment, and in particular the integrity of the surrounding must be the priority concept in the work of this system is areas.

8. Provision of mandatory certification of objects aviation for compliance with regulatory requirements and environmental expertise

The control and supervision of observance technical, ecological and other requirements in the aviation industry are provided by mandatory state certification. Among the types of certification the aviation industry, give off the certification of aircraft, airports and aerodromes as objects, which, according to the legislation, reflect a danger to the environment and people's health. For example, in accordance with the provisions of the Law of Ukraine "On Environmental Protection", environmental certification in the field of aviation must be carried out at the placement, design, construction, reconstruction, commissioning and operation of enterprises, structures and other objects of the aviation industry. There

are airports, aircraft, as well as in the provision of environmental safety of transport modes, other modes of transport and facilities, in particular, with respect to aviation, during the operation of aircraft, the maximum allowable emissions of pollutants and the maximum permissible levels of physical impacts, such as noise on their compliance with legal requirements [13].

Concerning the presence of an aircraft type certificate, this is one of the main conditions for registration of an aircraft in the State Register of Civil Aircraft.

In the absence of such a document, the state authority for certification and registration might prohibit the operation of the aircraft.

Consequently, certification in the field of aviation is appropriate to determine as well as:

- 1) a certain type of control and supervision over observance of technical, ecological and other requirements;
- 2) the type of environmental certification as an integral part of the registration and licensing form of organizational and preventive measures in the system of the mechanism of legal provision of environmental safety in aviation;
- 3) a mandatory condition for registration of a civil aircraft type.

The review and analysis of information sources on the study of the ecologization problems of the use of land transport allows making the next conclusions about the fact that transport modes are the main polluters of the territories of cities and urban agglomerations, and in particular, separate local territories. The problems of assessing the impact of transport on the environment are not sufficiently studied; existing approaches are mostly unique in terms of use. Researches on the interaction of transport modes in the traffic flow and related changes for emissions of harmful substances were not detected by authors.

The analysis of the impact factors of roads and runways on the environment shows that the negative impact will happen mainly due to air pollution and acoustic impact on the population, which is caused by intensive traffic flows and will take place in the range of the strip.

The environment at the stage of operation after reconstruction must provide for monitoring of the state of the environment (air pollution, noise, etc.) in the zone of influence for reducing the negative impact of highways and runways.

Actual environmental safety of airports and fleets must be ensured by a set of measures, which aimed at reducing the negative man-made and technogenic impact on the environment.

Measures of ecological and legal protection of soil and water from pollution from wastewater from warehouses fuel and lubricants materials are an integral part of the environmental safety of the transport system. It is also necessary to involve scientific institutions and environmental public organizations in developing professional, adequate and current ecologically and economically sound technologies for the protection of soils and water bodies, minimizing the negative

effects of technogenic and economic activity.

It ought to be noted that environmental and economic activities include the introduction of new technologies for resource conservation, rational use of existing resources, use in the production process of solid waste production, replacement of materials for new ones - environmentally safe.

Such ways of ecological safety are related to the implementation of innovative developments, their experimental implementation and subsequent use in production, and ensure the environmentally sound use of land resources. In turn, it requires significant funding and development of a relevant strategy. Organizational and managerial issues of structural adjustment of the aircraft industry and automobile engineering, technical exploitation of fixed assets, transport modes servicing, especially after sales were not considered in the conditions of the administrative-command system of management. Efficiency of operation and repair at different levels of subordination of these enterprises were not raised or resolved, let alone already about the possibility of their attribution to various forms of ownership.

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2.3. Innovative potential of evolution of productive infrastructure in the global environment

A comprehensive, global scale and a character of globalization on the turn of the millennium led to a further deepening of the international division of labor, specialization expansion of national economies, the increase in the economic life of the world community, and has necessitated the need to optimize the reproductive process both at national and international levels. Their sustainable development depends on the availability of an adequate service system, which is called the global industrial infrastructure of the world economy. The latter can be defined as an integrated set of national, regional and international production infrastructures that interact and complement each other, and thus ensure the effective functioning of supranational reproduction process. At one time, Smith, analyzing international trade, pointed to the need for transport routes as means of its implementation among States. To them he relates various instruments, cars, factories, railways, ships, and so on. That is, long before the introduction into the economic science of this category, the infrastructure actually existed and partially functioned [9, p. 30-31].

When exploring the genesis of global industrial infrastructure, it should be noted that its foundations laid in the ancient times when the exchange between states and regions through land and sea was led by cargo transportation. Great geographical discoveries have given a new push to the development of elements of global industrial infrastructure, since the development of new territories objectively required the expansion of means and routes of relocation not only at the national but also international level. This accelerated the formation of the world market of goods, expanded the number of its participants, the scale of the economic life of civilization and led to the need for progress in the means of transfer between states and continents. Alfred Marshall, considering the structure of capital, said: "... auxiliary or indirect capital is named so because it contributes to the application of labor in production. These include tools, machines, factories, railways, ships, etc...". And further argues that "... the rivers were also convenient transport routes that promoted the simple forms of trade and division of labor..." [6, p. 136].

Global industrial infrastructure has resulted from the acceleration of the process of internationalization of economic life, the intensive development of productive forces under the influence of the scientific and technological revolution, the formation of supranational production complexes, the functioning of which is impossible without an adequate servicing system – a complex of industries that ensure the movement of factors of production, its results and other production services character on a planetary scale. Supranational industrial infrastructure is a leading element of the global economic system, linking economic entities among

national economies and internationally. Karl Marx, analyzing the "Capital" progress of machinery and heavy industry pointed out that "it is a revolution in the mode of production, industry and agriculture made necessary a revolution in the general conditions of the social process of production, that is, communications and transport ... it was the last gradually adapted to the method of production of large industry through the system of river steamers, railways ... and telegraphs" [5, p. 395-396].

Formation and development of a new economic, technological system based on innovation infrastructure not only can overcome a deep systemic crisis, but also bring the country to a higher level of economic development. Conversely, a state that is incapable of creating and introducing new technologies into the growth of the position of a new, innovative business, before the emergence of a new elite will have difficulties in shaping the prospects for its development, "an economy that is not able to develop a new business will be roll down to stagnation" [6, p. 121]

The experience of many foreign countries shows that the recovery from the stresses caused by the deep economic crisis is often accompanied by introduction of new technologies to improve productivity, develop new products and implement them to new markets. Technological changes determine the structure of industry not only in the national but also on a global scale. There are long-term trends in world technological development and modern technological advances and innovative infrastructure, which dominate in the distribution of productive forces and the nature of management of various types of production activities. The undisputed global leader in the field of innovation is the United States, which continues to dominate all major areas of research and development. Over the past 50 years, there have been around 60% of all technical innovations. The advantages of this country in the creation and commercialization of information, military-space, biotechnological and environmental technologies are undeniable. Further activation of the process of internationalization of economic life has led to the emergence of international industrial formations – transnational corporations that directly affect material production, subordinating themselves to individual industries in the scale of individual countries, regions and the world economy, while creating the conditions for the development of national, regional and international infrastructure. But the formation of an integrated production system of a planetary type proves the necessity and need for a global industrial infrastructure. Analyzing the relationship between the evolution of the world market in the process of globalization V. Medvedev emphasizes that: "The new stage of development of the world market of goods and services, capital and labor under the influence of globalization manifests itself in the formation of its international economic infrastructure - world and regional" [7, p. 5].

The leading, dominant role in global technological development and the formation of elements of international industrial infrastructure was played by

transnational monopolies that embraced all corners of the planet with their firms. Innovations as the main factor of scientific and technological progress are directly related to the operation of TNCs at the national and international levels. In this case, it is a question of qualitative updating of post-industrial technological systems by certain innovations, which will create the possibility of obtaining a new quality in the relevant society, which is a structural element of modern civilization. The effective functioning of the technological systems of the latter implies a dialectical relationship and interdependence of national, local and world systems.

Functioning in the global economic environment, TNCs control overseas markets due to their competitive advantage, which is based on technological leadership. Innovative influence of leading transnational corporations on the economic growth of the world economy is realized through the creation of their respective innovations and their use in industrial production. The development of inventions requires significant financial resources, as it is impossible without the use of the achievements of NTP, upgraded equipment and the production process and other phases of reproduction, in particular the branches of industrial infrastructure.

One of the elements of global industrial infrastructure is the transport system of the world, which provides continental and intercontinental transportation of goods and passengers. Combining all kinds of transport, it constantly develops and modernizes under the influence of scientific and technological achievements and implements the growing demands of international production. The transport infrastructure is actively influencing the development of national economies, facilitating their faster integration into regional unions and the world economy. The use of transport infrastructure objects intensifies the expansion of international economic relations, accelerates globalization trends in the development of modern civilization. In this regard, the statement by N. Zlokasova that "the single transport infrastructure on the continent also has a significant political aspect - the interests of the national governments of the countries of Central and Eastern Europe completely coincide in this part with the interests of the TNCs operating in the region" [3, p. 63]. The expansion of spatial scales of functioning of the world transport system in the conditions of globalization is due to the lack of an integrated approach to its development. As a rule, firstly, interests of inter-industry transport organizations dominate here, therefore the formation of global trends in the development of this infrastructure element contradicts the national interests of the governments of individual states. Secondly, the growth of the number of subjects of transport has caused the intensification of competition both at the regional and world levels, which in turn causes the necessity of forming a coherent transport policy. Thirdly, a certain imprint on the operation of the world transport system is creating environmental problems and the level of development of the infrastructure of sea and river ports, which significantly reduces the volume of

freight. The result of the innovative development of the transport industry is the intelligent transport system (ITS), which is a single complex of automated systems designed to collect, process and transfer information about the state of the transport infrastructure, the exchange of information between its users and the relevant management structures in real-time mode [11]. Implementation of ITS improves the efficiency of the functioning of transport infrastructure, expansion of foreign economic activity entities. The application of innovative technologies in the world transport system should be based on the global information system of transport communications, which may be over ground and surface overhead roads using Stun Technologies of Yunitsky (STY). The length of the existing world tranch communication in general is 35 million kilometers, of which more than 32 million – highways, more than 1.2 million – railways, about 1 million kilometers – main pipelines; There are currently no transport systems based on string technologies. The energy efficiency of two-way STY is 1.5-2 times higher than the rail and 3-5 times the car, and the mono-STY has no equal among well-known and promising transport systems. In particular, at a speed of 100 km/h in urban cycle, the specific energy consumption (fuel) will be: 0.6-0.8 kWh of electric energy per 100 passenger-kilometers, or 0.15-0.2 liters of fuel per 100 passenger-kilometers [11].

In the system of supranational production infrastructure, the energy economy is a source of viability for both supranational and international production. By transporting oil, gas, coal, electricity within continents and in the global environment, the energy infrastructure provides the necessary resources for all consumers of national economies and the needs of the subjects of world economic relations. Functioning at different levels of international economic relations, energy infrastructure influences the further internationalization of economic life. V.G. Varnavskyy, while assessing the role of the electricity sector, emphasizes that "electricity plays an extremely important role in modern society and the economy, being one of the main infrastructural sectors" [1, p. 25-32]

Information technology radically changes the decision-making process itself by the actors of national economies and world economic relations in general. In this process in today's conditions is influenced by several global trends, characterizing the new system of relations of participants of the world market. Firstly, under the influence of the use of information technology opportunities, consumer behavior is changing dramatically: he wants to get the most out of the market. This effect is achieved through the introduction of technologies in all areas of the economy, including industrial infrastructure. Consumers can easily and quickly obtain information on services, including transport infrastructure, and choose the one that most fully satisfies their needs. At the same time there is a double effect: the time for service search is reduced and the expenses for their use are reduced. Secondly, economic activity, which throughout the previous period was based on limited resources, gives way to knowledge as the main resource of

the information economy. Information and communication infrastructure is becoming a leading factor in the growth of the new economy. Thirdly, due to the availability of many sources of information, their availability, manufacturers have the opportunity to take a dominant position in the market of goods and services. This tendency gets the features of internationality, and therefore the global competitive environment is formed, where the new elements of the global industrial infrastructure will occupy the leading place. At the same time, information technologies modify the actions of subjects of world economic relations; create an opportunity for more extensive use of their advantages in the formation and functioning of objects of global industrial infrastructure [14].

The information and communication network as a result of the information revolution creates new conditions for the functioning of international production. Its scale is expanding and the number of employed is decreasing. The information sector of the economy is being formed, which produces, implements and services computer equipment, communication facilities, and provides various information services. Information technologies penetrate all spheres of the economy, transforming their structure and increasing the efficiency of labor. As a result, the use of all the advantages of information technology accelerates the functioning of a complex of industries global production infrastructure.

The defining features of the information era – the leading role of computers and telecommunications, microprocessors, the fundamental value of theoretical knowledge. That is, in all approaches to the characteristics of the emerging society, the global processes and the determining role of information and communication technologies are distinguished. As I. Osadcha notes: "Globalism is essentially the next stage of internationalization based on the development of information technology. It is precisely modern communication and information technologies that have created completely different conditions for the movement of capital, for its rapid transfer from one country to another "[8, p. 3].

The global industrial infrastructure of the world economy, acting as a structural element of the information economy, is both a result and a condition for its successful functioning, as well as a lever and a factor of economic growth. The transition of the world economy into a qualitatively new information space of development enhances the interplay of national reproductive structures, leading them to a new economic stage of development. This is largely due to the fact that telecommunication infrastructure and its services are the foundation of the information economy [16].

The process of internationalization of economic life has led to an increase in the scale of international development, expansion of spheres of influence of the world market, deepening of the international division of labor and the globalization of monetary-financial and credit relations. All this resulted in the need to regulate the financial provision of large-scale infrastructure projects and coordinated

development and operation of global industrial infrastructure facilities. In this regard, a system of international institutions of a multi-faceted nature – a universal, economic and financial type – was created. Their activities are aimed at developing a coherent strategy for the development of national economic complexes and their integration into the global industrial infrastructure of the world economy.

International organizations of various types, along with economic and financial activities, ensure the effective functioning of global industrial infrastructure facilities through its information activities. Adequate processes taking place in international, intergovernmental and financial-credit institutions are aimed at regulating and realizing their interests in the global economic space. All subjects of the information society influence the development of information and communication, as well as global industrial infrastructure [12, p. 34].

Economic development of modern civilization largely depends on the use of the results of scientific, technical and information revolution. At the same time, the compulsory component of modern growth is the attraction to international production – the intellectual, professional and organizational potential of a society based on innovation. The use of innovations in the process of formation and modernization of the basic elements of the global production infrastructure will make it possible to make changes in their qualitative and quantitative parametric characteristics, expand the scope of their involvement in transnational processes, and improve the efficiency of the world reproduction process. Describing the role of TNCs in the development of innovation activity, N. Ivanova notes: "The economic history of innovation activity, the patterns of formation and change of industries – leaders of technological progress, show that each new product that forms the industry, as a rule, is related to the activity of that or another large corporation" [4, p. 11].

Globalization of world economic relations is carried out simultaneously with the introduction and use in the international production of the main resource of the modern economy – the intellectual, professional and institutional potential of society. A new type of economy is formed, the effectiveness of which depends on the ability of the vast majority of countries to withstand technological and organizational competition based on innovation. In such circumstances, the use of innovative developments in the creation and improvement of objects of international industrial infrastructure will accelerate operations in the global financial market, reduce the costs of world trade and international production, deepen its specialization and cooperation.

The development, reconstruction and modernization of objects of global industrial infrastructure requires use of investment potential of various subjects of the world economy: national investment resources, private investments, loans of international financial institutions and international insurers of large infrastructure projects. At the same time, global subjects of the financial market can directly or

indirectly influence the formation and functioning of objects of a supranational service system of a planetary scale [17].

Under conditions of globalization, the supranational reproduction process is mediated by foreign economic activity in the broad sense of the word. On the one hand, traditional forms of world trade are kept, and on the other hand, international exchange is intensively developing, which is directly related to new forms of foreign economic activity, in particular, investment and scientific and technical cooperation. The beginning of the third millennium becomes a period of analysis of the huge opportunities of information and communication technologies for humanity and their use in various sectors of the economy and international business. Recent advances in the development of global information and communication technologies (Internet technologies) have led to the rapid growth of economic activity, called "electronic commerce". The term *innovatio* is a synthesis of the words *investio* (clothing) and *novatio* (update). On the basis of the definition, it is obvious that e-commerce is among the innovative technologies associated with information provision of trading operations. Electronic commerce (from English E-commerce) is a field of economics that includes all financial and trade transactions carried out through computer networks and business processes associated with conducting such transactions.

E-commerce development and an increase in its volumes will be accompanied and already accompanied by a number of positive effects for the world economy. These are the results of the expansion of e-commerce: first of all everything, reducing transaction costs, simplifying trade procedures, expanding opportunities for investment, expanding geography, and engaging in business, increasing competition. Aspects of e-commerce are now one of the most relevant. In modern conditions, the issue of promoting wider access to international e-commerce is increasingly becoming a priority in the agenda of a number of influential economic and trade organizations, as well as in the decisions of state bodies of many developed and developing countries.

Implementation of traditional forms of cooperation is impossible without the cost of financial resources for the creation and use of elements of international industrial infrastructure. Moreover, there is a direct relationship between world financial resources and global production infrastructure through the forms of interaction of infrastructure and sources of investment in their development. At the same time, V.G. Varnawski emphasizes that "in conditions where the state is not able to solve the problem of financing, support and modernization of the infrastructure network ... the main conceptual condition for the development of infrastructure should become one or another form of partnership between the state and the private sector" [2, p. 78].

Globalization trends in the modern economic environment require the development of strategic directions for the development of global industrial

infrastructure, which should take into account the influence of endogenous and exogenous factors. National economies as subjects of the world economy in the process of economic globalization develop national strategies for the development of industrial infrastructure, while coordinating further directions of their cooperation through the prism of the implementation of state interests. An important role in this process is played by the economic organizations of the UN system, which formulate programs for the coordination of infrastructure relations in the world economy in the near future.

The adaptation of national economies to the globalization processes of the evolution of the world economy in the new millennium requires the development of an adequate development strategy that should include and take into account the factors of post-industrial growth. Each state must adapt itself to the requirements of globalization, new types of fierce competition, active dissemination and introduction of information technologies, and the formation of social development goals in modern conditions. These are the realities that are the result of the objective historical development of the world economy, its introduction into the civilization phase of post-industrialism – technogenic, taking into account the informational and innovative model of development. This tendency is rapidly evolving and becomes the main paradigm of the economic development of modern civilization.

Under the conditions of the formation of economic unity of the world, the development of an adequate strategy involves directing the efforts of the relevant actors to form a concept that could, despite the influence of various factors and external forces, realize the goal. Development strategy of a subject of international economic relations in the context of globalization requires consideration of its national interests and therefore optimal integration into the world community. It is necessary to take into account the influence of factors of the environment. As the national economy act as structural elements of the global economy, they are in constant interaction and interdependence and significantly affect the implementation of national strategies. There is also the possibility of inconsistency of actions of the subjects of the world economy between themselves and international organizations, which poses a threat to the achievement of individual states objectives [18].

The modern innovation process in the industrialized countries is characterized by a computer revolution, the formation of global research networks, the rapid spread Internet technologies. In this regard, the world's leading countries must adjust their economic, in particular, industrial policy. Its task is to create optimal conditions for innovative development of the state, providing the following areas: improving the scientific and technological capacity, intellectual and professional level of the workforce, stimulate the creation of innovation infrastructure (technology parks, venture funds and risk firms, business incubators) that

necessary for expanding cooperative ties between financial institutions, firms, and scientific institutes. In addition, the formation and development of the new economy have led to the accelerated growth of the international exchange of complex technical products and changes in the nature of competition in world markets.

Thus, an analysis of the innovative potential of the development of global industrial infrastructure in the twentieth century and its promising directions in the new millennium makes it possible to draw a number of conclusions and proposals on the use of the potential of the innovative economy:

- a significant result of innovation progress in the last century was the formation of a new sub object in national economies – national innovation systems, which operate within clusters and technology parks and technopolises, which are the constituent elements of the innovation infrastructure. This, in turn, influences the formation of global production infrastructure;

- the functioning of the innovation sector is largely determined not by the scientific and technological progress itself, not by its results, but by their use in various objects of the industrial infrastructure. The innovations make it possible to call the economy of the twentieth century – innovative and informative;

- an important role in innovation progress is played by competition, which causes the interaction between educational institutions and research institutes to be strengthened, and education and science are transformed into a real productive factor of the innovative economy;

- the main leaders in implementation of innovations are TNCs. They determine the level and trends of national innovation activities, having financial resources that are not in the power of other elements of innovation infrastructure – universities, state laboratories, research centers;

- state policy in the field of innovation should be guided by the development of additional motives of innovation and investment activities in the dominant subjects of the national economy, aimed at introducing innovations in all spheres of global industrial infrastructure.

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2.4. Enhancing sustainable energy development in local authorities through the usage of innovative tools

Global energy saving potential is rather huge and grows each year. In this regard, national governments all over the world invest in resourceful developments of power grids, transport, industry and buildings.

In nowadays conditions, improvements in energy efficiency field and reduction of CO₂ emission are the most significant drivers of energy transition procedure. World regulations are becoming stricter, which cause the need to increase the level of energy efficiency by implementing innovative methods, processes and products.

European political initiatives in energy efficiency field are strongly supporting this course, strengthening therewith the role of local authorities. For example, in 2008, within the framework of the European Union Climate and Energy Package, the European Commission launched the Covenant of Mayors program initiative [1], which brings together local and regional authorities in order to declare a commitment to increase the level of energy efficiency in their communities through reduction of specific energy consumption and CO₂ emissions while increasing the potential of renewable energy usage. Thus, regional and local authorities become crucial stakeholders for the effective implementation of policy measures in energy sector and main actors for the energy transition processes. Furthermore, the ways of developing an ecologically oriented economy of local communities and improving the quality of citizen's life have been modified. Thanks to the Covenant of Mayors initiative, an unprecedented step towards direct involvement of local authorities in energy transition processes was taken, which lead to recognizing an important role of local authorities in achieving ambitious long-term energy and climate goals (20% of CO₂ emission reduction until 2020 and 40% of CO₂ emission reduction until 2030).

Existing trends show that more and more cities are aware of important role of urban energy policy and implementation of municipal sustainable energy and climate protection plans that cover the main areas of production and consumption of fuel and energy resources in cities [2], [3].

In general, energy resources are used through many different processes (e.g. production, supply, consumption), which cause main difficulties of sufficiently targeting the energy efficiency goals. In this regard, the creation of comprehensive instruments for an energy efficiency transition becomes more complicated, mostly because of the variety and complexity of end-users of fuel and energy resources.

In order to understand better the policymaking process regarding the sustainable energy development of local communities, a comprehensive analysis of the baseline of energy consumption in cities should be conducted. In this context, it is essential to examine the aggregated amount of energy consumption of local

authorities, to identify and prioritize municipal infrastructure sectors with high potential towards energy efficiency. These approaches allow to select the most energy efficient goals and provide organizational, administrative, financial, technical and other capabilities for realizing the existing energy saving potential.

It is recommended to provide the analysis of municipal energy balance sheets in the dynamics of at least the last 5 years. This approach allows to track the trends of energy usage and to assess the effects of previously made management decisions. In addition, based on the authentic data, obtained in terms of years, further calculations on energy savings and the resulting economic effects can be made as a result of introduction of energy efficient measures from a certain baseline year. Among the main criteria for selecting a base year, as a rule, are the availability and reliability of data for the selected period, its completeness, as well as the sustainability of economic processes in municipal infrastructure sectors.

Among the main sectors with significant potential for energy efficiency, it is expedient to consider the following: public and residential buildings, tertiary sector buildings, street lighting, transport, solid household waste, industry, enterprises engaged in centralized water supply and sewage, as well as production and supply of thermal and electrical energy.

The appliance of sectoral approach enables to elaborate the structure of urban energy balance, considering the amount of primary energy entering the consumer's line, as well as the subsequent stages of its transformation, transportation and usage by the end-users.

In the case of examining the largest end-users of European cities, it is seen that the highest percentage of energy consumption falls on transport – 34%. Further it is manufacturing sector – 27%, residential sector – 19%, services – 14%, other industries (e.g. agriculture, mining, construction etc.) – 6% [4, p. 6], [5], [6].

In the case of investigating the level of energy consumption of Ukrainian cities, it is seen that the uppermost ratio of energy consumption falls on the sectors of residential buildings, public buildings and municipal objects (fig. 1).

Taking into account the International Energy Agency reports [4], [7] it is estimated that globally the building sector (in particular, residential buildings as well as public buildings and facilities) is responsible for over one third of final energy consumption and CO₂ emissions linked to the sphere of energy generation. In addition, it is proved that in this sector the level of consumption of electricity is the highest (approximately 42 per cent) [4, p. 7], [7, p. 14]. In many countries, buildings consume more energy than transport and industry [2], [6].

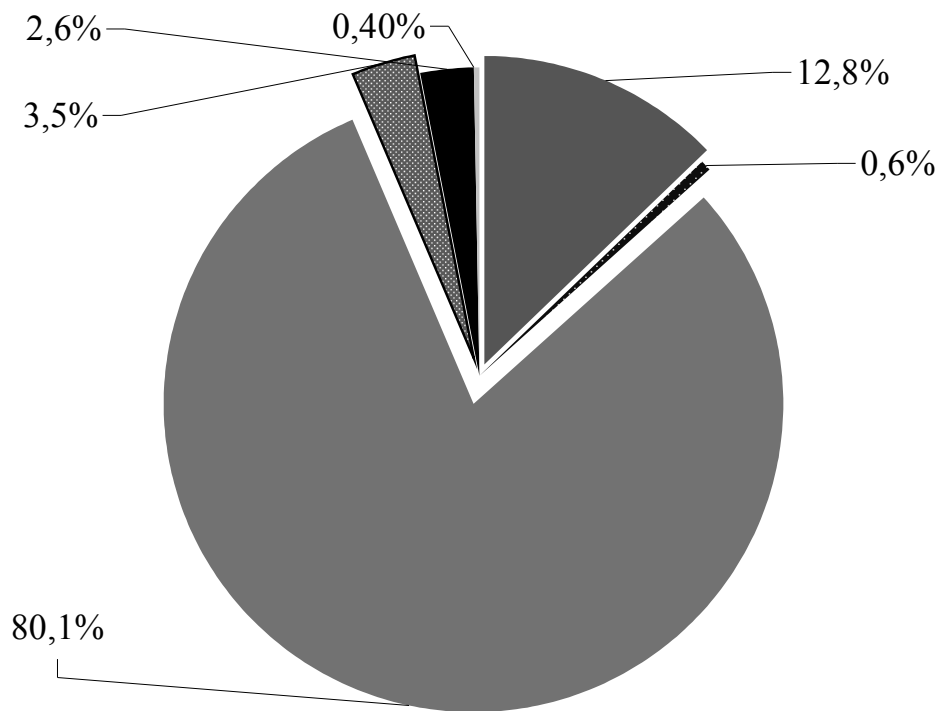


Figure 1. Typical distribution of energy consumption in Ukrainian cities in the context of sectoral approach

Source: Author's research, based on [1]

The building sector covers a varied set of end-users, which have diverse energy use consequences. The efficiency of building energy use estimably depends on the efficiency of the buildings in which the operation of main facility systems (heating, cooling and lighting), as well as on the type of building designs and constructional materials. In the industrialized countries, the level of energy efficiency potential is much higher, which is mostly caused by a rapid growth of quantity of new constructions. With increasing tempos of urbanization processes (especially in developed countries), the number of buildings in urban areas is extremely growing and resulting on increased demand for fuel and energy resources. In building sector, the level of energy consumption can be decreased through reducing heating and cooling demand, energy requirements for ventilation and lighting, electricity consumption of office equipment and appliances and people behaviour. Also, it should be mentioned that during last year's passive design measures became very popular, that can minimize the energy consumption of buildings relating to thermal comfort, lighting, vertical transportation and hot water.

Energy efficiency opportunities in the industry sector cover more than thousand different energy efficiency technologies due to the complexity of industrial processes and their variety, whereas in the sector of residential buildings

the number of energy efficiency measures is much lower.

It is worth noting that over the years, companies around the world have resisted the idea of “climatic” and “environmental” investments, justifying it as expensive and inconsistent amount of money spent on the process of achieving the expected results. However, the rapid increase of prices for fuel and energy resources significantly changed the existing situation. In today’s global environment, companies operating in the climate technology market receive annually trillions of dollars of investments. In Ukraine, this segment of the market is in its infancy, but has great prospects. Ukraine became the first country in which the European Bank for Reconstruction and Development (further – EBRD), in March 2017, launched a project of financial support for climatic innovations through the issuance of innovative vouchers [8]. Through the Climate Innovation Voucher Program, the EBRD seeks to support Ukrainian companies in improving the climate issues for the development and implementation of climate technologies.

In general, the Climate Innovation Voucher Program is an opportunity for Ukrainian companies to receive irretrievable financial assistance for the projects related to reducing the consumption of fuel and energy resources, reducing greenhouse gas emissions, as well as changing the situation with a significant level of resource concentration and energy intensity of production.

The Climate Innovation Voucher project in Ukraine is being implemented by the NGO “Greencubator” within the framework of the EBRD’s FINTECC program (Finance and Technology Transfer Centre for Climate Change). During 2017 – 2018 Ukrainian companies will receive vouchers of EUR 1,000,000 for the development and implementation of climatic technologies [8]. Projects that claim to receive innovative vouchers should demonstrate the potential for reducing CO₂ emissions, as well as the ability to scale the proposed technology and its implementation in other infrastructure sectors and industries. In general, the described initiative has substantial prospects, as it can significantly increase the existing market potential for the modification of the ecosystem of climate innovations in Ukraine.

It is important to note, that EBRD delivers a comprehensive maintenance package for Ukraine in order to assist in stabilization and securing its reforms. EBRD focuses on strengthening energy efficiency potential and energy security, providing quality infrastructure tools and reinforcement of financial sector. Current portfolio of EBRD projects in Ukraine covers € 13,749 million (29% represent projects in energy sector) [9].

As it was already mentioned, energy sphere is characterized by increasing number of consumers not only supplying fuel and energy resources, but also producing their own energy (very often a “green” one), customizing it for their own personal use.

An important issue of identifying the components of the municipal energy

balance structure for its further evaluation is the avoidance of double counting of fuel and energy resources. This risk could be avoided by calculating the level of energy consumption directly in the end-users chain, considering the usage of energy resources for their own needs by power generating enterprises and losses in transformation and transportation processes.

The main problems in the development and further implementation of municipal integrated plans for sustainable energy development in nowadays conditions are the following: availability and reliability of data on consumption of energy resources in selected infrastructure sectors; the possibility of local authorities to influence on municipal sectors through political instruments, as well providing financial resources in order to implement energy efficient measures and projects.

Nowadays a lot of data can be measured by specialized meters, tracked through different networks in real time (for example, weather forecast, road traffic, quality of nature resources, level of CO₂ emission, level of production and energy consumption etc.). Power generation plants, residential and public buildings, plants, means of transportation become interconnected, and a lot of cities become “smart”.

If we look at the household sector, we can see that energy consumption data of facilities of public and residential areas is affected by the various features, such as building structure, types of existing meters, climate environmental parameters, presence of lessees’ types of energy resources and under-lessee organizations, operating modes, type of construction and user behaviour patterns. That is why well-developed urban system for monitoring energy consumption should collect information about the temperature, humidity, pressure, electrical signals and control signals of main municipal infrastructure systems.

In order to provide comprehensive analyses of municipal energy consumption, it is necessary to identify key energy efficiency indicators (tabl. 1), which are an important tool for analyzing the interaction between economic and human activities, total energy consumption and CO₂ emissions. It should be mentioned, that for performing this identification, the recommendations of the European Commission on priority infrastructure sectors, which must be included in the municipal action plans for sustainable energy efficiency development [10], [11], have been selected as the basis.

The outlined indicators provide an opportunity to determine in which infrastructural sectors it is primarily possible to achieve energy savings. It is advisable to use the method of decomposition, which divides and quantifies the results of the influence of individual factors in each of the infrastructure sectors, covered under this study. Besides presenting the information about past trends in energy consumption, key energy efficiency indicators also allow to provide a high-quality simulation and forecast of energy consumption in the future.

Table 1

Key energy efficiency indicators of the main municipal infrastructure sectors

Infrastructure sector	Key energy efficiency indicators
Public buildings and facilities	<ul style="list-style-type: none"> – Dynamics of energy consumption in terms of years – Costs of payment for energy resources – Heated area, volume and other technical characteristics of buildings – Budget allocations etc.
Street lighting	<ul style="list-style-type: none"> – Volumes of electric energy consumption – Electricity costs – Quantitative and qualitative characteristics of lighting sources – The length of streets and lighted roads etc.
Transport	<ul style="list-style-type: none"> – Volumes of energy consumption – Costs of fuel resources – Number of cars, buses, electric vehicles in the city – Volumes of carriage in passenger-kilometres and ton-kilometres etc.
Residential buildings	<ul style="list-style-type: none"> – The dynamics of energy consumption in terms of years and the cost of their payment – Production indices of electricity, heat, water supply and drainage systems – Structure of sales and consumption of fuel and energy resources etc.
Solid waste	<ul style="list-style-type: none"> – Structure and sources of solid waste – The cost of recycling of solid waste – Quantitative and qualitative indicators for the collection and disposal of solid waste – The amount of fuel consumed for the collection and utilization of solid waste etc.
Industry	<ul style="list-style-type: none"> – Dynamics of energy consumption in terms of years – Costs of payment for energy resources – Quantity of equipment – Heated area, volume and other technical characteristics of industrial units – Production indices of electricity, heat, water supply and sewage systems – Structure of sales and consumption of electric power, heat energy, water and sewage etc.

Source: Author's research, based on [7], [10], [11]

As it was already noted, the practical result of analyzing the baseline energy consumption in cities should be determined as the level of energy efficiency of the infrastructure sectors and the city as a whole, which, in turn, allows to outline the priority directions for the further development of investment project portfolios. At the same time, it should be noted that the implementation of energy efficient projects should be aimed not only at reducing the consumption of fuel and energy resources, but also at preventing the growing physical destruction of urban infrastructure due to insufficient or not current capital repairs; achieving socially acceptable level of financial burden on legal entities and individuals; providing energy services of the proper quality etc.

It is proposed to conduct a specific sectoral analysis, which may reveal important gaps in the instrumental mix, needed for effective implementation of rational energy police in different sectors. These are very important issues since the ambitious energy efficiency targets mean that each of described above sectors have a significant contribution on the level of reduction of CO₂ emission. It is essential to develop a comprehensive framework in order to clarify to what extent certain sectors are targeted by municipal energy policy (tabl. 2).

Table 2

The matrix of local governmental influence on key municipal infrastructure sectors

Infrastructure sector	Level of municipal influence		
	Implementation of energy efficiency policy	Organizational and administrative influence	Expenditure control
Public buildings and facilities	high	high	high
Street lighting	high	high	high
Transport	medium	medium	low
Residential buildings	medium	low	low
Solid waste	medium	low	low
Industry	low	low	low

Source: Author's research

Using an existing dataset of Covenant of Mayors initiative [1], the study of policy tools and mechanisms in the area of energy efficiency was made (table 3). There is now a rising acknowledgement that technological neutral policy instruments are insufficient for achieving an ambitious and wide-ranging energy and climate goals [12], [13].

Based on the empirical analysis and peculiarities of instrument types (table 3) and their role in the overall segmentation, it is proved that there is a need for using a comprehensive instrumental combination rather than particular instruments.

Table 3

Key policy instruments in energy efficiency field

Policy instrument	Objectives	Limitations / Risks	Implementation conditions	Estimated effectiveness
Information campaigns (e.g. Energy days)	<ul style="list-style-type: none"> - informing on policy - supporting decision- making process - education - raising awareness 	<ul style="list-style-type: none"> - knowledge gaps - government policy - political stalemates 	<ul style="list-style-type: none"> - highly educated and involved population - high penetration of media 	<ul style="list-style-type: none"> - hardly assessed - cost-benefit rate - highly effective - easy target group selection
Energy audits	<ul style="list-style-type: none"> - demand side - demonstration of implementability - showing cost effectiveness 	<ul style="list-style-type: none"> - reluctance to innovation - lack of market transparency - level of quality of service providers 	<ul style="list-style-type: none"> - proven technology - non-acceptance - short pay-back period - unfamiliarity - applicability - combination with financial incentives - high level of experience of auditors 	<ul style="list-style-type: none"> - mixed results - high costs
Demonstration projects	<ul style="list-style-type: none"> - showing implementability 	<ul style="list-style-type: none"> - reluctance to innovation 	<ul style="list-style-type: none"> - proven technology - pay-back periods 	<ul style="list-style-type: none"> - highly effective
Technical handbooks and guidelines	<ul style="list-style-type: none"> - support of implementing energy efficiency tools - stimulate energy analysis capacity 	<ul style="list-style-type: none"> - lack of knowledge - availability of practical support 	<ul style="list-style-type: none"> - selection of target group 	<ul style="list-style-type: none"> - effects depending not only on the context of handbook
Labels and guides	<ul style="list-style-type: none"> - comparison of products - increasing marker transparency - inducement of efficient products 	<ul style="list-style-type: none"> - lack of marker transparency - lack of knowledge 	<ul style="list-style-type: none"> - awareness for artificial trade barriers - intensive interaction of authorities / companies 	<ul style="list-style-type: none"> - highly effective with adequately functioning authorities
Energy management system	<ul style="list-style-type: none"> - making energy an issue in authority / company - add energy analysis to other operational considerations 	<ul style="list-style-type: none"> - low priority of energy aspects in authority / company decisions 	<ul style="list-style-type: none"> - high energy intensity - energy proportion of product price large 	<ul style="list-style-type: none"> - mixed effects - highly dependent on high level of management participation
Government based advisory services	<ul style="list-style-type: none"> - permanent dissemination of products and services 	<ul style="list-style-type: none"> - barriers to innovation 	<ul style="list-style-type: none"> - specific economic sectors - high degree of cooperation in economic subsectors 	<ul style="list-style-type: none"> - institutional effects
Training and education programmes	<ul style="list-style-type: none"> - improving analytical and technical skills 	<ul style="list-style-type: none"> - lacking skills 	<ul style="list-style-type: none"> - specific economic subsectors - adequate analysis of actual needs 	<ul style="list-style-type: none"> - existing structural effects, which are difficult to quantify

Source: Author's research

Every city should decide which financial sources are the most appropriate for financing energy efficient measures. Municipal budget or grants should be used for unprofitable (e.g. social) projects, preparatory studies (energy audits, environmental impact assessment, etc.). International financial institutions or commercial banks can finance profitable projects with quick return on investment. A combination of several funding sources is the most common solution. There is an economic justification for implementing energy efficient solutions with different levels of cost-effectiveness. It is proved that highly cost-effective solutions should be implemented first, before investments are made in other, more expensive low-carbon options [14]. In this regard so called 'low hanging fruits' tend to be characterised by relatively low cost and technological simplicity.

In order to achieve global climate change goals an energy transition strategy is definitely needed. However, it requires implementation of long-term mitigation processes with a variety of policy intervention instruments, which can steer the direction and speed the achievement of adopted targets. One of possible instruments is sustainable energy action plan, which transform the long-term strategy into action through defining concrete reduction measures together with time limitations and assigned responsibilities.

It is important to observe the logical and structural approach for determining the portfolio of investment projects in the field of energy efficiency. In particular, it is essential to construct a result-based model using the SMART method, define a task assignment matrix, identify the milestones of the projects with the appropriate set of key energy efficiency indicators, to achieve the objectives of the municipal sustainable energy action plan, key outcomes and risks. In future it is necessary to outline the sources of sustainability of the project results and the expected effects (economic, social, technical, environmental). The technical effect of the project should be measured in the implemented technical solutions, which, in turn, meet the requirements of innovative development of the country and promote its further sustainable development. The ecological effect should be calculated due to the impact of project innovations on the amount of CO₂ emissions in the atmosphere. The economic effect is determined by indicators of reducing the level of financial burden on legal entities and individuals in the setting of paying for fuel and energy resources, taking into account the size of the real cash flows of the project. The social effect is measured by the contribution of the project to improve the living conditions of the stakeholders, and also it takes into account the impact of project results on solving the social and institutional problems of the target audience.

Energy efficiency offers a number of tools for reduction of CO₂ emission. It is extensively acknowledged that energy efficiency improvements will need more sophisticated mechanism that requires well-targeted and comprehensive policy instruments in order to support different energy efficiency measures, starting from simple and cost-effective as well as complex and costly technologies [13]. In this

regard, it is important to take into consideration the issue of inclusiveness of technology specificity and complexity of energy efficiency measures while developing portfolio of investment projects in the field of energy efficiency.

Taking into consideration the rapid improvements of information and communication technologies (further – ICT) in the modern world, an innovative concept in urban development, named “Smart Energy City”, was created, aiming to optimize municipal energy systems and improve the quality of life for citizens. A holistic approach to Smart Energy City concept through using sectoral approach is shown on figure 2.

The Smart Energy City, as an essence to the concept of the Smart City, “provides its users with a liveable, reasonable, climate-friendly and engaging environment that supports the requirements and benefits of its users and is based on a sustainable ecological economy” [15], [16].

The Smart Energy City should be resource efficient, driven by innovative approaches in strategic municipal energy planning and ICT. It should provide engagement of different groups of stakeholders, supporting sustainable decision-making process, oriented on climate change issues.

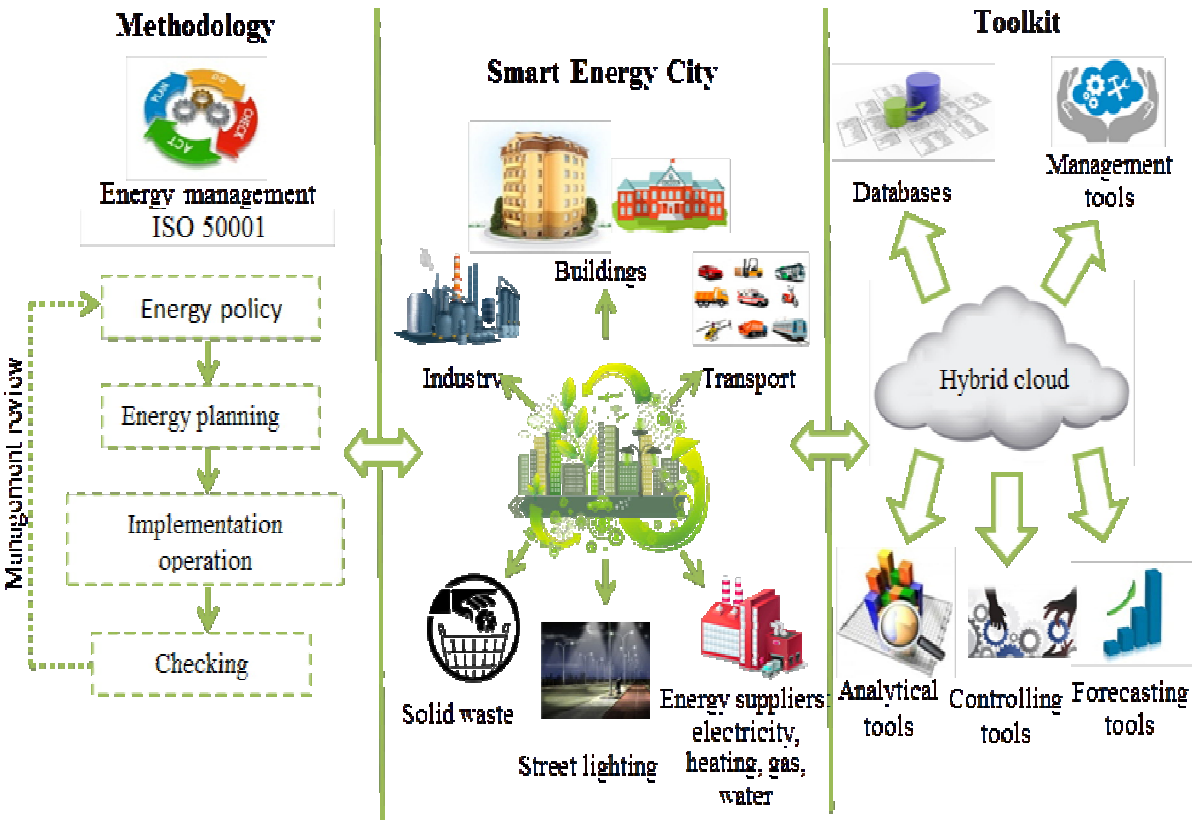


Figure 2. Architecture of Smart Energy City concept through using sectoral approach

Source: Author’s research, based on [17]

The definition of the Smart Energy City should be performed by a number of key performance indicator categories, such as resource system integration, access to energy services, energy efficiency, renewable energy, active and engaged users, sustainable economy. For all mentioned categories, the local authority should determine key performance indicator based on its own vision, objectives, possibilities and challenges.

In Europe, the Smart Energy City concept is very popular [16]. In Ukraine several cities (in particular, Kyiv, Lviv, Vinnytsa) [17] are already actively implementing this model. The concept targets to generate opportunities for linking strategic approaches, hi-tech advances and extensive public involvement in the establishment of a new quality of lifecycle. Still, it should be mentioned that, taking into consideration the issue of not adequacy of commercial accounting of energy resources in our country, it is difficult to extend this approach in other cities in Ukraine.

Further development options of effective energy efficiency policy should be the following:

- strengthening monitoring activities for all described municipal infrastructure sectors, including specific energy efficiency measures;
- creation of national and local/regional energy agencies;
- development of roadmaps for each category of energy-consuming users;
- evaluation of buildings through an improved energy certificate;
- strengthening and supplementary enlargement of the requirements for energy audit for buildings (residential, public, national) and companies;
- creation of high quality energy consulting services and educational training programmes (including the option of certification of professionals) in the energy efficiency field;
- providing effective funding programmes for implementing energy efficiency measures in key infrastructure sectors etc.

Summarizing mentioned above, it is important to note, that the conceptual foundations of municipal sustainable energy development should be the following:

- formation of effective control system over management processes in municipal infrastructure sectors in order to create the preconditions for reducing their energy intensity;
- introduction of energy saving measures and innovative technologies at all phases of production, transportation and consumption of fuel and energy resources;
- upsurge the share of fuel and energy resources of own production in conjunction with their economical usage;
- further intensive usage of renewable energy resources.

Achieving these goals will help to create favourable conditions for increasing the competitiveness of local authorities, and thus, national economy, and ensure further sustainable development and appropriate level of energy security.

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2.5. German energiewende. A switch from feed-in-tariff to auctions

“Energiewende” (can be translated as energy transition), dates back to nuclear opponents in the 1970s aiming to demonstrate alternative energy scenarios. After German reunification in 1990, Germany, being of the few countries at that time pursuing renewable energy, reaffirmed its course on the sustainable development of clean renewable energy. This process has been known as an “Energiewende” as Germany has become the global leader in this industry and is in the pole position to abandon conventional energy [1].

Before the establishment of the Federal Republic of Germany (West Germany) in 1949, an autonomous German energy policy did not exist. At the time, energy policy was not considered an independent policy field, but constituted an essential part of economic policies. Consequently, the energy policy efforts of the first West German government under Chancellor Konrad Adenauer (Christian Democratic Party (CDU), 1949-1963) focused primarily on the economic necessities in post-war Germany: the first objective was to reconstruct the energy infrastructure in general and to overcome the prevailing energy shortage. In this regard, West Germany pursued a strategy of focusing on domestic energy sources such as lignite and hard coal (“coal economy”), aiming for a power and energy supply as affordable and secure as possible [2]. After the ratification of the Paris Agreements in 1955, which made West Germany a (partly) sovereign state and established its integration into NATO and the Western European Union, the government was keen to establish atomic energy as a second pillar of the energy supply system. In 1955/56, the Federal Ministry for Nuclear Affairs and the German Atomic Commission were established. In 1957, further important decisions were made. By joining the European Atomic Energy Community (EURATOM), launching of the first national nuclear program (“Eltviller Programm”) and commissioning the first research reactor (imported from the USA) at Munich University of Technology, West Germany tried to catch up with the international nuclear industry. At the same time, the emerging crisis in the German coal industry (falling prices for oil and coal imports made many collieries unprofitable) encouraged politicians to assume that nuclear energy should be promoted to secure the German energy supply. On 1 January 1960, the Act on the Peaceful Utilization of Atomic Energy and the Protection against its Hazards finally came into force. The act regulated the planning and approval process for the construction of nuclear power plants (NPPs).

From feed-in-tariff to auctions

The competition between mineral oil and domestic hard coal intensified in the 1960s. Even a massive coal priority policy characterized by coal subsidies and heavy taxation of petroleum products did not succeed in ensuring the

competitiveness of German hard coal. By 1970, the share of mineral oil in West Germany's primary energy consumption had risen to 53 percent. With increasing dependence on imports and a growing global integration of West Germany, politicians considered nuclear energy once again to be an important backbone to secure domestic energy supply [2]. Consequently, the second national nuclear program ("Spitzingsee Programm") was launched in 1963, this time on a four-year basis. Besides basic research on fast breeders, the program concentrated on the education and training of nuclear physicists, radiation protection experts and engineers. Financially, West Germany continued to make considerable funds available: until 1967, the federal government invested a total of DM 5.3 billion in research and development to promote the commercial use of nuclear energy. In 1965, the government finally decided to initiate the "experimental storage" of radioactive waste in the disused Asse mine in Lower Saxony (in spite of doubts about the suitability of the site). This decision eliminated one of the last hurdles to widespread commercial use of nuclear power, namely, the (still) unsolved question of final radioactive waste disposal [3]. The various measures of German nuclear policy proved to be effective. In 1967, NPPs at Würgassen and Stade marked the first purely commercial production of nuclear power. At this point, "German producers had caught up with the world market standards, and between 1968 and 1989 more than 24,000 MW of nuclear capacity were put on line" [4]. The belief in technical progress was still unquestioned in the late 1960s/early 1970s and nuclear energy was popular, even across party lines. Nuclear power had become a widely accepted "contemporary technology"

As a response to the first oil crisis and inspired by the research projects of the Carter administration in the United States, the R&D program on energy launched by the Ministry of Research and Technology in 1974 spent about DM 10 million for research on renewables. Individual technologies, especially photovoltaics (PV), were supported, but a goal-oriented development combined with a general concept for a sustainable energy supply clearly was not in sight. In 1977, an incentive system was introduced, which provided a governmental investment subsidy of 25 percent for solar panels and heat pumps. However, politics and industry greatly doubted that renewable energies ever could become a major source of electricity. Consequently, the Kohl government cut research funds for renewables up to 1986 by half as part of its financial consolidation measures. In contrast, it was political and economic studies and major technical pilot projects by the German energy companies that gained widespread attention in the 1980s. Even though the term "Energiewende" had not been used in the 1970s, "the discussion about an alternative path of energy policy, beyond nuclear and fossil fuels, goes back the post-1968 movement" [5].

The governmental energy policy from 1990 to 1998 pursued two primary goals: Firstly, the acceptance and disposal of the environmental and energy

political legacies of former East Germany including the integration of the former East German federal states (“Neue Länder”) into an all-German energy system and, secondly, a better integration of renewables into the electricity market. After reunification, the German government sought to redesign the energy system of the former German Democratic Republic (GDR – East Germany). The primary energy consumption of East Germany had been based almost exclusively on the use of solid fuels such as lignite (65 percent). Fuels such as oil (20 percent), natural gas (10 percent) and nuclear power (3 percent) played only a minor role. In the power supply, the share of lignite had been even higher (80 percent, nuclear power constituted 10 percent). Surprisingly, the government was able to transfer the structures of the West German energy system to the Neue Länder fairly smoothly. With one exception all nuclear power plants in East Germany were shut down. The ecological effect of the transfer of the energy system and environmental standards from West to East Germany was a drastic decrease in the emissions of pollutants and greenhouse gases. The collapse of East German industry had contributed to this as well [3].

In 1991, Germany established the first feed-in tariff for renewable energy, which obliged energy utilities to purchase renewable energy from third-party producers at a fixed price, in order to make renewable energy sources more attractive to investors. In 1998 the coalition government decided to change the law on progressive withdrawal from nuclear energy and in June 2000 it agreed to an arrangement setting a limit for output from nuclear plants (equivalent to 19 reactors operating for 32 years). This was combined with other complementary measures, such as a tax exclusion and an examination of the safety of reactors in Germany, as well as maintenance of waste storage facilities in Konrad and Gorleben [6].

Buying off support for a feed-in tariff was successful only for a short period of time. Soon afterwards, a new bill for such a tariff circulated among MPs, supported both by conservative (CDU/CSU) and green deputies who gathered support among the other parliamentary groups as well. In the end, the conservative leadership both in the Economic Affairs ministry and in parliament reluctantly accepted this idea; support came however from the Ministries of Research and of the Environment. A government bill was prepared after an unsuccessful, lastditch effort to secure a voluntary commitment by the electricity sector grant more favourable terms to RES-E. The bill secured consent from all parliamentary parties and became the Electricity Feed-in Law of 1990. The large utilities did not mobilise at that point, probably because they underestimated the importance of the law (which at first was expected to play a minor role, mostly for small hydro); also, taking over the East German electricity sector during reunification absorbed their attention. The Feed-in Law required electric utilities to connect RES-E generators to the grid and to buy the electricity at rates of 65 to 90 percent of the average tariff

for final customers. Generators were not required to negotiate contracts or otherwise engage in much bureaucratic activity. Together with the 100/250 MW programme and subsidies from various state programmes, the Feed-In Law gave considerable financial incentives to investors, although less so for solar power due to the latter's high cost. One of the declared purposes of the law was to 'level the playing field' for RES-E by setting feed-in rates that took account of the external costs of conventional power generation. In this context, the chief Member of Parliament supporting the feed-in bill on behalf of the Christian Democrats in the Bundestag mentioned external costs of about 3-5 Eurocents per kWh for coal-based electricity. Before adoption, the law was notified to the European Commission for approval under state aid provisions. The Commission decided not to raise any objections because of its insignificant effects and because it was in line with the policy objectives of the Community. However, it announced that it would examine the law after two years of operation [7].

These incentives greatly stimulated the formation of markets and led to expansion for wind, from about 20 MW in 1989, to over 1,100 MW in 1995. This encouraged technological and political learning in this sector, but also strengthened political resolve on the part of conventional electricity generators – particularly the supra-regional utilities – to attempt a rollback of this law, via both politics and the judiciary. This was more than just opposition to small and decentralised generation. First, no provision had been made to spread the burden of the law evenly in geographical terms; a satisfactory solution to this problem came only in 2000. Second, the utilities were by this time marked by the experience of subsidies for hard coal used in electricity generation which had grown from € 0.4 billion in 1975, the year the 'coal penny' was introduced, to more than € 4 billion annually in the early 1990s. Two thirds of this was covered by a special levy on electricity, one third had to be paid by the utilities directly but was also passed on to the consumers.⁴ Political efforts to change the law seemed at first more promising. In 1996, utilities association VDEW lodged a complaint with DG Competition (a subdivision of the European Commission) invoking violation of state-aid rules. The Commission now expressed similar concerns due to "excessive" minimum prices for wind, considering the substantial advance of technology since 1990. Accordingly, it proposed possible amendments: reduce the minimum price for wind to 75 percent of average sales price (instead of 90 percent), limit the support [8].

While the Feed-In Law of 1990, combined with the 250 MW wind programme, led to the breakthrough for wind, solar photovoltaics did not benefit similarly. The 1,000 roof programme of 1989 had been a success and led to installations of 5.3 MW by 1993, but this market volume did not justify the installation of new production facilities in the solar cell industry. The Feed-In Law provided little help since rates did not come near PV costs, and a new

demonstration programme was not forthcoming. If the industry was to survive, market creation had to come from other quarters. This led to intensified efforts to mobilise other resources, a process which demonstrated the high level of legitimacy that solar PV enjoyed in German society.

The Renewable Energy Sources Act of 2000 (Erneuerbare-Energien-Gesetz, EEG) maintained the philosophy of the StrEG (Law for FiT) [9] for specific technologies and as a long-term (20-year) support mechanism for renewable energies (mainly wind, solar PV and geothermal and later extended with regulations covering bioenergy). Specifically, the act led to development of more wind energy. The “conventional” energy sector decided to take legal action. EU Commissioner for Competition, Karel Van Miert, went on the record as stating that he considered the FiTs to be unlawful subsidies and the German power company Preussenelektra (which merged with Bayernwerk in 2000 to create E.ON Energie), decided to take the matter to court. The case reached the EU Court of Justice, which in 2001 ruled that FiTs did not constitute public subsidies and were therefore not illegal, thus enabling the development of renewable energies [10].

EEG is the primary tool for realizing energiewende and was introduced in 2000. It regulates only the renewable electricity sector. This law has been revised a number of times since then. EEG when it was first introduced in 2000 had the following three provisions [11]:

Renewable energy producers will receive fixed remuneration for 20 years (feed-in-tariff) and will also have priority access to the grid over the conventional sources;

The FITs will decrease by a fixed percentage to incentivize renewable energy producers to reduce cost;

FIT is not paid by government funding but rather by the market and consumers. Renewable energy is directly sold in the market and receive the market price. The difference between the market price and the predetermined FIT is levied on the consumers in the form of EEG surcharge. The surcharge is applied to household consumers and small-scale industries, while the energy intensive industries are exempted from it. Similarly, operators of renewable and small conventional power plants that use the electricity they themselves generate are also exempt from the EEG surcharge.

During the grand coalition from 2005 to 2009, climate protection and energy policy had finally become dominant political issues. The government provided political continuity in the field, confirming the energy policy measures of the red-green coalition. However, a consensus on the question of the further use of nuclear energy between parties was still pending.

The Fukushima accident led to hysterical reactions within the German media as well. This becomes clear if one compares the reactions in Germany with those in France and the United Kingdom. In Germany, extra supplements of daily and

weekly newspapers were published; the disaster was documented by the minute. Even major newspapers, which were politically close to the ruling parties, criticized the nuclear policy of the CDU/CSU and FDP after Fukushima. The social and media response to the disaster applied pressure on the government. None of the usual justifications in favor of nuclear power seemed to work any longer [12].

The recent amendments of the EEG in 2014 envisage (skeptically: ponders – depending on the reading of the rather vague formulations within the law) a long-term transformation away from feed-in tariffs and towards tender schemes. Again, this conforms to the overall direction, if the EU Commission's guidelines may serve as point of reference [13]. The EEG in 2014 or the EEG 2.0, aims to keep the energy prices down, promote energy security, and also to develop the electricity market [14]. The most striking features of the reform (EEG 2.0) include [15]:

EEG surcharge exemption for energy-intensive industries have increased from 297 in 2005 to 2098 in 2014. These companies were not excluded from all EEG surcharges, instead the privileged companies have to pay 15% of their EEG surcharge.

Feed in tariff are adjusted according to the targets (flexible cap) i.e. newly built renewable plants (above 100 kW) are required to market their electricity themselves and only received market premium. This market premium covers the difference between the fixed payment stated in the EEG and the average spot electricity price. No feed-in tariff during period of negative power prices (more than 6 consecutive hours), exceptions apply.

Consumers are obligated to pay a smaller portion of the EEG surcharge as compared to before.

Nuclear energy, which will be completely phased out by 2022, provided 30 percent of Germany's electricity supply at the beginning of the 2000s, but this share has already been halved amidst the growth of renewable energy sources [16]. The Energiewende is also taking place against the background of Germany's ambitious climate protection goals: greenhouse gas emissions shall be reduced by 40 percent by 2020 and by 80–90 percent by 2050, compared to 1990 levels. As almost 85 percent of current greenhouse gas emissions derive from the energy sector [17], this sector is the primary target of mitigation efforts in Germany. The Energiewende and its overarching goals are strongly backed by society. Public opinion polls consistently report approval ratings exceeding 90 percent [18]. This overwhelming public support is also a result of strong citizen involvement in the energy transition, with pioneering activities of towns and villages since the 1990s and almost 50 percent of renewable energy capacity being owned by private citizens and farmers.

The previous Environment Minister Peter Altmaier stated that the Energiewende is the greatest political and economic challenge Germany has faced

since reconstruction after the Second World War (Der Wiederaufbau) [19]. With many countries keeping a close eye on events in Germany, Modell Deutschland is also of enormous international importance [20]. Although the circumstances, which lead to the German Energiewende, are unique, the policies developed and implemented in Germany could be transferred to other countries, in particular if the Germany experience is successful.

The history of the Energiewende also informs why Germans remain so supportive of the Energiewende: in 2016, 93 percent of Germans saw the Energiewende as very important or important, with 55 percent thinking that the transition to renewables is happening too slowly [21]. Many see Energiewende becoming a generic term used to describe a transition to renewable energy.

While many countries have used auctions in regular public procurement processes, experiences with the use of auctions for RES-E support are limited, and early examples have indicated the existence of implementation problems. The European Commission recommends that Member States increasingly adopt more marketbased-based instruments, including competitive bidding processes. Current State Aid Guidelines for Energy state that by January 2017 all Member States shall set up competitive auctions to grant support to all new installations, with only very few exceptions. In this context, international experiences with auctions provide important lessons for the reform of existing or the implementation of new auctions schemes [22].

The new Energy and Environment State Aid Guidelines of the European Commission require as of 2017 that support for renewable energy projects generally be awarded in a competitive bidding process. Exceptions to this rule are allowed only for small-scale projects, if too few bidders would be eligible, if support levels would increase or if project realisation rates would decrease. In economic theory, calls for tenders, or auctions, are an efficient tool for determining prices. However, the literature draws attention to various prerequisites for a successful tendering process: sufficient competition must be assured, for example, through a sufficient number of bidders as well as by involving small market actors. Since the tendering process brings about additional risks for project developers, the auction design needs to address these risks or else costs may increase significantly. In addition, experience in other countries shows that a significant number of awarded projects may not be realized [23].

Renewable energy auctions are also known as “demand auctions” or “procurement auctions”, whereby the government issues a call for tenders to install a certain capacity of renewable energy-based electricity. Project developers who participate in the auction submit a bid with a price per unit of electricity at which they are able to realise the project. The government evaluates the offers on the basis of the price and other criteria and signs a power purchasing agreement with the successful bidder. Renewable energy auctions, despite some difficulties in

implementation in the past, have become a popular policy tool in recent years. The number of countries that adopted renewable energy auctions increased from 9 in 2009 to at least 44 by early 2013, out of which 30 were developing countries. The renewed interest in auction schemes is driven by their potential to achieve deployment in a cost-efficient and regulated manner. Auction schemes have benefited from the rapidly decreasing costs of renewable energy technologies, the increased number of project developers, their international exposure and know-how, and the considerable policy-design experience acquired over the last decade. When well designed, the price competition inherent to the auction scheme increases cost efficiency and allows price discovery of renewable energy-based electricity, avoiding potential windfall profits and underpayments. While auctions have become very attractive, they only benefit the successful bidders and tend to favour large players that are able to afford the associated administrative and transaction costs. Based on national energy plans as well as the size and maturity of the renewable energy market, the design of auction schemes will reflect each country's priorities in terms of technology, volume and location. Technology-specific auctions allow for the promotion of certain technologies and diversification of the portfolio. In addition to selecting the technology, auctions can be site-specific. The identification of sites with ideal resources and secured grid connection potentially reduces risks to investors. Technology-neutral auctions have also served to promote renewable energy technologies, which have even been able to compete with fossil fuels on certain occasions. The design of auctions allows governments to include other national priorities, the most common one being local content requirements. These different aspects of renewable energy action schemes are described in this report, drawing on experiences from five countries, namely Brazil, China, Morocco, Peru and South Africa [24].

Policy discussions on support for renewable energy typically cite improving cost efficiency as a key requirement. Efficiency implies reaching a given goal with the smallest possible effort or, alternatively, using given resources to achieve the greatest possible output. "Cost efficiency" is the term commonly used in this connection. Nevertheless, other factors and criteria that influence the total costs to society have to be taken into account when designing support instruments. Some important factors and criteria are listed and discussed briefly below, serving as a point of reference for the following sections [25].

→ Static efficiency is assured if the defined target for expansion can be reached with the least possible effort. Static efficiency thus requires the optimal allocation of resources. Applied to the expansion of renewable energy, this means that at a given point in time the most cost-effective technology and/or combination of technologies is used at the best locations.

→ The criterion of dynamic efficiency reflects the extent to which a support mechanism is – among other things – capable of spurring technical progress and

innovation, and thereby achieving the greatest benefit for the economy as a whole. In this regard, technical innovation and the continuous improvement of operational procedures provide room for medium- and long-term cost reduction. At the same time, it has to be considered that static and dynamic efficiency can be at loggerheads. For example, when trying to achieve a short-term expansion for renewable energy, it can be statically efficient to exclusively focus on the technologies that are currently the cheapest. However, subsidizing new and more expensive technologies can prove to be dynamically efficient with a view to attaining technological progress (but does not have to be!).

→ From a political point of view, minimising support costs, especially those assessed to consumers via levies and surcharges, is an independent and important criterion alongside maximizing system-wide efficiency. While minimizing levies and surcharges is often considered to be more efficient in promoting renewable energy, this viewpoint is not entirely correct.

The auction scheme in Germany was implemented with three objectives in mind: to determine the required level of support for RES-E in a competitive manner, manage the capacity expansion of renewables while staying on track with targets, and allow the participation of a variety of market players. Moreover, and like in other EU countries, auctions in Germany were introduced to comply with the current EU State Aid Guidelines. The first round of the pilot auction was held in April 2015, with future auctions planned for rooftop solar PV, wind onshore and offshore from 2017 onwards. The case study focused on the first two rounds of the ground-mounted solar PV auction pilot taking place in 2015. The pilot scheme operates as a multi-item, static (sealed-bid), pay-as-bid auction (except for two rounds in 2015 using uniform pricing). The scheme is technology-specific, as only ground-mounted PV plants between 100 kW and 10 MW may participate. To meet pre-qualification requirements, bidders need to specify the location of the project, include proof of a zoning approval by the responsible authority, and hand in a first bid bond worth €4/kW [26]. The bid bond is halved if the bid includes a definitive zoning approval, instead of a preliminary one. All actors participate on equal conditions, regardless of the type or size of the participant. Price is the only evaluation criterion for eligible bids. Auction winners are required to submit a second bid bond worth €50/kW, which is halved if the submitted zoning approval is a definitive one, a distinction introduced to assist smaller actors. Both rounds exhibited high levels of competition: in the first round, the auctioned volume (150 MW) was exceeded four times, while in second round the volume (159 MW) was exceeded three times. Effectiveness in terms of the timely commission of projects cannot be yet evaluated due to the 18-month realisation period. The first two rounds led to lower support costs: the average price of the first auction round (pay-as-bid) was €91.7/MWh, which was significantly below the ceiling price of €112.9/MWh. In the second round (uniform price), support level further declined

to €84.9/MWh [8].

The unprecedented Energiewende can only succeed as a collective effort. This effort is based on the public perception of a long-term, foresighted transition process, which in turn requires an active and ambitious state. So far the Energiewende has benefited strongly from the considerable engagement of actors at all levels, from individual citizens to municipalities, companies, and regions. National policies have produced some impulses, but there still is a clear lack of long-term planning and concerted political effort. Technological and social innovation as well as accelerated market transformation demand vivid entrepreneurship across all levels of society – including our political systems. And let's not forget that the active participation of citizens – resulting from the democratization and decentralization of the energy system – is by no means a nice-to-have side-effect, but the key pillar on which the Energiewende and its public acceptance rest [27].

Germany is heading towards becoming an economy fueled by renewable energy. However, challenges such as rising costs, questions about implementation, and the need for technological innovation remain. German Energiewende is arguably the very important historical phenomena in the current development of the energy industry. In times when the scientific consensus about climate change issues has been widely accepted amongst the World's leaders, as well as by the general public in individual national states, the Germans are spearheading the World's efforts to replace fossil fuels with renewable energy sources (RES) as a means of covering energy needs.

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CHAPTER 3

REGULATION OF BRANCHES OF ECONOMY IN THE CONDITIONS OF INNOVATIVE CHANGES

3.1. Innovative strategies for ensuring competitiveness of retailers' activities

The problem of the development of trade enterprises for the improvement of their competitive positions, in particular through the use of various innovations, is relevant, because the state of trade in the country determines the economic aspect of its development as a whole. In addition, the acceleration of regional trade turnover is in dependence of it.

One of the new methods to improve the competitiveness of retailers is innovative strategies based on taking into account their stage of the life cycle and new opportunities for sectoral development in ensuring the success of the management of these entities as a whole. Choosing a strategy, one should be guided by a clearer definition of the competitive position of these enterprises, combined with careful diagnostics of the internal and external environment, as well as an integral assessment in determining their competitiveness. All of this has determined the choice of the topic, the formation of aims and objectives of the study.

The aims of the study is to find new ways and construct innovative strategies to increase the competitiveness of domestic retailers in theoretical generalization and with practical application on the example of retail chains of supermarkets in Lviv region.

The research objectives: the formation of a theoretical basis and practical implementation of the phased adaptation of competitive strategies of retailers to market changes due to the application of innovative approaches.

The object of the study is the process of establishing, forming and strategically regulating the level of competitiveness of retailers.

The subject of the research is the theoretical and applied basis for assessing the level of competitiveness of supermarket retail chains in the Western region of Ukraine, specializing in retailing, and substantiating of strategic management decisions (in particular, innovative) to raise this level.

The following *methods* were used during the research: general (observation, comparison, generalization, analysis and synthesis), expert method – to identify and to assess the main components of the competitiveness of retailers, the method of complex analysis and SWOT – to compare competitors, the life cycle method and the directional policy matrix Shell / DPM – for choosing strategic decisions.

Elements of scientific novelty of the obtained results are contained in the following:

- 1) adaptation of existing types of innovative strategies of commodity

producers to the specifics of enterprises in the retail sphere;

2) addition of separate methodological approaches to the integrated assessment of competitiveness of retailers and their basic products;

3) improvement of the procedure for justifying a choice of a strategic alternative in the process of forming a strategy for obtaining these enterprises competitive advantages through various innovations.

Practical significance of the research is to display a step-by-step procedure for conducting strategic diagnostics of the competitiveness of retailers (on the example of retail chains of supermarkets in the Western region of Ukraine) and in forming a sequence of strategic decisions that allow finding new moves, options and opportunities for the success and development of enterprises in this field of activity.

1. THEORETICAL ASPECTS OF INNOVATIVE STRATEGIES APPLICATION IN ACTIVITIES OF RETAILERS TO ENSURE THEIR COMPETITIVENESS

The development of commercial enterprises in a highly competitive market environment and transformation depends on various economic factors that characterize the dynamic environment, namely finding the “golden mean” between supply and demand, purchasing power, forming the cost of goods and others. Moreover, the scope of circulation of goods is faced with such difficulties as lack of systematization intervention of public authorities in trade, service delivery of agent discrepancy customer requirements and insufficient information support customer market. In view of this, trade enterprises need to find ways to improve the competitiveness of the organization to ensure the effective functioning of the sales function, based on the implementation of innovative strategies.

Research state and development of domestic trade and enterprise competitiveness are reflected in the works of such famous foreign economists, statisticians, analysts, as A. Mazaraki, J. R. Evans, T. Kent; I. Ansoff, M. Porter, D. Ricardo and domestic scientists, as E. Svidersky, E. Azaryan, V. Apopii, M. Balaban, B. Berman, V. Galejev and others.

According to the Law of Ukraine (Project concept) “On Domestic Trade”, trading activity is “the activity of the sale and purchase of goods, including own production, or intermediary activities, including the provision of agency, commission and other services for the promotion of goods from producers (suppliers) to the final buyer” [1].

The activities of enterprises engaged in the sale of goods are directly dependent on the conditions of market competition and consumer demand in the sense of satisfying their needs. Therefore, it should be noted that *competitiveness of organization* (CTVo) is regarded as a method of achieving the efficiency of trade turnover between this organization, its encirclement and domestic trade as

a whole. According to M. Porter, CTVo is “the ability to successfully operate in a specific market (sales area) within a certain period of time by issuing and marketing competitive products and services.” He also argues that the competitiveness of a company depends on its economic environment, which, in turn, is determined by the general resource [2].

The increase of CTV depends on many factors that is divided by external and internal. To external factors belong politics in the country and changes in a legislative base as well as the presence and strength of the influence of competitors. To internal, for example, belong product quality, orientation to the marketing policy of the company, which will include merchandising in the rationality of the location of goods, the degree of satisfaction of consumers' needs, sales function of the organization, costs for the implementation and introduction of innovation strategies, etc.

An innovative strategy (IS), based on the notions of scientists [3-9], should be understood as a long-term plan for the achievement and realization of the goals of the organization, which includes the rational use of resources, the movement on the innovative path of development and the impact of external and internal factors that affect to this specific organization. Considering IS as one of the systematic approaches, it should be noted that it is one of the components of economic competitive strategy, which is defined as a certain methodology, which embodies a set of rules, methods and means of searching for promising directions for the development of resource policy and scientific-technical research. With certain adjustments all the above is relevant for organization-retailers.

Consequently, based on the results of the analysis of literature sources, it is possible to conduct an appropriate grouping of the proposals of different scholars regarding the typing of IS, indicating the advantages and disadvantages of these strategies in the use for retailers. We adapted the general strategic proposals for the innovative development of enterprises of any kind of activity for the retail sector and summarized them in Table 1.

The strategy of retailer potential management is unique and specific because of its dependence on factors of the external and internal environment. Therefore, the development and implementation of IS for the trade sector requires consideration of its influence factors and its features.

In the formation strategy for retail we should consider several factors [12]:

- The scale (whether the company aims to expand its area, that is, to enter new domestic and foreign markets);
- Scope (with what product groups the organization plans to work);
- Distribution network (how effective will be this or that distributor / supplier);
- Implementation period (for what period the strategy should be realized);
- Requirements to the enterprise (how rationally some resources are allocated

for implementation of the strategy).

Table 1

Typization and analyzation of innovative strategies for use by retailers

Author	Strategy	The essence of the strategy	Advantages	Disadvantages
Ch. Freeman	Offensive (aggressive)	The company's ability to respond quickly to changes and adapt to new opportunities	It provides the company with the ability to use the new technology from competitors	The riskiest strategy
	Defensive	The management of new technologies (in management and sales) and through them the access to new markets	It gives analyze of the achievements and mistakes of partner firms / competitors	It needs to spend a lot of time on advertising and staff, it requires high mobility
	Imitative	Copy of technologies (in management and sales) of "Pioneer" firms	It allows to reduce sales costs by attracting cheaper resources or using existing capacities for new appointments	It is successful only if you add "own" ("branded") additional qualities to the original technology
	Dependent	Dependence of marketing and management policies from the "parent" firm (typical for trading networks)	It provides predictability of changes for all members of the trading network, which reduces the risk to them from innovations (with increasing risk for the "parent" company)	A significant limitation in initiating innovative approaches and forms for all participants in the trading network
	Traditional	Lack of changes in sales and promotion technologies	It provides a meaningful refusal to update these technologies due to a thorough analysis of the market situation and the state of competitors	It may come into conflict with the need to improve the forms and services of the traditional way of selling (selected for a long period of time as unchanged)
	Opportunist ("by chance")	It is associated with the rapid development of information and opportunities that arise in the enterprise environment	The advantage is to find a special niche on the existing commodity markets (typical for retailers oriented to the consumer with non-typical, but diverse needs)	It makes sense only when it is the first step towards other strategies. Without this, this kind of strategic behavior is unpromising

Table 1 continuation

Author	Strategy	The essence of the strategy	Advantages	Disadvantages
B. Twiss	Avoidance	Avoiding direct confrontation with competitors, finding a “niche”	Using strong positions in the chosen “niche”	Problems with the search and employment of “niches” for firms-retailers
	Market creation	Access the market to a product that nobody else produces	Possibilities of quick recoupment of expenses, formation of monopolization in the market	High degree of risk of loss of competitive advantage
	Defensive	Missing orientation towards occupation of leading positions; not lagging others	Lack of strong competitors, the ability to use already proven technologies in the market	The probability of passing an important innovation that is changing
	Offensive	The desire to be first in the market in terms of product promotion	Rapid response to the emergence of “technologies”	Probable risks associated with the failure of the innovation
	Invasive	Invasion on a new market, which leads to a decrease in its size	Receiving profits by reorienting consumers from traditional to new products	Lack of experience in an unfamiliar market (high costs, low payback for retailers)
Yu. Denisov	General	Innovative activity is present in most possible areas	Possibilities of using new technologies both in the management of the company and in sales operations	Distribution of funds between many areas
	Elective (selective)	Use of resources in one effective direction	Ability to quickly avoid retardation due to concentration of resources	Retardation in integrated development among competing enterprises
	Combined	Combination of different strategies	Efficient use of resources	With incorrect combination of strategies, slow development is possible

Source: Processed by the authors using data [3-11]

Given the above factors, it's important to understand that retailers first need to analyze their potential, identify goals in innovations and combine them with common goals, assess the macro- and micro-environment, including domestic and foreign markets, competitors' actions, and possible risks. Next it is necessary to determine the priorities of development, based on the innovative potential; to plan

directions of this development based on innovative goals; to develop rationally-optimized ways of innovative development in the future and to coordinate the work of divisions of the enterprise. Therefore, it is necessary to ensure the continuity of the process of implementing innovations, as well as to implement IS in accordance with the emerging innovative goals of increasing the competitiveness of trade enterprises. It is also important to control the life cycle of innovation and to analyze changes in the external and internal environment and to adjust (if anything) innovative objectives of retailer.

2. ANALYTICAL GROUND FOR THE FORMATION OF COMPETITIVE INNOVATION STRATEGIES FOR RETAILERS IN THE WESTERN REGION OF UKRAINE

A trading company in its activities is a participant not only in the competition for leadership in the maximum sales of consumer goods and services, but also in the struggle for the buyer. Therefore, the choice of strategy for the further development of the organization depends on the assessment of the state of competition in the market of trade, as well as determining the position of the retailer on it. Consequently, strategic diagnostics and thorough preparation of future strategic moves are an important means of survival in conditions of constant competition.

Competitiveness (CTV) has two main features in its basement, namely: comparisons and dynamism. In the first case, CTV is detected only if it is compared to another competitive object. Therefore, it can be estimated only by comparing the essential parameters. Including the complex assessment, they will help identify the level of CTV. On the other hand, CTV should be considered in the short term to prevent possible significant losses in the future. This is confirmed by the fact that the revealed retailer's competitiveness index in the long term cannot be rated as leading in the area of goods circulation, regardless of its effectiveness.

Considering this, attention should be paid to the concept of the "life cycle (LC) of the enterprise" as the basis for the assessment of the retailer's CTV. According to various assessments of the LC, we select the approach of B. Colasse [13], who distinguishes four stages of company development in covering its size of profit and turnover. The first stage – "Childhood" – represents the beginning of the activity of any enterprise, which is damaged and has a low growth rate of turnover. "Youth", as the second stage is characterized by the fact that the enterprise begins to flourish, that is, it receives profits, accordingly, its turnover increases. The third stage – "Maturity" - allows us to maximize profits, but turnover is slowing down. And in the last, fourth stage – "Old age", the company loses its solvency and could become bankrupt.

To evaluate and to detect the level of CTV, we use the method [17] and its

four stages. *At the first stage*, we will define a group of competitor companies, which should be characterized by a reasonable set of features, namely: 1) the only regional market activities identified in the city, area or region; 2) compliance with the width, depth and structure of the range of products; 3) combination of LC phases and the main strategic objectives of the enterprise; 4) the use of similar channels of distribution; 5) both equal access and opportunities for resource formation. *The second stage* involves collection of information about the competitors' activities.

Thus, at these two stages, we will consider the activities of such retailers as “Silpo Retail” Public Joint-Stock Company (PJSC), PJSC “Evrotec “Arsen” and “Furshet” Private Joint-Stock Company (PrJSC), located in the Western region of Ukraine and complying with the specified list of features.

In this study, the basis is PJSC “Silpo Retail” as one of the leaders in the sphere of circulation of goods in Ukraine and expanding production capacity to 238 supermarkets. This retailer has been in the market for more than 19 years and is a part of the most profitable FMCG group of Ukraine – Fozzy Group, characterized by the sale of food products and develops five brands, depending on the specifics of this or that object. Consider its sales for the years 2007-2017 (Fig. 1), which can estimate its life cycle. The analysis carried out shows us that PJSC “Silpo Retail” holds firm positions in the state of goods circulation. In the company there was a decline in net income in 2011 and 2013, and therefore this indicates that such minor variations observed in different plants, but not every organization tend to keep their position in the market and occupy a leading place among retailers in Western Ukraine. According to this analysis, it can be argued that the company is between the stage of “rapid development” and “maturity” for the life cycle. And this means that it managed to strengthen its competitive advantage through marketing policy, consumer loyalty program, lower prices and other factors.

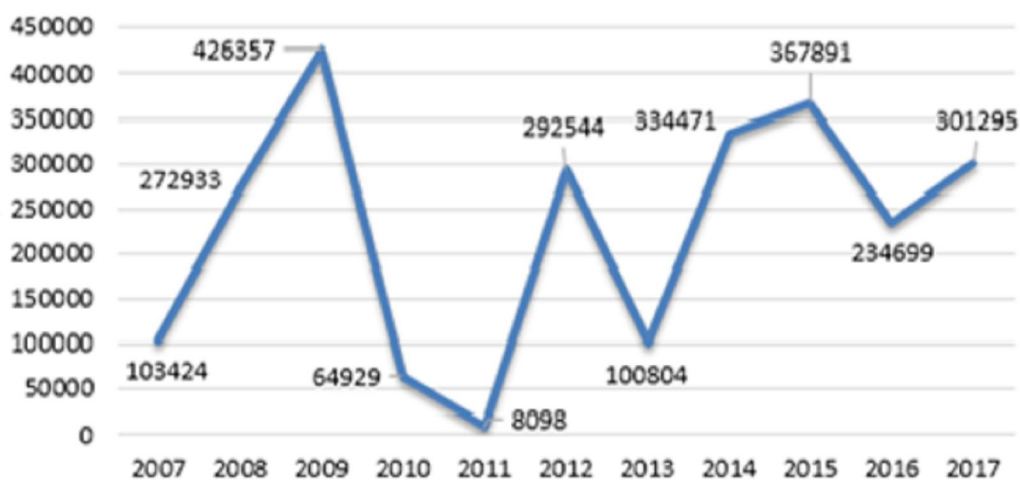


Figure 1. Volume of sales of goods, services in PJSC “Silpo Retail”, thousand UAN
Source: compiled according to the data [18]

The main rivals of this retailer in the West of Ukraine are PJSC “Evrotec “Arsen” and PrJSC “Furshet”. As for “Arsen”, it has insignificant production capacities, since it owns only seven supermarkets. This retailer has been in the market for 15 years and is a member of the “Evrotek” Company. In addition, it develops three of its trade brands: “Supero”, “For You”, and “Arsen Freshmilk”. The dynamics of its volume of sales of goods, works and services is presented in Fig. 2.

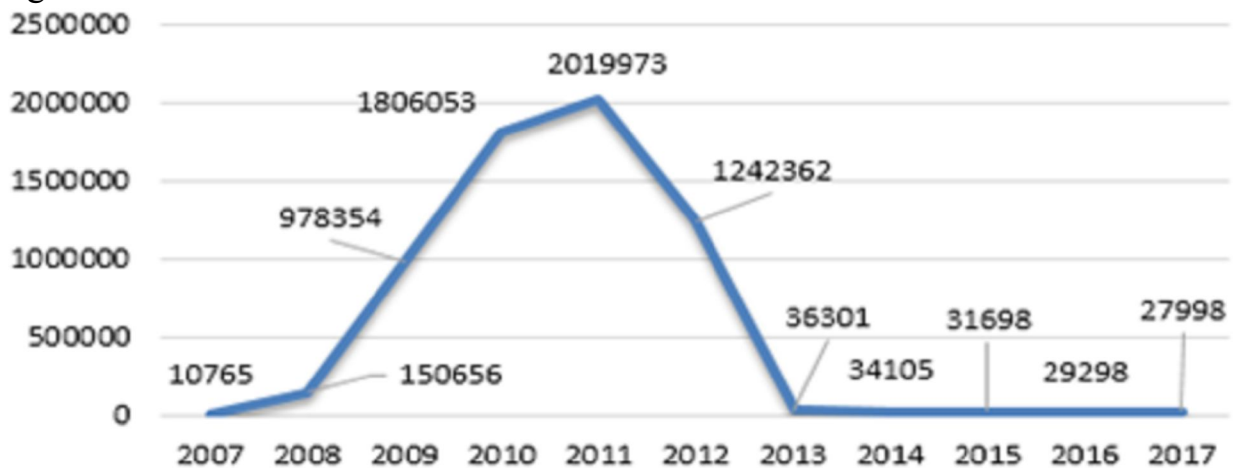


Figure 2. Volume of sales of goods, services in PJSC “Evrotec “Arsen”, thousand UAN

Source: compiled according to the data [19]

Analyzing the volume of “Arsen”'s sales, it can be argued that this retailer is gradually losing its competitive advantage over others. Since its inception, the company has proved itself to be relatively good, as shown by the growth in sales volumes in 2008-2011. However, since 2012, the sales growth rate has slowly started to decline in this trade enterprise, which means that it is at the stage of «old age” or prolonged decline.

Furshet has been in the market for more than 25 years and has relatively good production facilities, because its network has 81 supermarkets and, besides, it has business in such countries as: Georgia and Moldova. The difference between this retailer is that among the selected competitors it is not part of any group of companies. He also owns two “Furshet” and “Narodna” brands. In fig. 3 there are shown the sales volumes of this enterprise.

After analysis of the retailer, it can be argued that it keeps its nice position in the trade market. Only in 2012 there was a decline in net income, however, next year the situation in the company stabilized, and in the future, it managed to strengthen its competitive advantages due to the introduction of loyalty program, the corresponding quality of goods at moderate prices and other factors. According to the analysis, we can say that “Furshet” is at the stage of “maturity” of LC.

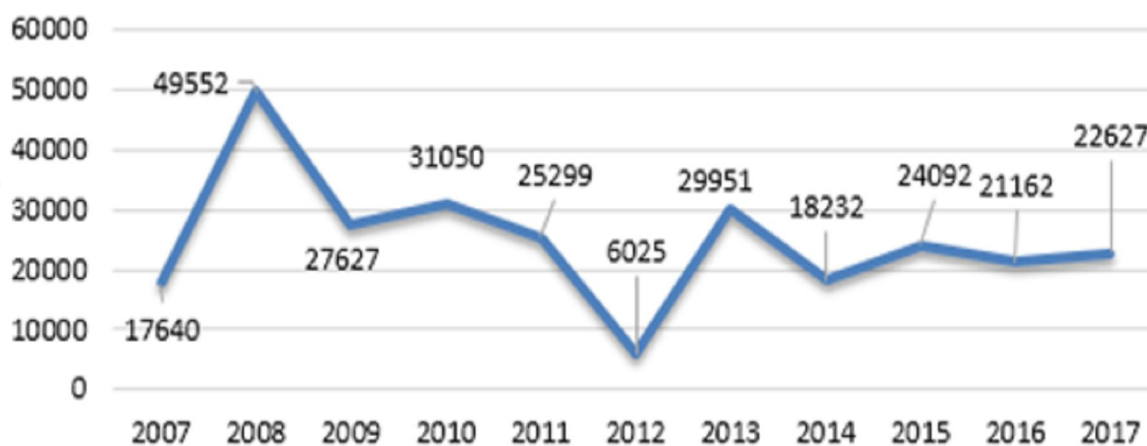


Figure 3. Volume of sales of goods, services in PrJSC “Furshet”, thousand UAN
Source: complied according to the data [20]

The third step in the CTV assessment is to formulate a system of key valuation indicators for the best assessment of the retailers' competitiveness, which in the future will allow to develop an innovation strategy. For the comprehensive provision of an integrated approach to the CTV assessment, the standard procedure was supplemented by finding the integral indicator for the “price-quality” criterion, analyzing the state of financial and economic activity, resource availability, etc. All these considerations are presented through the competitiveness assessment index of the organization (CAI):

$$CAI = 0,25*EA + 0,25*FS + 0,25*EOS + 0,25*CT, \quad (1)$$

where EA – group of indicators of economic activity, FS – a group of indicators of the financial state of the enterprise, EOS – a group of indicators of the sales organization effectiveness, CT – the indicator of competitiveness of goods by the brand (TM) (according to the criteria “price-quality”).

Calculations are summarized in Tables 2-4 and shown in Appendix A.

Let's start with the last indicator (CT). By part of the methodological approaches, the competitiveness of the enterprise can be characterized by the transfer of the assessment of the competitiveness of its products / goods. It is known that the CTV product is influenced by a few parameters that can be used to identify the priority of its choice and determine the volume of sales of products on the market. These parameters include: qualitative (technical) and price (economic). Let's evaluate the competitiveness of the same merchandise retailers that are sold for their brands. For this product the refined oil bearing the names of the corresponding brands is taken: “Full Bowl” (“Silpo”), “For You” (“Arsen”) and “Furshet” (product is named like this supermarket).

Estimation of the complex index of competitiveness of this product for TM retailers will be carried out according to the criteria “price-quality” and calculate according to the formulas (2-5). The qualitative parameters of the product and their evaluation are summarized in the Table 2. The consumer survey has a set of these

parameters. In this case, the partial relative quality index (q_i) (provided that all partial indicators of the estimation by nature are stimulators) will be calculated according to the formula:

$$q_i = \frac{P_i}{P_e}, \quad (2)$$

where P_i – the value of the i -th parameter of the evaluated object (when comparing competitors, they are considered in turn); P_e – the value of the i -th sample parameter / product standard (if there is no data for the reference, one of the competitors can be taken as the basis for comparison).

Then the weighted partial relative quality indicator (I_{ti}) considering its weight (a_i) calculated as:

$$I_{ti} = q_i \cdot a_i. \quad (3)$$

Accordingly, the integral index of the competitiveness of the goods by the criterion of quality by the set of indicators (I_q) is calculated by the formula of the weighted arithmetic mean:

$$I_q = \sum(q_i \cdot a_i) / \sum a_i \text{ (note that } \sum a_i = 1, I_q = \sum I_{ti} \text{)}. \quad (4)$$

Then the integral index of the competitiveness of the goods according to the criteria “price-quality” (CT or I_{qp}) will be calculated as:

$$CT = I_{qp} = \frac{I_q}{I_p}, \quad (5)$$

where I_p – competitiveness indicator for the price criterion (taken as the ratio of prices of the estimated and reference (base) object).

Table 2

Calculation of the integral indicator of the competitiveness of refined oil retailers “Silpo”, “Arsen” and “Furshet” based on the criteria “price-quality” in 2017

Indexes	Unit	Value for:				Partial relative indicator			Validity	Weighted relative quality index		
		TM «Full Bowl» (FB)	TM «For You» (FY)	TM «Furshet» (F)	Etalon of refined oil	FB	FY	F		FB	FY	F
Design	points	9	8	9	10	0,9	0,8	0,9	0,14	0,16	0,18	0,16
Taste quality	points	10	9	10	10	1	0,9	1	0,6	0,6	0,66	0,6
Expiration date	month	4	4	4	4	1	1	1	0,1	0,1	0,1	0,1
Capacity	1	0,85	0,85	0,85	0,85	1	1	1	0,16	0,16	0,16	0,16
Integral indicator of competitiveness on the criterion of quality										0,986	0,912	0,986
Price	UAN	25,74	25,75	34,79	29,90	-						
Competitiveness indicator by price criterion										0,861	0,861	1,164
Integral indicator of competitiveness according to the criteria of 'price-quality'										1,145	1,059	0,850

From Table 2 the product of the retailer “Furshet” is not competitive (because its integral indicator CT is < 1), although it is close to quality to the standard of the studied product. In addition, it is important to note that TM “Silpo” and “Arsen” are competitive due to a more attractive price.

The composition of the remaining groups, named in the formula (1), is shown in Table 3.

Table 3

Assessment of components of the competitiveness of retailers in the Western region of Ukraine

Competitiveness Indicators	Characteristic	PJSC “Silpo Retail”		PJSC “Evrotec “Arsen”		PrJSC “Furshet”		Weight of the indicators
		2016	2017	2016	2017	2016	2017	
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>
<i>1. Group of indicators of efficiency of economic activity (EA)</i>								
1.1. Sales to Expenditure ratio (SER)	It reflects the coverage of production costs by Sales	1,17	1,06	1,03	1,01	1,15	1,2	0,31
1.2. Fixed-Asset Turnover (FAT)	It characterizes the efficiency of the use of fixed assets	0,26	0,22	0,18	0,16	0,23	0,21	0,19
1.3. Income-to-expense ratio (IER)	It characterizes the degree of profitability of the goods	0,14	0,3	0,22	0,21	0,33	0,22	0,4
1.4. Labor productivity to Salary ratio (LPS)	It shows the ratio of productivity growth to an increase in average annual salary	1,94	1,93	1,38	1,61	1,29	1,02	0,1
<i>2. Group of indicators of financial state of enterprise (FS)</i>								
2.1. Equity to Assets ratio (EAR)	It characterizes the enterprise's independence from external sources of financing	0,54	0,46	0,37	0,33	0,33	0,38	0,29
2.2. Current Ratio (CR)	It reflects the ability of an enterprise to fulfill its financial obligations and measures the probability of bankruptcy	1,05	1,07	0,98	0,93	1,01	1,02	0,2
2.3. Acid-Test Ratio (ATR)	High ATR generally indicates that a company is quickly converting receivables into cash, and easily able to cover its financial obligations.	0,62	0,59	0,25	0,23	0,42	0,44	0,36
2.4. Current Assets Turnover (CAT)	It characterizes the turnover rate of all current assets	1,32	1,36	1,22	1,27	1,06	1,25	0,15

Table 3 continuation

1	2	3	4	5	6	7	8	9
<i>3. Group of indicators of sales organization effectiveness (EOS)</i>								
3.1. Net Profit Margin (NPM)	It characterizes the degree of profitability of the company in the market	0,16	0,35	0,28	0,31	0,38	0,25	0,37
3.2. Inventory turnover (IT)	It displays the turnover of the enterprise inventory for the year	4,7	4,2	3,1	3,2	2,7	3,4	0,16
3.3. Capacity utilization (CU)	It evaluates the useful areas of supermarkets	0,84	0,87	0,72	0,75	0,83	0,84	0,12
3.4. Sales promotion efficiency (SPE)	It shows the economic efficiency of promotional activities; compares the growth of operating profit and sales costs	3,15	3,35	2,54	2,61	2,09	2,17	0,35
<i>4. The indicator of competitiveness of goods (CT)</i>								
4.1. Index of competitiveness of retailers' goods by "price-quality" criteria	It reflects the competitiveness of one enterprise's products / goods among others (see table 2)	1,11 1	1,14 5	1,02 3	1,05 9	0,95	0,85	-

Source: Formed according to data [18-20] according to their own system of weighting indicators established for the averaging of the results of the survey

The value of each indicator from the Table 3 we compared it with its average value for 2016-2017 for three objects: PJSC "Silpo Retail", PJSC "Evrotec "Arsen" and PrJSC "Furshet" (interim calculations - see more in Appendix A). For indicators, their weight (column (9)) and weight of groups are considered (see formula (1)). Already for such a preliminary estimation of CTV in the Table 3, we see that PJSC "Silpo Retail" outperforms its competitors.

The fourth stage in assessing the level of CTV involves processing information and generalizing the assessment of the level of competitiveness of retailers. This assessment can be carried out using a variety of methods ("points", graphic, reference and difference method). As a result, we get the possibility of quantitative (Table 4) and visual (Figures 4 and 5) comparison of the positions of the three retailers among themselves and considering their average level for all used partial indicators, which represent not only the results of financial and economic activities of these enterprises and their manufacturing facilities, but also CTV of their basic goods.

Table 4

Comprehensive assessment of the competitiveness of commercial enterprises
“Silpo”, “Arsen” and “Furshet”

Group Indicators *	Value of group indicators (normalized and weighted)					
	PJSC “Silpo Retail”		PJSC “Evrotec “Arsen”		PrJSC “Furshet”	
	2016	2017	2016	2017	2016	2017
EA	0,916	1,134	0,911	0,893	1,173	0,973
FS	1,270	1,218	0,815	0,775	0,915	1,007
EOS	0,983	1,174	0,972	0,967	1,045	0,859
CT	1,081	1,125	0,995	1,040	0,924	0,835
CAI	1,062	1,163	0,923	0,919	1,014	0,919

* *EA – group of indicators of efficiency of economic activity, FS – group of indicators of the financial state of enterprise, EOS – group of indicators of the effectiveness of the organization of sales of goods, CT – the indicator of competitiveness of goods (according to the criteria “price-quality”); CAI – competitiveness assessment index of organization (integral indicator).*

Table 4 and fig. 4 and 5 illustrate consolidated results that prove the competitive advantage of “Silpo” for all the group indicators in 2017 and by the majority in 2016, namely: on the efficiency of economic activity, financial state and level of its sales’ organization, the competitive level of their goods properties and the total complex assessment (CAI). In this study, the worst is the CTV assessment’s level of “Arsen”. After this analysis we can distinguish the leader in the field of goods turnover ($CAI > 1$) – “Silpo”, but we cannot allocate an outsider ($CAI < 0,5$). That is, it can be argued that each of the objects under study has its competitive advantages, which can be used in the formation of new strategic moves.

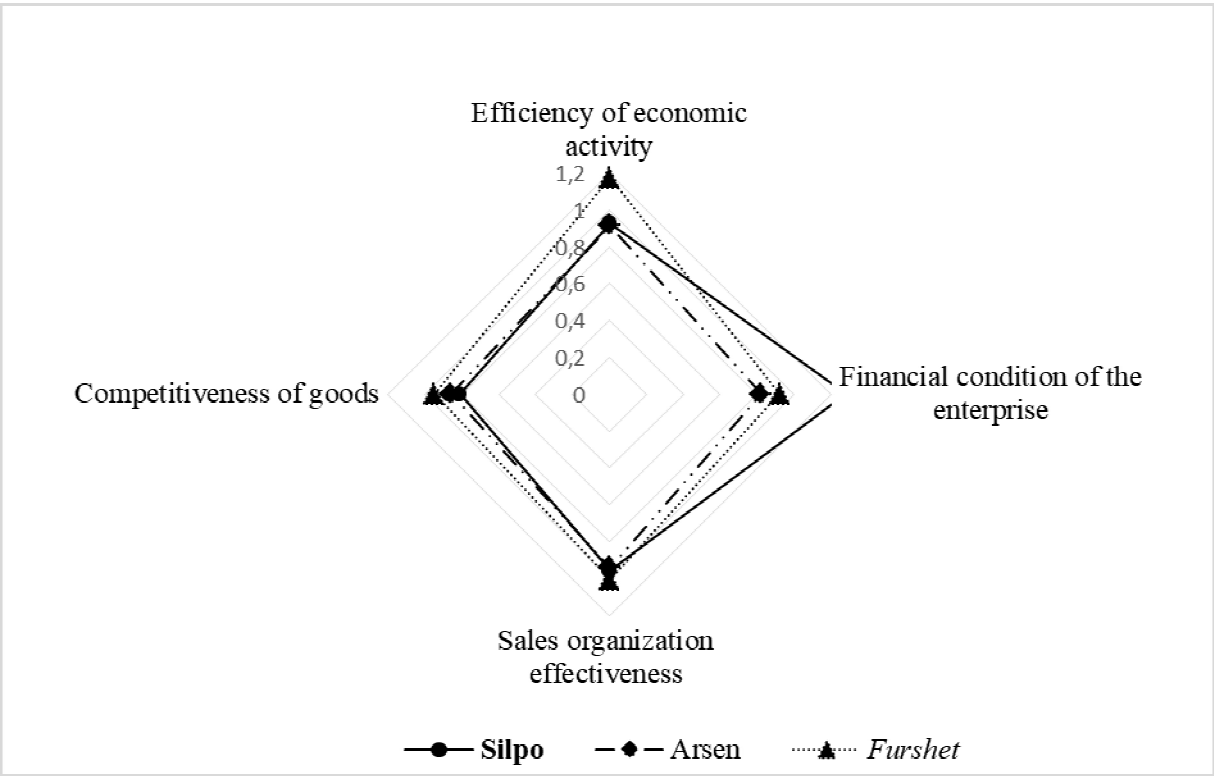


Figure 4. Competitiveness of the analyzed retailers in 2016

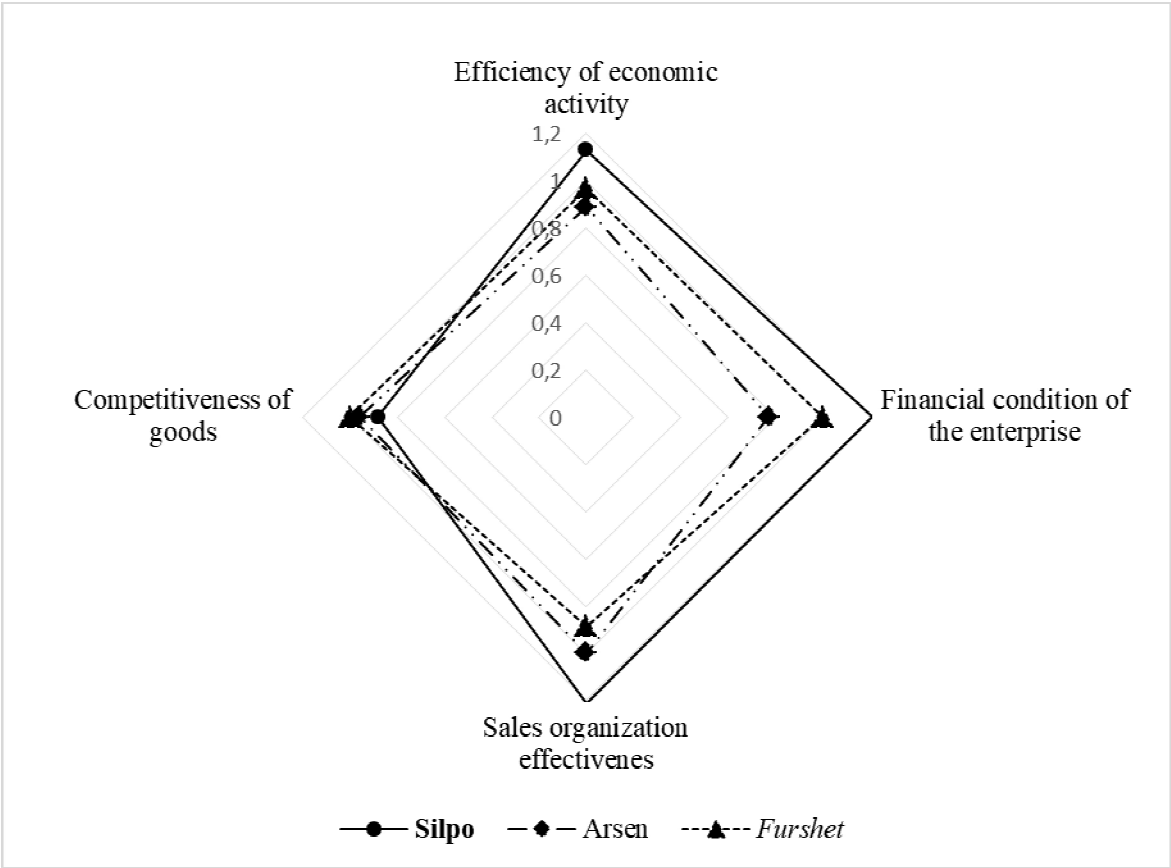


Figure 5. Competitiveness of the analyzed retailers in 2017

3. IMPLEMENTATION OF NEW STRATEGIC DECISIONS TO INCREASE THE COMPETITIVENESS OF RETAILERS

In this study, competitiveness is an important criterion in determining the state of a trading company, which allows us to assess the possibility of achieving strategic goals and objectives and make the desired adjustments to the overall strategy of the retailer, based on innovations.

The company's next steps in maintaining and gaining competitive advantage must be well thought out and clearly targeted. This task will help to perform the four stages of the CTV assessment of the three objects under consideration in previous chapter and is intended to combine this assessment with the expected prospects for the industry development of the matrix of Shell / DPM [14]. Table 4 allows us to assert that “Silpo” is characterized by high CTV’s level, “Furshet” – medium, and “Arsen” – ranges between medium and low.

Appendix B shows a procedure for evaluating their prospects in conjunction with the prospects for developing their sectoral market for a slightly revised set of indicators and a way of combining them to make a verdict on the choice of “targeted” competitive policy for each of the analyzed enterprises (Table 5). A list of evaluation criteria for component 1 – “market growth” has been formed. Also, during such an evaluation it is proposed not to explore the industry as an abstract set of enterprises and expected changes, but rather to look at the possible reaction of the retailers analyzed to the impact on these sectoral changes. That is, consider the probable reaction to change, including and innovative.

The estimates of the competitiveness of the three retailers obtained by us (Table 4) and the quantified their response to the expected changes in the industry (see Table in Appenix B) are grouped together in the matrix (Table 5). The latter suggests that for PJSC “Evrotec “Arsen” the average prospects for industry development and low competitiveness are characteristic, therefore it falls into the sector “to continue the business with caution or partially collapse”. PJSC “Silpo Retail” is characterized by a high prospect of industry development and high competitiveness; therefore it can recommend the sector “strategy of leadership in this type of business”. PrJSC “Furshet” demonstrates the average prospects for the development of the industry and the average competitiveness, which is why it falls into the sector “continuation of business with caution”.

The matrix (Table 5) provides only basic guidance on the further selection of strategies for the prospects of the industry and the competitiveness of retailers. But we still propose to reinforce these strategic plans by further elaborating their capabilities and threats to identify possible, most successful stages of the life cycle of competitive innovation strategies (using their adapted typology – see Table 1), modified Porter's competitive strategies, as well as additional advantages of SWOT-analysis.

Table 5

Matrix of Shell / DPM directed policy of “Silpo”, “Arsen” and “Furshet” retailers

Competitive capability	Strong	Cash generation: double sales or business collapse	Growth leader: a strategy to enhance competitive advantage	Leader: leadership strategy in this type of business <u>PJSC “Silpo Retail”</u>
	Average	“Try harder!” or Continue business with caution or partial curtailment <u>PJSC “Evrotec “Arsen”</u>	Custodial growth: continue business with caution <u>PrJSC “Furshet”</u>	Phased withdrawal: growth strategy
	Weak	Disinvest: the strategy of curtailing business	Phased withdrawal: partial collapse strategy	“Double or quit” cash-flow strategy
		Unattractive	Average	Attractive
Segment attractiveness (Prospects for sector profitability)				

Let's start with the last. The SWOT analysis can be used to streamline, and test planned strategic moves, evaluate the resource supply of enterprises, choose the optimal direction (for example, choosing to follow optimistic trends (S-O field) or overcoming problems and threats (W-T).

The results of a combination of new trends in the field of trade and commodity circulation, analyzing the strengths and weaknesses of the three investigated companies, are presented in Fig. 6 and are presented in more detail in the tables of Appendices C, D and E.

Given the SWOT analysis, it should be noted that PrJSC “Furshet” and PJSC “Silpo Retail” have rather similar weaknesses, which include lack of qualified personnel, poor merchandising of goods, strong competition and moderate or low purchasing power of consumers. The development of PJSC “Evrotec “Arsen” is marked by the basic problem – the slowing down of sales, which threatens to curtail its business. “Arsen” has many weaknesses, from the lack of indicators on the location of basic assortment groups of goods, and to complete – the lack of loyalty programs. The strengths of the three retailers are reasonable prices, sales policy effectiveness and availability loyalty programs (except “Arsen”).

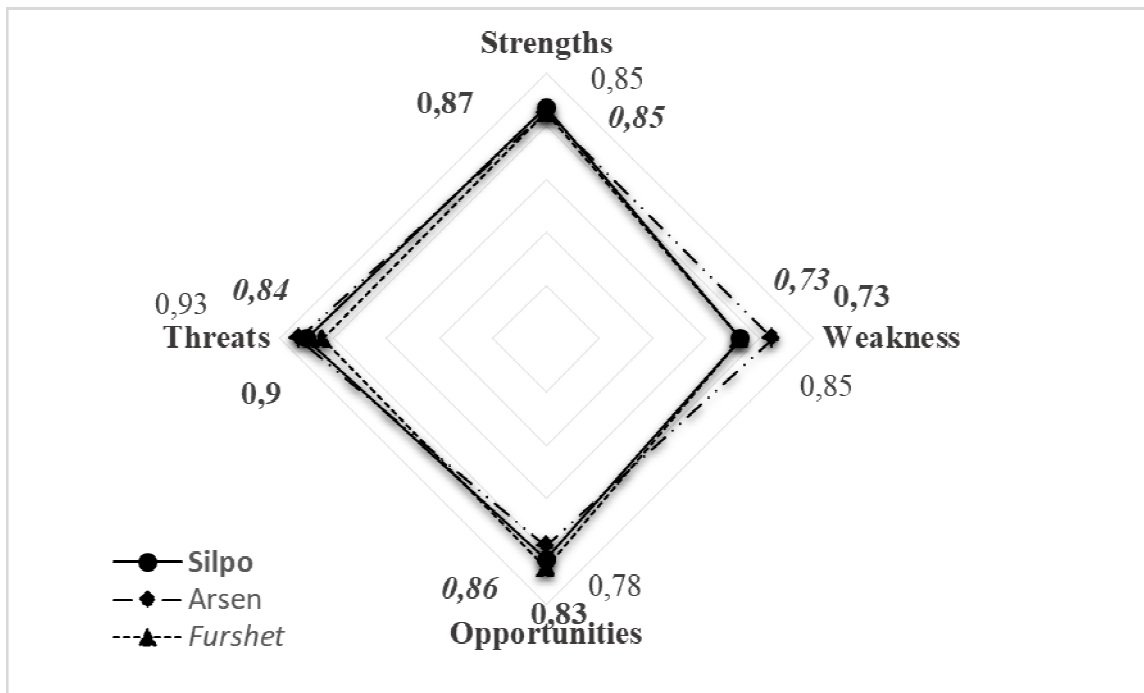


Figure 6. SWOT-analysis of retailers “Silpo”, “Arsen” and “Furshet”

Among the main strengths of all three retailers there is no factor of innovation activity (its level is estimated at 1-2 points, not more). These enterprises are in no hurry to use industry innovations for their own development and competitiveness, but this does not prevent us from laying the factor of innovation in strategic plans.

All three retailers, by the combination of the main characteristics (external and internal environment, state and prospects), still have balanced, stable positions, the proof of which are the coordinates of SWOT components, which, according to the “diamond” (Fig. 6), do not cross the limits from 0.73 to 0.93. This may be an unnecessary argument in favor of the presence of latent potential for the production and use of various innovations (first, in management and sales technologies).

At the same time, the conducted diagnostics in general allows to assert about significant differences in the results of functioning, and therefore in the management of each of the analyzed enterprises. To justify the strategies, we combine verdicts to change the positions of these three companies in the Shell / DPM directed policy matrix with modified competitive strategies that can be used as guidance for increasing the CTV depending on the stage of their lifecycle. According to the prevailing Table 1, which covers adapted for retailers of varieties of IS, we will select such strategic decisions that will combine the nature of the activity of enterprise with its position (current and forecast) in the existing market.

Thus, research of the direction of the policy of the retailer “Silpo” shows that it is in the sector of “leadership” in this type of business. Therefore, since the market share and quality of goods are high enough and the image is mature and positive, it can be argued that in the future, the company can become a leader if it rationally uses its resources and capabilities. In this case, the retailer should choose

an IS that will help him to raise funds, considering other business sectors, to expand trading space and, in the long run, to fight for his market share.

According to Ch. Freeman (see Table 1), it is worthwhile choosing a combination of “opportunistic” and “imitative” strategies for optimal improvement of the activities of this retailer and taking a leading position on the market. This IS will find a special niche on the existing market in the field of goods and services circulation, which will target consumers with diverse needs and use existing production capacities or simulate interesting strategic moves of retailers with foreign investment.

Considering the stage of the life cycle of PJSC “Silpo Retail”, we see that it is between the stages of “rapid growth” and “maturity”, and therefore, taking into account the theory of Porter, it is worth choosing a strategy of “concentration”. It will allow us to focus on a specific segment of consumers with a certain selected level of income or focus on one product group or pricing policy. And this, in turn, will enhance the image of the retailer, find its niche and attract new customers to strengthen their competitive advantage.

Having analyzed the above list of IS for PJSC “Silpo Retail” it is necessary to integrate them into one whole and to make the following strategic moves:

- to improve existing own brands for quality and price parameters;
- to supplement and update the loyalty program, to develop a system for monitoring its failures so that it does not detract from existing consumers;
- to reorient their activities for increase the proportion of non-food products along with food in the product portfolio;
- to check price tags for goods for the supply of truthful information (which is the source of persistent complaints);
- to continue expansion of its retail space, for example, the shopping center “Victoria Gardens”, with a diverse concept of merchandising of products;
- to mitigate part of their competitors in the fact that the consumer, when he comes to buy a variety of goods in accordance with his needs, at the same time, he will be able to have a snack at a specially designated place, having paid for food first.

Regarding PJSC “Evrotec “Arsen”, this enterprise, according to the policy matrix (Table 5), is characterized by weak positions in the industry and a moderate reaction to changes in it, and therefore falls into the sector “to continue the business with caution” or partly “to curtail the activity”. So, it should choose an IS that would allow it to stay afloat due to the selected assortment groups and additional activities until they give income, and financial managers should concentrate on balancing its cash flow.

According to the assessment of “Arsen”, in the framework of our adaptation for retailers the strategy typology of Ch. Freeman, we consider it desirable to recommend “defensive” IS. After all, it allows you to analyze the mistakes made

by your activity in the forms of product promotion and marketing, as well as its competitors. This strategy will be able to identify those gaps that should be avoided due to the accumulation of company funds and pushing their products with the help of after-sales technology, which will keep their positions on the market.

The results of life cycle analysis PJSC “Evrotec “Arsen” indicate that it is in the “old age” or “decline” stage. Recognizing the generally stable position of the company and based on the matrix of competitive strategies of Porter, this company should offer a strategy of “leadership by reducing costs”. This strategy will help to improve the existing competitive position in the market by optimizing sales revenues and expenditures, which are now aimed at a wide range and introduction of individual products (dairy, bread and bakery products) of options for a full cycle of production and distribution of products. Such innovations still allow “Arsen” not to change its pricing policy (“low prices”) and to resist competitors in this area. Now, these innovative moves yield decent results: reducing costs through the introduction of such own innovations, the growth of labor productivity per employee, and more.

Soon, these innovative strategies should continue to provide “Arsen” with the activation of its own bakery, the emergence of new own brands and the marketing of Fresh Milk dairy products from their own farms at affordable prices and the corresponding quality of the product compared to its competitors.

Therefore, by simulating the above-mentioned proposals, we recommend that the strategic decisions for PJSC “Evrotec “Arsen” were following:

- to optimize production and management system for the accumulation of cash flows;
- to implement a loyalty program that will encourage consumers;
- to reduce prices for widespread products and products and, in part, to redirect their activities to middle-class buyers, while retaining a segment of those who are low-income;
- to increase the qualifications of employees, including sales consultants;
- to develop its own concept of rational distribution of goods and introduction of in-store instructions about group of goods locations;
- to develop strategies specific to “cost-cutting leadership” to stimulate sales function.

Such strategic moves will allow PJSC “Evrotec “Arsen” to strengthen its competitive position and to increase its competitiveness overall.

According to the policy orientation matrix (Table 5), it can be argued that PrJSC “Furshet” is characterized by a strong competitive position by the coordinates of the prospects of industry development and competitiveness and belongs to the sector of “continuation of business with caution”. Although this company is one of the top ten retailers in Western Ukraine, but the results of the assessment once again confirms the stage of maturity in the life cycle of the

enterprise. In these circumstances, it is characteristic of maintaining the current position, which provides it with all the necessary financial resources and allows you to generate additional funds that can later be invested in expanding its activities.

According to our adaptation of Ch. Freeman's IS typology, PrJSC "Furshet" should use an "imitative" strategy that will allow it to adjust its activities, taking into account a retrospective analysis of its actions and actions of competitors. Such "imitation" will allow to reduce the cost of sales and promotion of products by attracting cheaper resources or using its own existing production capacity for more innovative purpose. In addition, "Furshet" will be able to strengthen its competitive position if it improves its existing own brands, considering the preferences of consumers, previously, having conducted a marketing research.

According to the model of the life cycle, which is one of the main factors in determining the position of any company in the market (in our case – for retailers' market), PrJSC "Furshet" is at the stage of "maturity". Therefore, for Porter's approach to the formation of competitive innovation strategies, he should apply the strategy of "differentiation". After all, it is close to the simulation strategy because it also provides for an analysis of the actions of its competitors, the assessment of the technology of marketing their products / goods in differentiation by consumer parameters. The given strategy provides strengthening of this company positive image, allows to establish the raised price for the new goods or product, and to expand an assortment. However, we should consider some changes in the country's economy and the prospect of reducing the purchasing power of the population.

After analyzing the given list of innovative strategies for PrJSC "Furshet", it is worth uniting them and making the following strategic moves:

- to expand assortment with its own brands;
- to monitor the truthfulness of information on price tags for goods;
- to increase the qualification of employees;
- to enhance the image of the enterprise through already implemented and similar future social responsibility measures;
- to improve the card loyalty system;
- to ensure the effectiveness of the sales function of goods so that certain groups of goods had their discounts every day (so that the consumer, given his purchasing power, was able to come on the day when it is convenient).

Thus, mentioned innovative strategic solutions will strengthen the competitive position of the three researched retailers on the market and increase their CTVs by enhancing the positive image of each of them.

The study outlined the theoretical aspects of innovative strategies (IP) application in the activity of retailers to ensure their competitiveness. The existing typology of enterprise IP was adapted to the specifics of retail enterprises. The possibilities of improving the procedure of forming a strategy for obtaining

retailers' competitive advantages through various innovations are considered.

In the analytical part of the research, a 4-step methodology for assessing the competitiveness of retailers in combination with the life-cycle model was applied in practice. A brief description of each of the investigated objects (representatives of 3 retail chains of supermarkets of the Western region of Ukraine, specializing in retail) is given. The complex strategic diagnostics of these retailers (according to the method improved by the authors) was carried out. Mentioned method includes an analysis of their financial and economic status, the effectiveness of sales function and an integral assessment of the competitiveness of basic goods in terms of their own brands of selected retailers.

As a result of the study, the matrix of the targeted policy selection – Shell / DPM allowed to complement the research of competitive positions of the surveyed retailers. There was additionally assessed the prospects for the development of the industry. The results of such assessment were used for deliberate choice of retailers' next actions on the way of retaining and obtaining competitive advantages. Also SWOT-analysis was applied for better improvement and verification of the planned strategic moves, assessment of the resource support of enterprises, the choice of the optimal direction.

Basic and special innovative strategic proposals were formed to further enhance the competitive advantages of the studied enterprises. In general, the study allows to simulate and to justify the use of innovative strategies as a modified approach to increase the competitiveness of the studied enterprises in general. In the future it can raise the profitability of a particular retailer, increase the market share, attract new consumers, improve its image, etc.

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3.2. Investment providing of innovative development of Ukrainian agriculture

Economic growth of Ukraine is associated with the solving the problems of innovative restoration and development of basic industries, their structural reorganization, and the introduction of new economic relations between the market actors. The necessity of upgrade the production capacities, increasing their technical and operational characteristics due to a significant deterioration of fixed assets. The outreach of opportunities for the quality goods and services provision is determined by the efficiency of innovation and investment processes, the new investment technologies introduction, the predictability of the innovative projects and programs implementation final results.

It should be pointed out that Ukrainian economic development results from the restoration of the old technical base and the free production facilities loading. Once the potential of this kind is exhausted, the country's economy will face the threat of another economic crisis. In this situation, only innovation can lead the economy to stable development. That is why the company's high results can only be achieved through systematic and purposeful innovations aimed at finding opportunities that open the environment for the new types of goods production and introduction, the development of new production markets and production organization forms.

In a market economy, most agricultural enterprises require investments in order to upgrade their fixed assets and expand their volumes, introduce innovative technologies, purchase new varieties of plants and animal breeds, as well as other capital-intensive innovation and investment projects. Therefore, the question arises about the search for new forms and methods of activating the organizational and economic mechanism for the innovation and investment activities development.

The term innovation comes from the Latin '*innovare*', that means to change or renew. Innovation is a result of systematic activity aimed at the scientific and technological progress achievements and improvements realization, that contributes to the quantitative and qualitative changes in the enterprise internal environment and provides the efficiency increase and competitive advantages acquisition.

Innovation is the introduction of something new to the technique, technology, labor organization or management. It is based on the use of science and best practices. It is the final result of innovation activity.

J. Schumpeter considered innovations as a constitutive essential element and a necessary condition for economic development, which manifest itself in certain combinations of changes for the purpose of introduction and use of new consumer goods, new means of production, vehicles, markets and forms of production organization in industry [1, p. 176].

I.V. Safronov interprets the concept of "innovation" in its own way. He says

that it is a manifestation of modern advances in scientific and technological progress, a special kind of knowledge that was implemented as a new or improved product, a new or improved technological process used in practical activities having a set of functions that were implemented by them, which are aimed at meeting existing needs in the relevant market segments and bring an economic effect [2, p.129].

The object of innovation is an innovation. It should be noted that the terms novation and innovation are not identical. Novation (lat. *novatio* - update, change) is a product of person's intellectual activity, the result of fundamental, applied or experimental researches in any sphere of human activity that is aimed at increasing the work efficiency. From the moment of the adoption of the innovation to the implementation and distribution, it acquires a new quality, i.e. it becomes the innovation. In the world economic literature there are many definitions of innovation. Domestic scientists consider innovation as the term introduction.

In The Law of Ukraine on innovation activity [3] innovation is the newly-formed (applied) and (or) advanced, competitive technologies, products or services as well as organizational and technological solutions of industrial, administrative or other nature that improve substantially the structure and quality of production and (or) social sphere. Innovation is defined as an activity that is aimed at the use and commercialization of the research and developments results and that causes the launch of new competitive products and services. That is why innovation activity inherent such features as:

- scientific and technical novelty;
- production application;
- realization on a commercial basis;
- the latest or improved technologies introduced into production;
- new organizational and technical decisions of an administrative, commercial or other nature, used in practice.

Innovative processes require assistance in the form of financial and credit support, government preferences, as well as the creation of specialized infrastructure. The main criteria for the numbering of products and processes among those that are innovate are their novelty and significance.

Agricultural production today has an extensive character and this state of development is caused by a number of factors and, above all, the apathy of the state to the agriculture development state. As a result one can notice the shortage of financial and logistical resources in agricultural enterprises, the outdated labor force of fixed assets. Thus there is the need to increase the cost for their repair.

In modern conditions the activation of investment activity is decisive due to the global food crisis that has led to a sharp rise in the prices for foodstuffs. It has led to the need for domestic and foreign investment attraction.

Thus, investment is the most important part of the extended reproduction

financing that can provide economic growth in the long run. It determines the pace of agricultural production development. Investment application can cause structural changes, technological re-equipment and modernization, the introduction of modern high-performance and resource-saving technologies, the market power and priority of the industry.

Investment resources, in actual volumes, do not provide extended reproduction, and most of domestic enterprises has their own funds as their main source of investment. All these facts have caused the situation when most agricultural enterprises are unprofitable. They use the outdated equipment and most of the working capital is used not for upgrading of the equipment, but for the current and major repairs.

It should be noted that over the long period the investment activity had been falling that was due to inflation and a decrease in the stability of the national currency, budget deficit, and mostly due to the errors and imperfection of legislation. Insignificant financing of the industry led to catastrophic deterioration of the equipment, which greatly reduces the efficiency of the agrarian enterprises functioning, social decline of the countryside, unemployment rising in rural areas. The further development of agriculture will depend on the state's policy. A set of measures aimed at increasing the efficiency and stimulation of investment activity should be developed.

The main methods of such stimulation are:

- reduction of tax pressure on certain types of agricultural products;
- increase of the volume of agricultural production financial support;
- stimulation of import and export (exemption from export duty).

Since the investment activity is a social and economic process of investing that is aimed at ensuring the stable development and achievement of high results in the economy, a decisive factor in the whole economic policy it is necessary to determine the directions of its development.

In the Law of Ukraine on investment activity [4] innovation activity is defined as one of the forms of investment that is carried out in order to implement the achievements of the scientific and technological process in the production and social sphere which includes: the issue and distribution of fundamentally new types of equipment and technology; progressive interdisciplinary structural changes; realization of long-term scientific and technical programs with high payback period; financing of fundamental research in order to make qualitative changes in the state of productive forces; development and introduction of a new resource-saving technology that is designed to improve the social and ecological environment.

An innovative development model is an important tool for Ukrainian agriculture competitiveness improvement. The increase in the efficiency of agricultural production is largely caused by the widespread introduction of

domestic and international achievements in scientific and technological progress. The innovation activity plays there the strategic role.

In recent years the positive trends in the financing for performing scientific and scientific and technical works have been observed. However, the process of commercialization of development and the interest of agricultural producers for them remains unsatisfactory.

Agriculture is one of the priority and key sectors of the national economy. In the current economic and military-political conditions that are extremely difficult only agricultural production showed some positive dynamics and ensured an increase in the export potential of the state. However, further economic growth and a significant increase in the efficiency of production and investment in agriculture is possible only due to the industrialization of enterprises in the industry, the transition to an innovative development model, throughout the modernization and agricultural production re-equipment.

The main formation and development features of the innovation process in the agriculture are the following:

- 1) significant differences in the regions of the country in terms of natural and climate conditions and production specialization;
- 2) variety of agricultural products, processing products, the significant difference in the process technology, keeping and feeding animals;
- 3) a large difference in the periods of production of certain types of agricultural products and products of its processing;
- 4) the presence of a large variety of production types under different organizational and legal forms and forms of ownership, size, specialization, subordination, cooperation, etc.;
- 5) the high dependence of agricultural production technologies on natural and climatic conditions, road and transport networks, distance from supply centers and product markets and other factors;
- 6) isolation of agricultural producers, their remoteness from information and consulting services and organizations that produce scientific and technical products;
- 7) different social and educational levels of agricultural employees;
- 8) the absence of a clear and scientifically determined organizational and economic mechanism for transferring the science achievements to agricultural commodity producers and, consequently, the condition of a significant lagging behind the development of innovations in production [5].

It is worth to consider the main indicators that characterize the intensity of innovation in agriculture.

Distribution of national academies of sciences of Ukraine institutions, which carried out scientific researches and developments in 2016 as shown in Fig. 1.

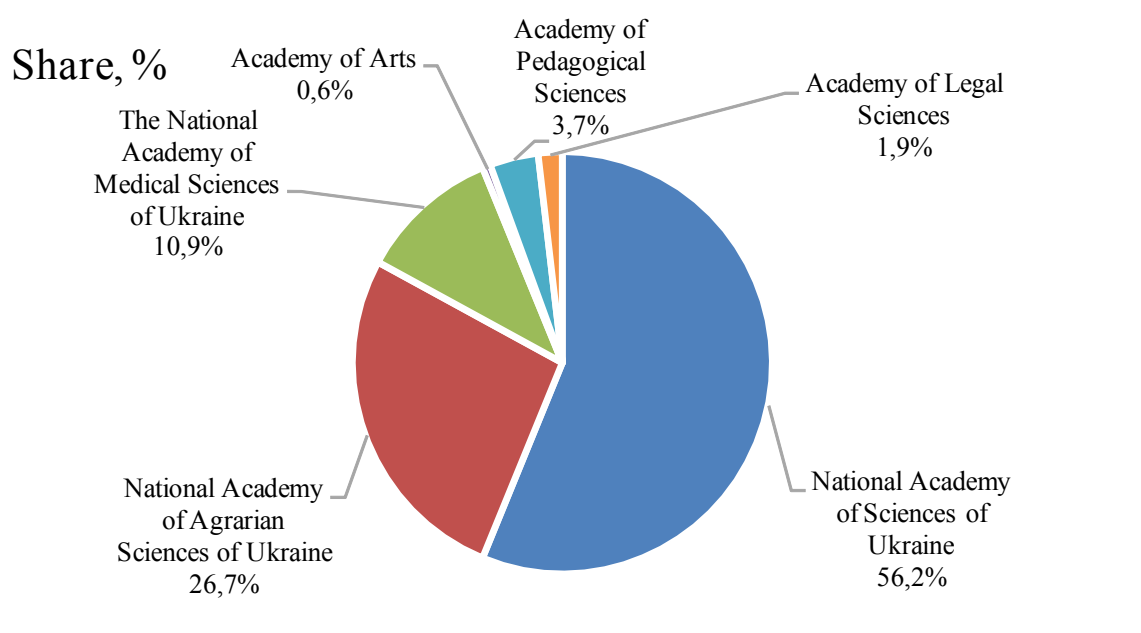


Figure 1. Distribution of organizations of national academies of sciences of Ukraine, which carried out scientific researches and developments in 2016 (% to the total number of organizations) [6]

As shown in Fig. 1, the Academy of Agricultural Sciences that specializes in scientific research in the field of agriculture was 26.7% in relation to the total number of scientific organizations in Ukraine as of 2016. This indicator is quite significant comparing the share of the Academy of Agrarian Sciences to other scientific organizations. One can see that the Academy of Agrarian Sciences is ranked the second (after the Academy of Sciences – 56.2%) by the number of scientific organizations.

The dynamics of the number of scientific personnel in the field of agricultural sciences during 2014-2016 is presented in the Table. 1

Table 1

The dynamics of the number of scientific personnel in the field of agricultural sciences during 2014-2016

Years	Total for Ukraine			In the field of agricultural sciences		
	the number of doctoral students	accepted for doctoral studies	Graduated from doctoral studies	the number of doctoral students	accepted for doctoral studies	Graduated from doctoral studies
2014	1561	603	459	24	10	12
2015	1821	650	563	42	12	13
2016	1229	20	551	30	-	12

As shown in Table 1, the number of doctoral students in the field of agricultural sciences during the 2014-2015 period increased by 18 people. However, in 2016 its decrease to 30 people was observed (-12 people compared

to 2015). The situation above shows that during the period 2015-2016 the level of training of scientific personnel was reduced. It is worth paying attention to the number of researchers who carried out research and development in the field of agricultural sciences (Table 2)

Table 2

The number of researchers who carried out research and development in the branches of science by sector of activity in 2016 [6, 7]

Index	Total	Including					
		natural sciences	technical sciences	medical science	agricultural sciences	social sciences	humanities
Total	63694	18461	26266	4845	4663	6506	2953
by sectors of activity:							
state	30192	12369	5504	3141	3776	3208	2194
entrepreneurial	15673	2155	13040	116	297	49	16
higher education	17829	3937	7722	1588	590	3249	743
private non-profit	–	–	–	–	–	–	–

It is evident from table 2 that the largest number of scientific and technical personnel in the agricultural sector was employed mainly in the public sector by 2016 – 3776 employees (81% of the total). In the sector of higher education, 590 employees were employed (12% of the total). Only 297 employees (6% of the total) were involved in the entrepreneurial sector.

It should be noted that the large part of employees involved in the implementation of scientific research and development in the field of agriculture are the employees of the Academy of Agrarian Sciences (Table 3).

Table 3

The number of employees involved in the conduction of scientific research and development in scientific organizations of national academies of sciences of Ukraine in 2016, (people) [6, 7]

Index	Total	Including					
		natural sciences	technical sciences	medical science	agricultural sciences	social sciences	humanities
Total for national academies	35829	15043	6594	3760	5198	2852	2382
Academy of Agrarian Sciences	6337	340	419	7	5196	330	45
The share of the Academy of Agrarian Sciences in the total number, %	17,7	2,3	6,4	0,2	100,0	11,6	1,9

An important criterion for innovation development in agriculture is the indicator of research financing. Its dynamics is reflected in Figure. 2

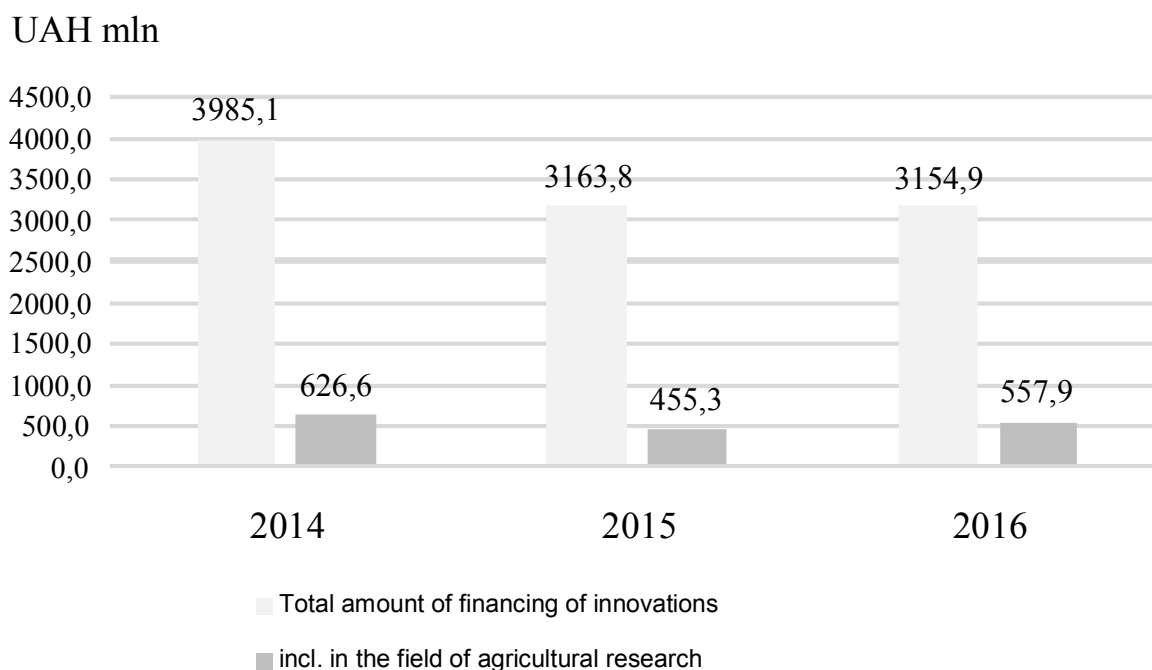


Figure 2. The total amount of financing of innovations in the agricultural sphere of Ukraine, mln. UAH [6, 8]

The volume of financing of innovations in the agricultural sector tended to decrease during 2014-2016. Thus, in 2015 financing of research expenditures in the field of agriculture amounted to 455.3 million UAH. (2.3% of the total funding).

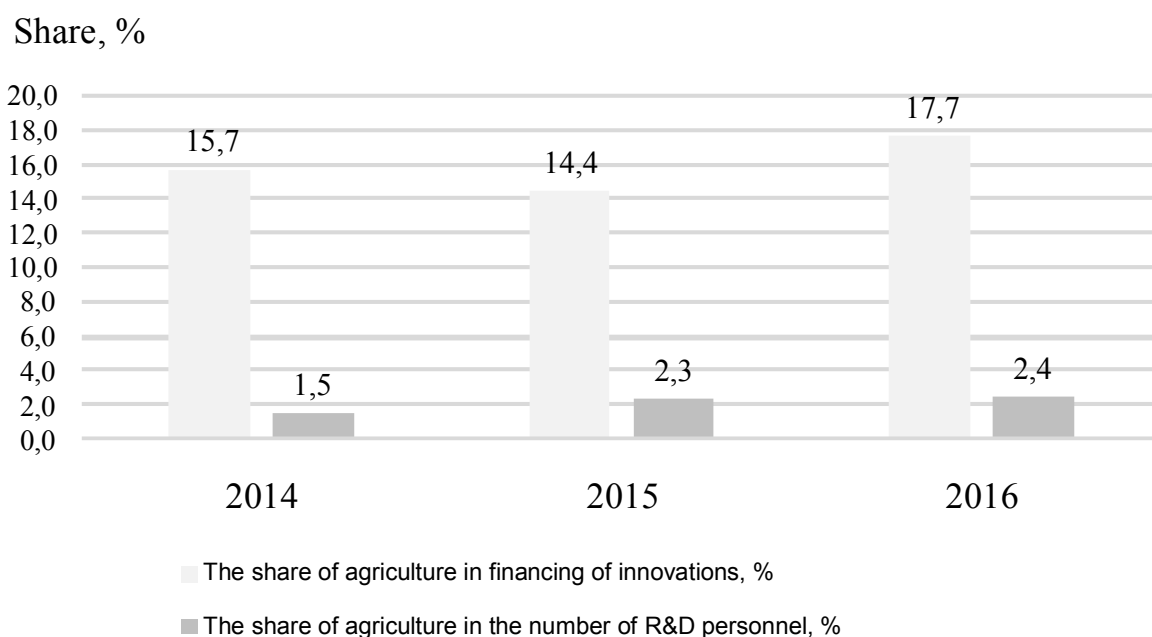


Figure 3. The share of agriculture in financing of innovations and in the number of R&D personnel in Ukraine, % [6, 8]

At the same time, for the period of 2014-2015, the level of financing of innovations in the agricultural sector decreased by 171.3 million UAH. (-27.3%). At the same time, in all branches of the economic complex of Ukraine the reduction of financing of innovation amounted to 821.3 million UAH. (-20.6%). In terms of the abovementioned data one can conclude that the volumes of reduction of financing of innovations in agriculture were more pronounced than in other branches. This is mainly due to the consequences of economic crisis and Russia's military aggression. However, in 2016, the situation in the financing of innovations began to improve somewhat. The volume of financing in the agricultural sphere has increased by 102.5 million UAH. (+22.5%) against the background of a general reduction of financing of innovations in the economy as a whole by UAH 9 million (-0.3%). It proves that the public administration gives the priority to innovation development in the field of agriculture.

The agrarian industry specialists search for innovative investment ideas, actively studying the experience of leading foreign countries. France is the largest producer of agricultural products in Western Europe and one of its largest exporters in the world. It is due to the favorable natural conditions and large areas of fertile soil. France is inferior only to the United States, Russia, India and Canada in the gross grain production. The population of France is provided with food products of its own production. Farmers in France receive subsidies to increase the efficiency of production and for the introduction of innovations, improvement of living conditions, for the withdrawal of arable land from agricultural production, support of land fertility, compensatory payments for the work in ragged natural conditions areas.

Agriculture in Germany is a highly developed industry. Germany belongs to the largest agricultural producers in the European Union. More than the half of the country's territory is used for agriculture. Pig breeding is widespread everywhere in Germany. The country ranks fourth in the world and the first in Europe in the pig population. A relatively high proportion of fodder crops characterizes crop production, which is along with pastures and natural meadows a reliable basis for the livestock-breeding development.

Nowadays Israel's agriculture is the most productive and advanced in the world by almost all indicators. Israelis have achieved it with due to the modern agricultural technology, which is effectively used by local farmers and due to the large number of innovative solutions that are implemented annually in the industry. It is necessary to borrow from Israeli such a considerable experience and apply it in Ukraine as well. Saving water is the core of the successful pursuit of agricultural activity in Israel.

Drip irrigation is used everywhere for open soil as well as aerosol irrigation in greenhouses which is conducted in a computerized way. It allows to feed water just when it is needed. Israel has developed a unique technology for turnkey

greenhouse complexes. Hothouses function in extreme conditions, in the absence of external irrigation and in excess of snow, in the conditions of the polar winter and in the heat. These organizations select the best solution for any client, selecting agricultural crops that have the highest demand in the market, designing the entire greenhouse complex, installing greenhouses and the entire infrastructure of the project. They are engaged in the supply of equipment and training of personnel, they are concerned about the financing of the project as a whole [10].

Scientific researches require annual large-scale financing and large-scale state support since the scientific level and quality of innovations depend on it. It is extremely important in the conditions of spreading on the Ukrainian market of scientific and technical products of competitive foreign firms, technologies and technologies that exceed technical and economic parameters of domestic analogues. This is especially true for the import of agricultural machinery, seeds of foreign plant varieties and plant protection products. Financial support for innovation activity is also required at the other stages of the innovation process, since the promotion of implementation should provide the demand for domestic research [11].

Historically, Ukraine has significant scientific and innovative potential. In the field of agricultural production, a wide network of scientific institutions, experimental productions and experimental farms of the National Academy of Agrarian Sciences of Ukraine was established. The Ministry of Agrarian Policy and Food of Ukraine had a large number of high and secondary education institutions.

Ukraine is the country that has the best natural and favorable climatic conditions in the world for agricultural production but due to technological backwardness and irrational organization of production today cannot provide its population with high-quality affordable food products.

On the domestic market, domestic products are being driven out by imported products because the latter are of the higher quality and higher competitiveness, that is achieved through the use of more advanced technologies. The development of innovation in agriculture in Ukraine is an important direction in the increasing of its competitive advantages, as the agricultural sector of economically developed countries gradually transforms into a knowledge-intensive industry.

It is essential to pay more attention to the development of innovation activity in Ukraine. As the objects of innovative activity in the field of agriculture can be:

- innovative programs and projects;
- production equipment and processes;
- production infrastructure;
- organizational and technical solutions of industrial, administrative, commercial or other character that significantly improve the structure and quality of production;

- raw materials, means of their extraction and processing;
- mechanisms of the consumer market and commodity products marketing formation.

As the subjects of innovative activity in the field of agriculture can be:

- natural or legal persons of Ukraine;
- natural persons or legal entities of foreign states;
- stateless persons, associations of these persons who carry out innovations in Ukraine and involve property and intellectual values, invest their own or borrowed funds in the implementation of innovation projects in Ukraine.

The financing of innovative agricultural programs should include:

- investigation of the innovation program expediency (at cost and planned profit taking into account possible risks);
- development of the program implementation plan;
- organization of financing that should include assessment of possible forms of financing and selection of the one that meets the innovator's requirements;
- definition of investor organizations and funding sources structure; control over the implementation of the plan and terms of financing [9, 12, 13].

Innovative activities in the field of agriculture should be aimed at the creating and the attracting from the external environment such innovations that would promote competitiveness, strengthen market positions and provide a development perspective.

The weak innovation and investment activity of agricultural enterprises in the current economic conditions is primarily caused by the high commercial risk of investing in the innovative sphere, as well as the need for high financial costs, long payback period, and the imperfection of legal system that is related with the scientific and technical activities. The situation is aggravated also by the fact that today there is no sufficient ground for stimulating the wide introduction to organizational production of organizational and economic and innovation in equipment and technology. Fiscal and financial and credit policy is imperfect, there is no specialized infrastructure of production resource provision and its innovation and investment activity [14].

In addition, there is low innovation and investment activity of agricultural enterprises. It is due to the lack of solvent demand for scientific and technical and science-intensive products as a result of unsatisfactory financial and economic situation, insignificant volumes of budget financing and discriminatory conditions for access to banks' credit resources.

The weak link in the development of innovation-investment processes in agricultural production is also the lack of innovative products market development, the lack of an effective organizational and economic mechanism for innovative activity management, especially for small and medium-sized enterprises in the industry. Another problem is that not all scientific, technical and research

developments are brought to the level of scientific production that is ready for implementation and effective use in agricultural production.

There are no organizational and economic structures in the agrarian innovation area today, whose competence includes study of the market of innovative products and the existing demand for it. The weak link in innovation in agriculture is that many selected agricultural and innovative investment projects do not undergo a technical, technological, architectural, environmental and economic expertise. Most agricultural enterprises do not use or even have at their disposal even an elementary system of indicators for the economic expediency analysis and effectiveness of the innovation and investment projects implementation and the justification of optimal schemes for their introduction into production. As a result of this there are quite often some difficulties in solving the issue of financing such projects for bank loans. Most of the appeals of agricultural enterprises to banks on this issue have an analytical basis that would convince the credit institution of the project participation expediency.

An important condition for the effective management of investment and agricultural enterprises innovation activities is the observance of certain requirements or principles. There are many suggestions on the subject in the scientific literature, ranging from purely pragmatic propositions to postulates based on the empirical analysis results and logical and scientific substantiation. In order to resolve this issue, there should be a compromise option that can take into account the requirements of scientific logic and the wishes of the existing agricultural practice of agricultural enterprises.

When implementing investment and innovation activity in the agricultural sector, it is necessary to stick to the following principles:

- *scientific character* – investment-innovation activity should be carried out in accordance with scientifically grounded organizational and economic preconditions and methodical principles, and in the process of organization and management of it, account of objective regularities and dominant tendencies in the development of socio-economic processes established by scientific research should be taken;

- *dynamism* – investment and innovation activity requires continuous and rhythmic exercise that can ensure the dynamic growth of the enterprise in accordance with the statutory objectives, regulatory requirements and economic interests of stakeholders;

- *compromise* that takes into consideration and harmonization of economic interests and regulatory requirements of different stakeholders – owners, managers, employees, business partners, businesses, state and local authorities, etc;

- *adaptability* that means the need for rapid response to dynamic changes in the external economic environment and internal environment to ensure performance sustainability and economic development, resource balance in the

industrial and financial activities and the development of business partnership;

- *self-organization* that provides the presence of an adequate level of organizational and economic resources in order to ensure sustainable operation of all elements of the enterprise as an open social and economic system as well as providing resources and exchange with the external economic environment in the process of investment and innovation;

- *self-regulation* local regulations and adequate organizational and management structure that is capable of creating the necessary economic conditions for normal investment and innovation process are required in order to promptly identify the negative deviations that occur and quickly adjust them according to the goals and objectives of the investment and innovation and tasks of strategic economic development of the enterprise.

It is necessary to develop some measures aimed at the eliminating the possible reasons that hinder the development of innovation and investment activities in the agriculture of the regions. According to the State Strategy for Regional Development for the period up to 2020, the state task is "to increase the level of innovation and investment capacity of the regions, to improve the regional investment and innovation infrastructure, in particular to create a regional network of scientific, technological and industrial parks, as well as systems of legal, personnel and information support innovation activity, formation of a favorable investment climate, positive investment image and promotion to the foreign market investment possibilities for the Regions of Ukraine" [10]. In this regard, it is planned to take a number of measures, among which the priority is to:

- development of scientific and innovative cooperation between the state and non-governmental sectors of science, higher education establishments and scientific institutions with the real sector of the economy;

- development of innovative culture by popularizing scientific, inventive and innovative activities, as well as creation of a coherent education system taking into account personnel provision of innovation activity;

- increasing the efficiency of the standardization and certification of products mechanism, protection of intellectual property rights, observance of copyright and related rights, ensuring achievement of high quality standards, security, product environmental friendliness;

- stimulation of industrialists to introduction of the latest technologies and innovations;

- ensuring the effective implementation of the public and private partnership mechanism by improving the relevant legal and regulatory framework;

- the establishment of consulting centers on public and private partnership at the national and regional levels, as well as the authorized bodies that are responsible for the implementation of public and private partnership in Ukraine, defining the functions, tasks and responsibilities of such bodies [10, p. 26].

The main problems of the development of the agricultural industry complex today are:

- lack of effective competition mechanism;
- disinterest of agricultural enterprises and reprocessors;
- insufficient level of financing of research and development programmes in the agricultural industry complex;
- insufficient development of material and technical base of research organizations;
- low innovative activity of scientific institutions;
- weak integration of science and education, the scientific potential of agrarian higher education institutions is not sufficiently realized;
- absence of a unified system of gene pool of plants and animals storage;
- undeveloped information and service sphere of scientific services;
- flow-out of young, professionally trained personnel in other branches of activity due to the social insecurity;
- insufficiency of personnel potential in the deficit and priority areas of agricultural science, in particular, in the field of dissemination of scientific developments and knowledge [15, p. 49].

The main directions of development of innovation and investment activities in the agricultural sector of economy are:

- improvement of the innovative activities management mechanism in agriculture sector of economy;
- intensification of innovation activity in the agriculture sector by providing various benefits, subsidies using foreign experience;
- technical and technological reequipment in the agriculture enterprises.

Thus, one can conclude that the use of investment and innovative approaches to economic activity is one of the promising directions of development of agricultural enterprises of Ukraine in the context of the existence of the necessity to increase production volumes and the competitiveness level of agricultural products.

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3.3. The modern approaches to liquidity regulation of banks

In the period of rapid development of financial markets, the emergence of new banking technologies and the globalization of the macroeconomic environment, the processes of banking systems' regulation and supervision of the countries all over the world are becoming increasingly important. Regulatory authorities in the person of international financial organizations and central banks of the world play a key role in this process, developing and implementing approaches to the regulation of banking systems adequate to the current stage of global financial development. Bank's capital, financial stability and liquidity are the main objects of control and regulation in order to ensure the maximum efficiency of banks.

As the global financial crisis showed, the role of liquidity was fundamentally underestimated, despite the fact that the requirements for the adequacy of capital were maximally respected. In this context, it is fair to define liquidity as a key factor of the efficiency of financial institutions and mentioned the need for it's tougher regulation to maintain overall banking stability. Particular attention should be paid to new approaches to banking liquidity regulation, which are commonly defined in international banking practice.

Note that many scientists, authors and researchers considered the topic of liquidity of banks, among them it is possible to highlight: V. Mishchenko, T. Smovzhenko, O. Vovchak, M. Dzyamulich, Yu. Rebrik, A. Kuznetsova, V. Stelmakh, Yu. Serpeninova, I. Lis, O. Lavrushin, P. Shalnov, O. Dzijublyuk. The problem of improving the existing approaches to liquidity regulation is described in the works such authors as L. Zherdetska, S. Achkasova, S. Manzhos, A. Falyuta, and others. However, the problem of applying the modern approaches to banking liquidity regulation, such as the regulation of systemic liquidity risk and new requirements for stress testing of banks, is not sufficiently covered.

The study and use these aspects in the general practice of regulating financial institutions will help more deeper to understand the essence of these approaches, their necessity and the possibility of introduction to regulate the Ukrainian banking market.

For the successful functioning of the banking services market, every institution that is the subject of such relationships should be regulated continuously: both self-regulation (through internal procedures and instruments) and external regulation by the central bank or other controlling authorities.

The regulation of banks' activities is happening constantly: from the approval of regulatory documents, instructions, resolutions to refinance loans for supporting liquidity and the application of influence measures for violating banking norms.

The liquidity regulation of banks, due to its importance, is aimed at maintaining a balance in the banking system, identifying problems of shortage or

excess liquidity and taking the necessary operational measures to bring it to an appropriate level.

As the French economist, Member of the Executive Board of the European Central Bank Benoît Cœuré [1] notes, there are three main objectives for liquidity regulation:

- to reduce the impact of uncertainty on the bank risk profile;
- to build up liquidity buffers;
- to mitigate the systemic characteristics of a liquidity crisis.

The first objective means that adequate liquidity regulation procedures allow to control unexpected outflows or cash inflows and allow the bank to withstand large amounts of cash withdrawals without threatening the stability of its activity. Consequently, the uncertainty factor is leveled, which reduces the risk of operations.

The liquidity buffer is a specific stock of high liquid funds, which serves as a kind of barrier for protect the institution / banking system in case of unexpected outflow of funds. In fact, the larger buffer of liquidity has accumulated, the less probability of non-fulfillment of obligations to its depositors and creditors, including at the moment of a crisis condition. However, it should be remembered that these funds do not bring the bank income (dilemma «liquidity-profitability»), so accumulate them in large volumes is simply inappropriate. Because of this, every bank independently determines for itself which buffer of liquidity will be both optimal and protective for it at the same time.

Liquidity regulation is also aimed at preventing a systemic liquidity crisis when liquidity problems in one bank (due to the «domino effect») inevitably lead to problems in other institutions that can reach the foreign financial and banking institutions through the contagion risk especially if the primary liquidity deficit arose in a large systemic bank. That is why, it is important to carry out constant control of the liquidity situation, paying particular attention to systemically important banks, and in some cases even the establishment of more tougher requirements for liquidity regulation process are justifying by setting higher values of economic norms, standards of mandatory reserve, etc.

The development of the global process of the liquidity regulation of banks was preceded by the following main factors:

- the emergence of central banks' institutes of the world (as the main state regulator in the regulatory system);
- the formation of two-level banking system, in which the first-level bank (the Central Bank) regulates the activities of banks of the second level (commercial institutions that carry out one or several specific activities or provide the full range of banking services);
- strengthening of globalization processes and development the competition in a global scale;

– the formation of new specific financial instruments, banking products and services;

– the deployment of global financial crises, which undermined the principles of public confidence to the functioning of banking institutions and led to total losses and bankruptcies in many countries of the world, and others like that.

Because the issues of liquidity regulation have become more important in recent years, the approaches used in this process are being modified and upgraded. In this context, the key role belongs to the question of systemic risks regulation, including the systemic liquidity risk, and the use of new approaches to the implementation of stress testing procedures of banks.

Systemic risks concept is quite complicated and dangerous. In our time, there is no doubt that uncontrolled local risks can easily be transformed into unregulated systemic risks that pose a serious threat to financial stability and economic growth of both individual economies and the global economic system as a whole.

Despite the considerable attention given to the systemic risks study, there is still no clear interpretation of it. A well-known domestic researcher and professor O. Baranovskyi defines systemic risk as a risk of violating of the whole system with potentially serious negative consequences for the domestic market and the real economy [2]. Other domestic researchers, S. Naumenkov and V. Mishchenko, have the opinion that systemic risk should be considered as a risk that objectively follows from the existence of systemic interconnection and the accumulation of imbalances in the activities of certain sectors or financial institutions on the basis of the implementation of mechanisms for the transmission of risks and potential mutual contamination because of insufficient management of financial processes in certain financial institutions or in the financial system as a whole [3, p. 188].

Consequently, the interpretation of the systemic risk concept reduces to a violation of the financial system on the basis of the contamination of unstable, high-risk institutions of other participants in the financial system, and lead to negative consequences for economic stability. Instead, foreign scientist J. Sinki considers systemic risk as uncertainty, which is associated with the possibility of the financial system collapse [4, p. 775].

The systemic risk concept is also considered by international financial organizations, such as the European Central Bank, The World Bank, International monetary fund and others. For example, the European Central Bank describes this category as a risk that the provision of necessary financial products and services by the financial system will be impaired to a point where economic growth and welfare may be materially affected [5]. In addition, it is precisely the prevention of the rise of systemic risk representatives of the European Central Bank called the state of financial stability, which only once again proves the interdependence of these financial concepts. Moreover, the fact that the representatives of the European Central Bank identify the financial stability as a state whereby the build-

up of systemic risk is prevented, only once again proves the interdependence of these financial concepts. A similar interpretation is provided by the World Bank [6, p. 6]: systemic risk is limited to financial shocks that are likely to be serious enough to damage the real economy. Definitions of the European Central Bank and the World Bank are mainly reduced to the economic side of possible problems, while the International Monetary Fund focuses on the social aspects of systemic risk manifestation, considering it as a threat confidence in the financial system and a substantive threat of growth and living standards [7, p. 5].

The generalization of existing approaches to the definition of systemic risk, allowed to distinguish three main approaches to disclosure the essence of this concept. (Fig. 1).

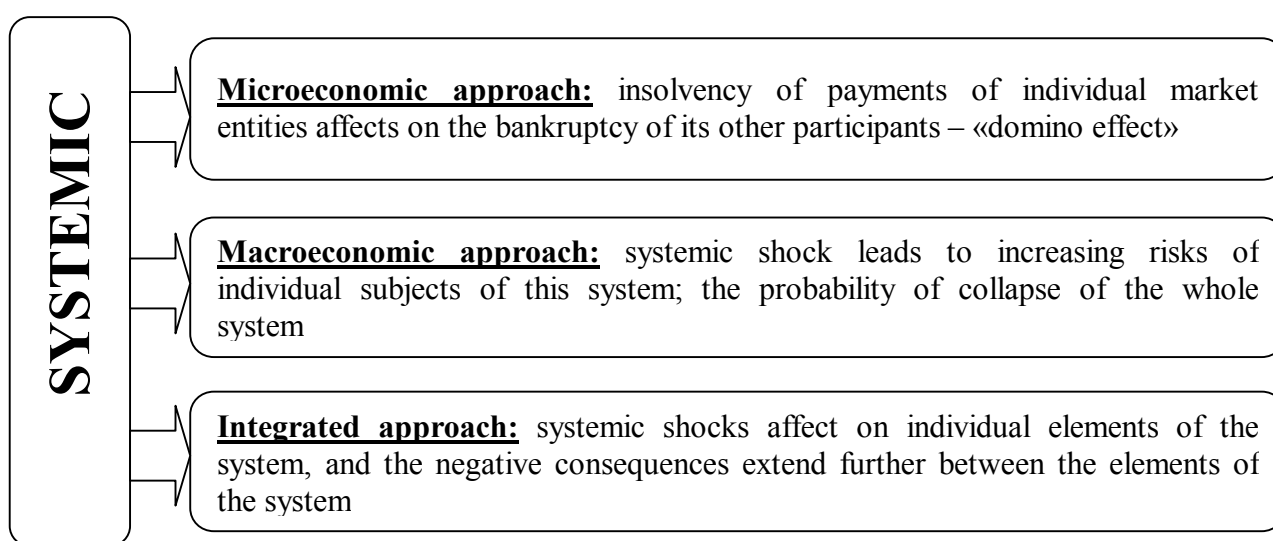


Figure 1. Approaches to the definition of «systemic risk»

Source: compiled by the author with the help of [8, p. 274-275]

The first microeconomic approach is based on the idea of interconnection between participants or system elements (domino effect). Representative of this approach E. Cherutti notes that «systemic risk arises due to the failure of one or more financial institutions to timely and fully fulfill their obligations to counteragents, which causes the insolvency (bankruptcy) of other participants in monetary and financial relations» [9].

The macroeconomic approach is based on the assumption that systemic shocks cause a disturbance of the stable functioning of the financial system. For example, J. Kaufman and K. Scott define it as «the probability of failure of the whole system, in contrast to the failure of its individual parts or components, as evidenced by the relationship (correlation) between the majority or all its parts» [10, p. 371].

The third (integrated) approach takes into account both horizontal and vertical relationships between financial market participants and the possibility of occurrence of systemic risk is allowed through the influence of macroeconomic

shocks on separate elements of the system with the further spreading of negative consequences between other elements of the system.

Note that the current legislation of Ukraine defines systemic risk only in the context of the stock market risks, which is interpreted as «the risk of losses in a large number of institutions, because of the impossibility of meeting their liabilities in connection with non-fulfillment (late fulfillment) of liabilities by one institution as a result of implementation the credit risk, the liquidity risk or other risk in this institution» [11].

Consequently, in the given situation, the concept of «systemic risk» is determined from the position of the microeconomic approach, which consists in the negative impact of unstable financial institutions on other subjects of the financial market («domino effect», the contagion risk).

The evidence of the total threat of systemic risks can be the creation of the European Systemic Risk Board after the global financial crisis of 2007-2009, the main task of which is to identify potential systemic risks of the financial sector and struggle with them through macro-prudential recommendations and approaches. The answer of the domestic banking market to that was to create a Financial Stability Board in Ukraine in 2015, which is assigned the task of identifying systemic risks and minimizing their negative impact on the financial system of Ukraine.

Systemic risks are even more worrying because they are difficult to predict and more difficult to overcome. Because they capture the whole financial system, it can be argued that exactly the systemic risks are responsible for a series of major-scale crises in the history of mankind.

One of the important risks of the banking sector is the liquidity risk, which represents the possibility of the bank / group of banks / banking system of the country at all to be responsible for all its obligations, and maintaining the optimum level of profitability, financial image and ability to provide an increase in active operations. It is an integral part of banking activity and mainly serves as the mainstay of the systemic crisis. The liquidity risk in the banking always exists, despite the fact that it is spoken only in a situation when it becomes significant and leads to a deterioration of the financial state either a separate institution or the whole banking system. In the case of its extension to the whole banking system, it is advisable to speak of the systemic nature of its manifestation.

The systemic liquidity risk concept is currently underestimated by domestic researchers, while global regulatory institutions in the face of the Basel Committee on Banking Supervision (BCBS), the International Monetary Fund (IMF), the European Central Bank (ECB) are paying more and more attention to this issue. Systemic liquidity risk can be defined as a risk of simultaneous liquidity constraints in several financial institutions. However, this category has a deeper background. According to the IMF (2011) [12, p.76], systemic liquidity risk

reflects the tendency of financial institutions to collectively underestimate the risk of liquidity in the period of financial stability when markets receive funding from the central bank without any obstacles. Underestimation of possible threats that may arise because of liquidity risk from financial institutions that mistakenly believe, that in the event of stress can uninterruptedly obtain the necessary funding from the regulator, pushes them to direct more and more of their assets to high-risk operations, and keeping a smaller amount of liquid assets, that is necessary to meet the needs of customers and timely fulfillment of all their liabilities. The more such institutions in the banking system, the greater probability of development the systemic liquidity risk, which, through the effect domino will capture all its entities.

Systemic liquidity risk depending on the source of the crisis can be divided into 2 types:

- external (global) systemic liquidity risk – arises outside the country, and through the effect domino spread into national banking institutions because of close interconnections of financial market institutions around the world. For example of this type of systemic liquidity risk can be the global economic crisis of 2007-2009;

- domestic (national) systemic liquidity risk - arises in the national banking market, with the probability of spread into the banking systems of foreign countries, and the spread of destabilization to foreign banking institutions. Such a course of events was characteristic of the crisis in Ukraine for 2014-2015.

It can be concluded that the systemic liquidity risk is the probability of a global liquidity crisis, reflecting the inability of most of the institutions of the banking system of the country / group of countries or the world at all (including systemically important banks) to fulfill their liabilities to creditors and depositors characterized by a decrease in banks' capital, a significant outflow of funds from the banking system, a sharp decrease in revenues because of a deterioration of the loan and investment portfolio, and causes a negative financial climate, reduction of confidence to banking system / banking systems of countries of the world on a global scale and falling economic activity.

For successful prevention and control of systemic liquidity risk it is important to identify it in time. Nowadays, it is difficult to do, there is no clear approach to its evaluation. Appropriate techniques are still under development and their implementation has some difficulties. Some methods are complicated mathematical models, for the others the problem is in the lack of necessary data. In addition, existing methods are discussed mainly for developed countries, while recent events have shown that this issue is also important for developing countries.

However, in its report on financial stability in April 2011, the International Monetary Fund proposed three methods for measuring systemic liquidity risk [12, p. 98]:

- Systemic Liquidity Risk Index;
- Systemic Risk-Adjusted Liquidity Model;
- Stress-Testing Framework.

Unfortunately, these methods cannot be called universal and fully understandable for use, which prevents their immediate use for monitoring the situation with liquidity in the financial market of Ukraine. Consequently, the primitive instruments that signal the emergence (occurrence) of a systemic liquidity risk in the Ukrainian banking market can be:

- decrease in the share of high liquid assets by more than 2 percentage points (p.p.) during the year;
- outflow of deposit resources from the banking system of the country (by 5-10% during the year), characterized by the emergence of panic among the population;
- default on mandatory liquidity standards by banks,
- the growth of volumes of refinancing operations (by 2-3 times a year) as the main tool for maintaining liquidity;
- increase in the share of toxic assets in it's total amount of banking institutions (by 5-10% or more during the year), etc.

High liquid assets of the banking sector characterize the degree of protection of financial institutions from various macroeconomic (systemic) shocks, another words, they act as an emergency stock. Note that in recent years there has been a positive trend in the growth of high liquid assets (Fig. 2). Compared to the beginning of 2015 (10.2%), the share of high liquid assets in it's total mount of Ukrainian banks gradually increased, which confirms the gradual restoration of the banking system of the country after a long period of crisis shocks. As of January 1, 2018, this indicator fell again (to 9,66%), showing a negative tendency in banks' liquidity.

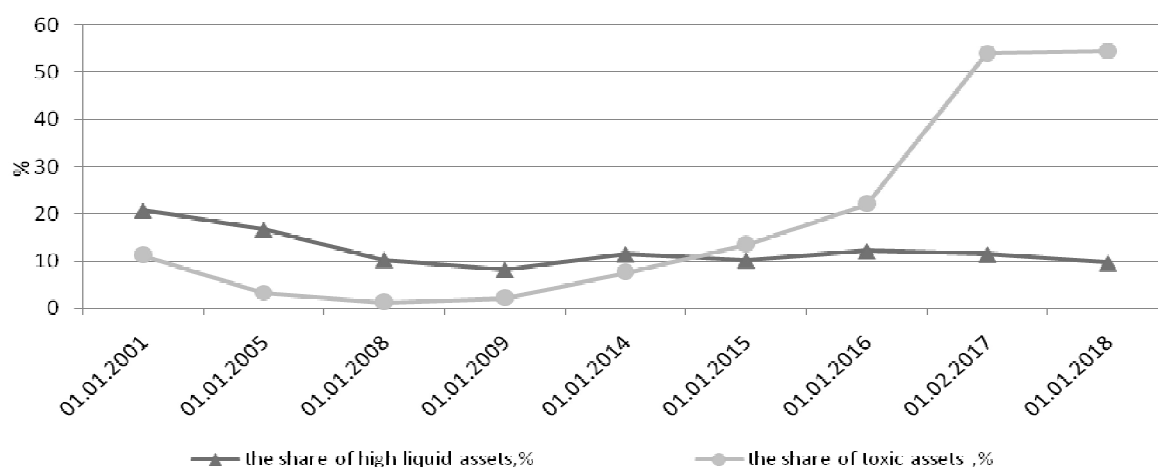


Figure 2. Assessment of systemic liquidity risk of Ukrainian banks in 2000-2017 years

Source: compiled by the author with the help of [13]

It should be noted that the lowest level of high liquid assets was observed in 3 periods: 1) during the crisis of 2008-2009 – 8.2% and 9.6% respectively; 2) during the national crisis of 2014 – 10.2%. Consequently, there is a direct link: the lower level of high liquid assets, the greater expose to systemic liquidity risk by the banking system of the country.

The significant amount of problematic (toxic) assets poses an increase in systemic liquidity risk, which leads to lack of banks' revenues and negatively affects on their liquidity and financial performance (Fig. 2).

The credit activity of the banks after the crisis of 2014-2015 has significantly decreased because of geopolitical factors and the difficult macroeconomic situation. In connection with a decrease in the resource base, worsening solvency and payment discipline of borrowers, banks reduced lending to both businesses and population.

Since 2017, lending has gradually begun to recover, but mainly in the segment of consumer lending. But even despite this, because of the low solvency of borrowers and the massive debt on foreign currency loans, the share of toxic loans has grown rapidly: if as of January 1, 2016 this indicator was 22.1%, then as of January 1, 2018, it reached 54.5%, increasing by more than 2.5 times in almost two years. Such data testify to the fact that the Ukrainian banking system cannot recover from the negative consequences of the crisis for 2014-2015.

As systemic liquidity risk arises because of the impossibility for most banks of the system to fulfill its liabilities, in this case we can talk about a decrease in confidence to banking institutions and a massive outflow of deposits of individuals. Therefore, to assess the systemic liquidity risk, it is advisable to analyze the dynamics of the deposit and loan portfolios of individuals in the banking system of the country (Fig. 3).

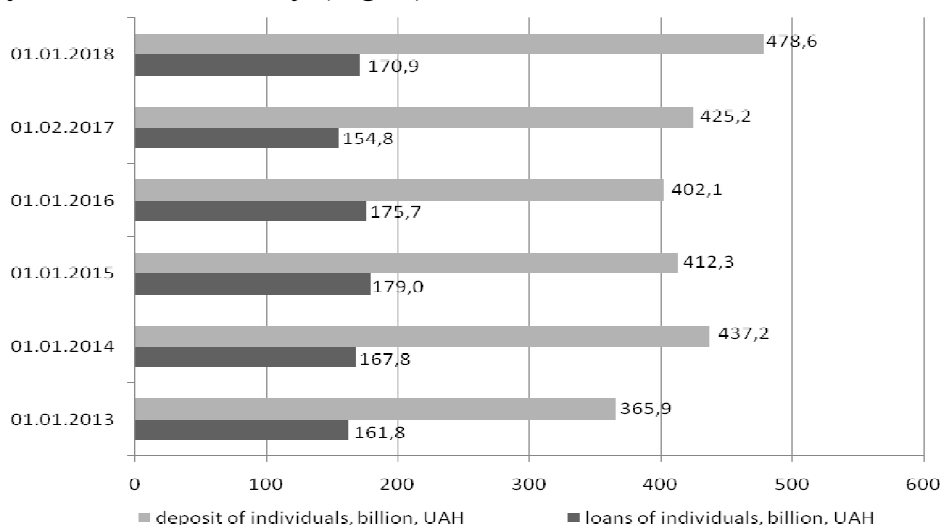


Figure 3. Dynamics of the deposit and loan portfolios of individuals during 2012-2017 years

Source: compiled by the author with the help of [13]

According to the table, there is a slight volatility of the deposit portfolio of individuals. Thus, during 2012-2013 there is a growth of the portfolio (approximately on 19%), but during the next 2 years – its gradual decrease (by 8% compared with January 1, 2014). From 2016, the volume of deposits grows again, reaching the figure of 478,6 billion UAH as of January 1, 2018 (16% compared to the indicator as of January 1, 2016). That is, during the period of the national crisis of 2013-2015, the volume of the deposit portfolio of individuals decreases, which characterizes the distrust of the population during this period and the withdrawal of deposits from the banking system.

At the same time, during the 2015-2016 the lending volumes of individuals decreased by 15%, which is also typical for the period of the crisis. A slight increase in lending in 2017 (practically reaching the index as of January 1, 2016) demonstrates a gradual restoration of the banking system.

Taking into account the deep systemic crisis of Ukraine's banking sector in 2013-2015, and the complicated post-crisis period, many financial institutions were unable to cope with the difficulties and lack of liquidity. In such difficult circumstances, the role of the national regulator comes to the fore, because from its work depends not only the predestination of bank services' market, but also the predestination of all economy of the country. The NBU, as the central management body in accordance to the functions assigned to it, provides support of banks' liquidity by various instruments, among which the main role is played by refinancing operations (Fig. 4).

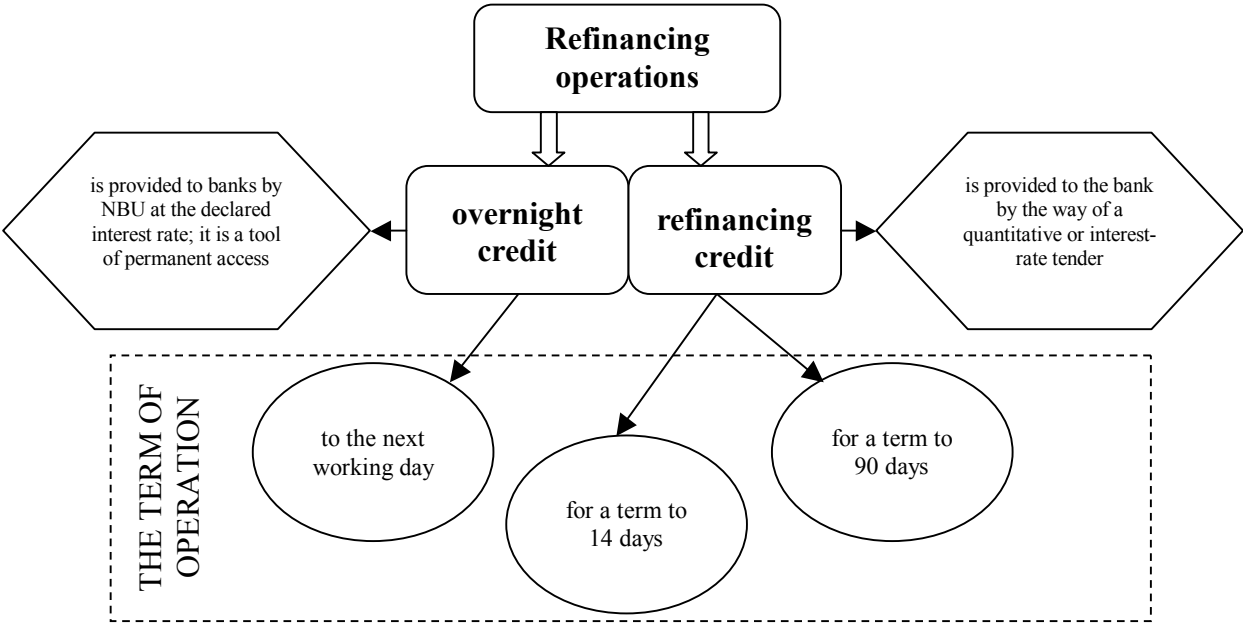


Figure 4. Types of refinancing operations of Ukrainian banks

Source: compiled by the author

Systemic liquidity risk can also be estimated depending on the volume of lending that was sent to refinancing operations to maintain the liquidity of banking

institutions. The bigger amounts of refinancing was provided to banks, the bigger problems with maintaining liquidity were observed in the banking sector of the country and to a certain extent, it shows the existence of a systemic liquidity risk (Fig. 5).

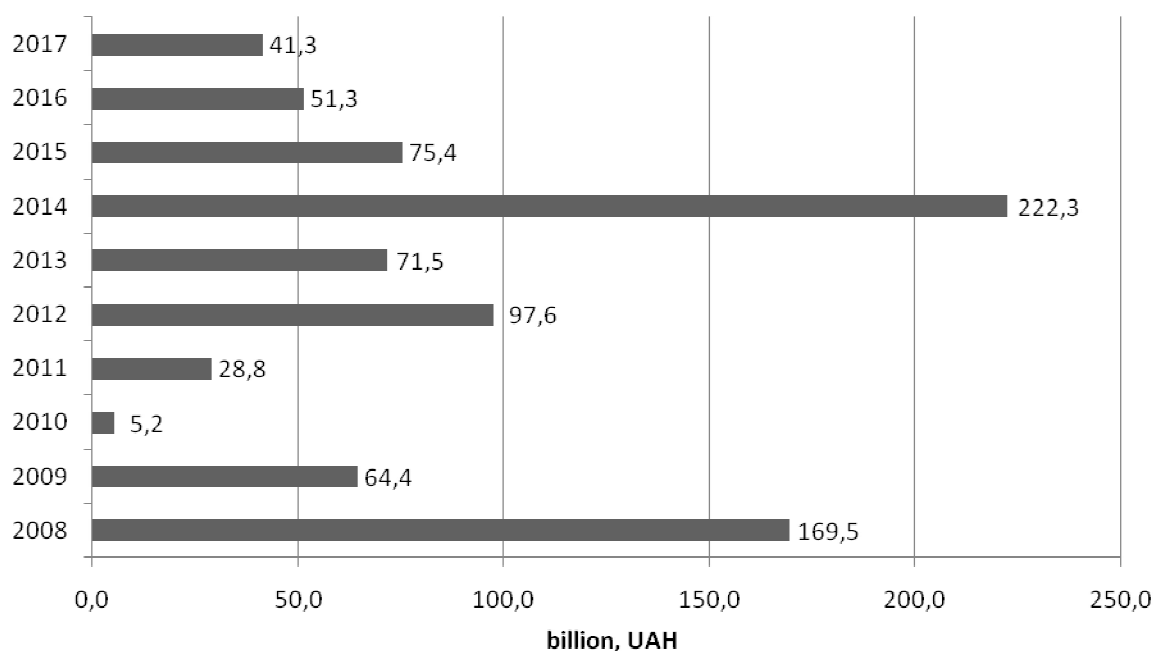


Figure 5. Dynamics of volume of refinancing operations in 2008-2017

Source: compiled by the author with the help of [13]

Based on this data, the largest amount of refinancing is observed in 2014 (UAH 222,3 billion), which indicates on deeper crisis of the banking system of Ukraine in this period, in contrast to the global financial crisis of 2008 (UAH 169,5 billion). Note that a significant reduction in lending since 2015 indicates a gradual exit from the «debt pit» of Ukrainian banks, reducing the risk of developing systemic liquidity risk.

Taking into account the massive outflow of deposits from the country's banking system, the high volatility of high liquid assets, the growth in the share of toxic assets and the largest amounts of refinancing operations (in 2014), we can conclude that the systemic liquidity risk occurred during the crises of 2013-2015, the results which still hinders the economic development of Ukraine and does not allow to fully achieve the pre-crisis level of profitability of banking.

The systemic liquidity risk concept is closely linked to the problem of systemically important banking institutions. The issue of systemic importance has been studied since the 80s years of the XX century, and has become special significance issue in modern realities. It is believed that the phrase "too big to fail" has a 27-year history. First time it was formulated by US Congressman Stewart B. McKinney on September 19, 1984 in a speech about the salvation of the Continental Illinois Bank, which faced insolvency because of unskilled lending [14]. In the general sense, systemically important institutions are financial

institutions with a significant share of the financial services market, and the bankruptcy of which will cause irreparable damage to the normal functioning of financial markets or other financial institutions operating within these markets.

Since a significant share of assets is concentrated in these institutions, increasing liquidity risk in them will cause to significantly worse results than, for example, problems in a pocket bank that is not so closely interlinked with other participants in the financial system. Besides this, failure to meet current liabilities that may arise in a systemically important bank can provoke a banking panic and total "invasion" not only on this, but also on others banking institutions. That is why each country defines the criteria for systemically important banking institutions, which require more control over their activities by regulators.

According to international practice, there are three approaches to the identification of systemically important banking institutions. The first approach is associated with a qualitative assessment based on specific indicators. This approach was proposed (BCBS, 2011) for the identification and regulation of global systemically important banks in terms of size, interconnectivity, substitution, global (international) activity and complexity of the institution. The second approach is related to the analysis of the interbank network (for example, in terms of its impact on other financial institutions through the systems of interbank connections, or in terms of its centralization on the interbank market). The third approach is to assess the financial institution's contribution to the overall systemic risk (consequently, what proportion of systemic risk, if it occurs, can be generated by this institution).

In Ukraine, the criteria for the systemic importance of banks are: the size of the bank, the degree of financial interconnections and the direction of activity [15]. Every year, the National Bank of Ukraine defines systemically important banks that have the greatest impact on the entire banking sector in the country.

Thus, in the 2016-2018 years, only three banks were considered systemically important – the largest in assets of PJSC CB «PrivatBank», JSC «Oschadbank» and JSC «Ukreximbank». It should be noted that since 2015 the status of systemic importance of banks with foreign participation in capital – «Raiffeisen Bank Aval», PJSC «Ukrsotsbank» (UniCredit Bank), PJSC «Prominvestbank» and PJSC «Sberbank» has been eliminated. For such systemic banks, tougher requirements should be set for economic standards. Besides this, in 2015 the Instruction of Banking Regulation in Ukraine No. 368 dated 28.08.2001 was supplemented with a new section (Section X. Requirements for Systemically Important Banks). In particular, according to the section, the instant liquidity standard (H4) for systemically important banks should be no less than 30%, compared to the usual 20%, and the maximum credit risk per borrower standard (H7) – 20% or less, compared with usual 25%.

At the global level, the list of systemically important banking institutions is

also annually determined. The Financial Stability Board and the Basel Committee on Banking Supervision identified a list of 30 systemically important banks in 2017. These institutions are subject to increased capital requirements (Table 1).

The use of adequate mechanisms for regulating systemically important banking institutions will minimize the development of possible financial crises and situations of instability, while possible problems in other institutions will be easier to overcome using the necessary tools and procedures, preventing the spread of imbalances within the system.

Table 1

Global systemically important banks, as of November 2017 allocated to buckets corresponding to required levels of additional capital buffers

Bucket	Global systemically important banks
5 (3,5%)	–
4 (2,5%)	JP Morgan Chase
3 (2,0%)	Bank of America
	Citigroup
	Deutsche Bank
	HSBC
2 (1,5%)	Bank of China
	Barclays
	BNP Paribas
	China Construction Bank
	Goldman Sachs
	Industrial and Commercial Bank of China Limited
	Mitsubishi UFJ FG
	Wells Fargo
1 (1,0%)	Agricultural Bank of China
	Bank of New York Mellon
	Credit Suisse
	Groupe Credit Agricole
	ING Bank
	Mizuho FG
	Morgan Stanley
	Nordea
	Royal Bank of Canada
	Royal Bank of Scotland
	Santander
	Societe Generale
	Standard Chartered
	State Street
	Sumitomo Mitsui FG
UBS	
Unicredit Group	

Source: [16]

The regulation of systemic liquidity risk in modern conditions of development is, although one of the most important approaches to regulation banks for ensures their efficient, stable and profitable activity, but is not exhaustive. In addition, there is a need to use specific mechanisms for possibility of monitoring the current financial situation, in order to comply with the requirements of central banks and other regulators, the adequacy of their capital and the required liquidity reserve, etc.

Taking this into consideration, the bank stress-testing tool is becoming increasingly popular. This tool is relatively the youngest among a set of other regulatory instruments, including the liquidity regulation of banks. The placement of basic stress testing principles as a risk management tool and crisis management modeling in the banking system began in the mid-1990s with the Basel Committee on Banking Supervision and the Policy Group on Derivative Financial Instruments.

Historically, the first country in which the macroeconomic stress testing of the banking system began to take place on the assumption of certain stressful events was the United States, but was most topicality in the global financial crisis, which became especially acute after the default of the «Lehman Brothers» investment bank in September 2008 [17, p. 49]. In the countries of the European Union, centralized macroeconomic stress testing began to develop from the beginning of the 2000s within the IMF Financial Sector Assessment Program, and during the implementation of national banking monitoring and oversight programs [17, p. 69].

Note that most researchers consider stress testing as the tool of assessing the financial stability of banks. It is an important risk management tool, which used by banks as a part of their internal risks management and capital adequacy. Stress testing prevents the bank management of adverse unforeseen consequences associated with a variety of risks and shows how much capital can be needed to absorb losses in the event of major upheaval.

The Basel Committee has identified 15 principles for sound stress testing practices [18], in which noted that regulators conducted stress tests using systemic analysis and paid more attention to credit risk and liquidity risk, and involving senior management, which should ensure that stress test results will be used in risk management.

Taking into account that stress testing has been used since about the 1980s, while the status of the leading tool of regulation and current control of the situation with banking institutions has come after the global financial crisis, it is advisable to follow the scale of key events of development the world practice of stress tests (Fig. 6).

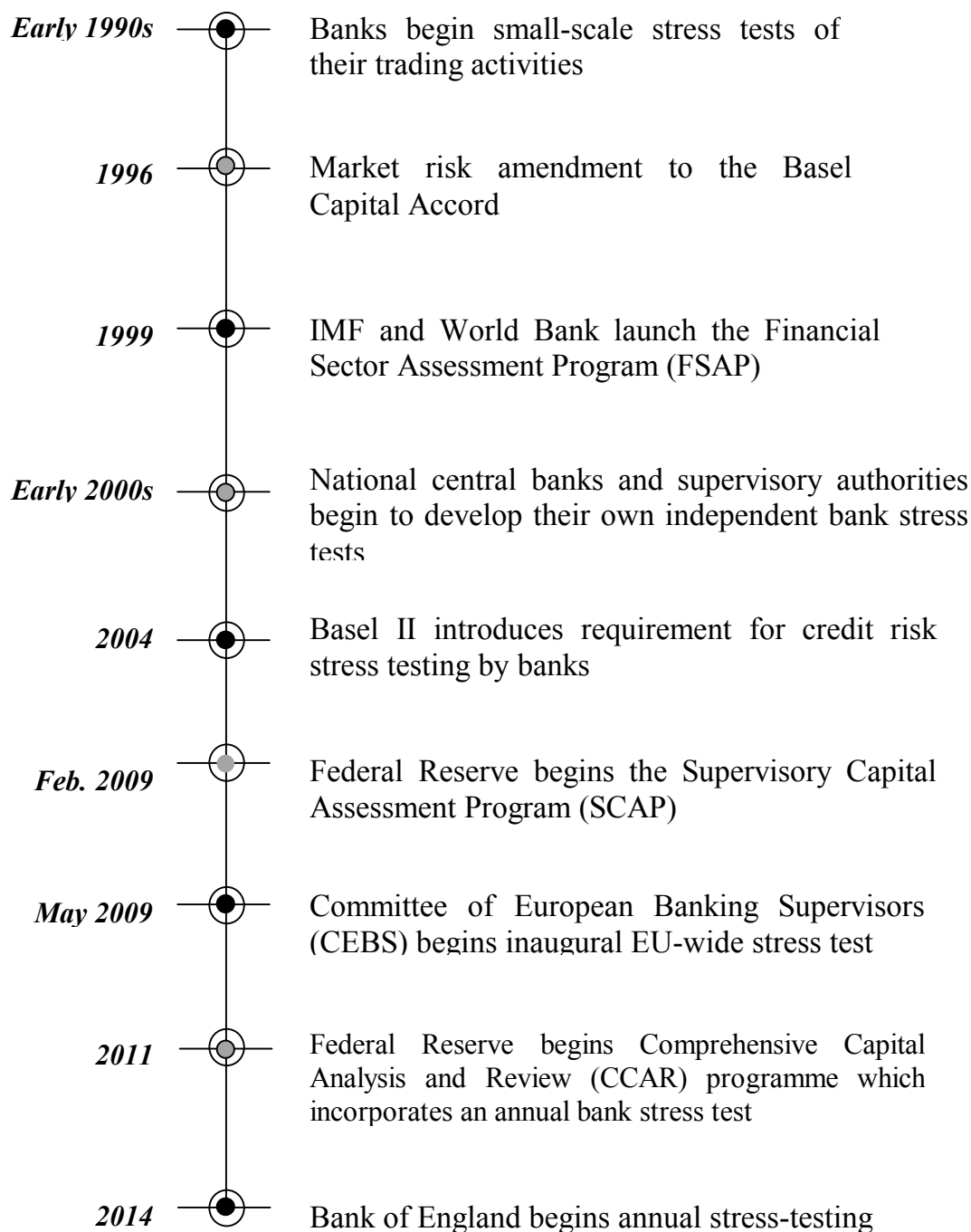


Figure 6. Timeline of key events in the development of bank stress testing
Source: [19, p. 132]

In process of developing scenarios of stress testing for Ukrainian banks are recommended to take into account the possible devaluation of the hryvnia (for a currency loan portfolio and currency liabilities of the bank), decrease in the amount of funds in the bank (outflow of deposits, reduction of limits which put on the bank by counterparty banks), an increase in the amount of overdue loans in the bank's portfolio due to the deterioration of the borrowers' financial position, etc. It is necessary to assess whether the bank is capable in the adverse conditions to effectively performing functions, to be solvency and ensuring compliance with

mandatory economic standards: capital adequacy, liquidity and credit risk.

It exists the view that stress testing is more a tool for evaluating the capital base of banking institutions, but this is not entirely appropriate. As the previous world financial crisis has shown, only capital is not enough for a bank to be able to withstand during the period of aggravation of instability, if there is not enough liquidity for protection against catastrophic cash outflows that occurred at that time. An assessment of the firm's sustainability based on stress testing also allows to determine whether sufficient liquid funds are available to cope with the potential problems that may arise in the future, and to identify the best ways to exit from unstable condition.

The results of stress tests can be used in several ways. It should be noted that all stress tests are tools for measuring and managing the risks that banks face on a promising basis. For those who are primarily interested in risk measurement, the results give a quantitative assessment of risks scale facing banks, whereas for those who monitor the results of stress tests – allows more actively handle the risk management process and, based on the results of stress tests, allow to make sound management decisions. The stress tests' results should also be taken into account in a process of determining liquidity management tools.

According to international practice, an effective system of stress testing uses several conceptual approaches. In particular, stress tests used by central banks are divided into 2 groups – "bottom-up" and "top-down" [20, p.73]:

– a bottom-up approach means that the regulator sets the scenarios for banks and they independently make calculations and deliver results to the regulator, and the regulator uses this results to obtain an integral assessment at the macro level in the banking sector as a whole. In Ukraine, mainly the bottom-up approach is used when the banking regulation and oversight authorities define scenarios. At the request of the IMF, the National Bank of Ukraine conducted stress testing of banks in 2008, 2009 and 2014. The stress testing procedure was carried out by audit firms (for banks of groups I and II – the international auditing companies). As a result of stress testing, banks have been required to increase capital, reduce risks and increase the stability of their activities;

– a "top-down" approach means that the regulator makes calculations itself based on a single methodology. Note that the National Bank of Ukraine, using the "top-down" approach and the sensitivity test, regularly conducts stress-testing of currency risk and liquidity risk according to the reporting of banks and takes appropriate measures to prevent the growth of risks.

The development of stress testing methodology, in addition to general requirements, needs to take into account the specific features of the countries in which it is used, and also the tendency of banking systems of these countries to separate types of risks. Consider the features of the international scenarios of stress testing of the leading controlling authorities of the world using Table 2.

Table 2

The features of the international scenarios of stress testing

Controlling authority	The features of stress testing tool
The IMF	Stress tests include two or three adverse scenarios constructed around the macrofinancial risks judged to be most significant for the economy concerned. Prior to 2009, stress tests focused mainly on bank solvency risk, later – on market and liquidity risk. Note, that factors of systemic risk development have not yet been fully embedded into macroprudential stress-test frameworks
The US Federal Reserve	The first stress test was conducted in 2011; includes an adverse and severely adverse scenario. The severely adverse scenario is modeled using certain anti-cyclical elements, including a 10% increase in unemployment. The adverse scenario incorporates different risks relative to the severely adverse scenario. The USA uses dynamic balance sheet approach to model the impact of these scenarios on the banking structures of the countries.
The European Banking Authority (EBA)	For the first time, the stress-testing tool was applied in 2011. A joined-up adverse macro scenario with a three-year horizon is used. The test is conducted on a static balance sheet basis (indicators do not change during the forecast period). Stress testing aim is to capture systemic risks, which are the most material threats to the stability of the EU financial sector.
The Bank of England	The first stress test was conducted in 2014. Stress tests incorporates an annual cyclical scenario and a biennial exploratory scenario. An annual cyclical scenario associated with the state of the financial cycle and based on such indicators as credit variables, financial market and other asset prices. Besides this, The Bank of England uses a dynamic balance sheet approach to building Stress tests. In cyclical scenarios capital requirements of individual firms and buffers for systemically important banks are also reflected.
The Bank of Japan	The Bank of Japan runs semi-annual top-down macro stress tests. The scenarios employed reflect the state of economic and financial conditions. The tests results are not, however, used to set capital for banks. There is designed to help the Bank of Japan to analyse feedbacks in stress conditions between the banking and macroeconomic sectors, and between different banks.

Source: compiled by the author with the help of [19, p. 138-139]

Over the past 25 years, stress testing has passed a long and complicated way of development: from an isolated risk management tool used by banks to assess the stability of their trading portfolios to the key and necessary regulatory tool for banks around the world for annual monitoring their activities to assess possible losses in crisis circumstances. Modern stress tests don't have restrictions already, and there are numerous of stress tests' components, the further development of which can improve their usefulness for supervisors and bank managers.

Taking into account all of the foregoing, in order to improve the existing practice of banks' liquidity regulation, especially from the point of prevention and elimination the systemic liquidity risk, and for modernization the stress testing tool of banks, it is necessary to implement a number of measures:

Improve the existing banking regulation and supervision practices, especially issue of developing key indicators of liquidity risk of financial system, and timely mechanisms of action in the case of their significant change.

Take into account the best practices of leading world supervisors in using the stress testing tool of banks, considering the key characteristics of the banking system of the country (for example, such as: the exposed to sharply fluctuate the monetary unit, the concentration of individuals' deposits, the distrust of the population to banks, etc.).

Develop scenarios for stress testing of systemic liquidity risk for the banking system according to the Basel Committee on Banking Supervision recommendations.

Intensify the requirements for systemically important banks, conduct on-site and off-site inspections, and conduct weekly monitoring of the efficiency of such institutions in order to prevent early liquidity problems.

Conduct a balanced monetary policy, supporting liquidity only in cases of exceptional needs, based on a careful examination of the solvency of banking institutions that apply to the NBU for obtaining the necessary funding, etc.

Adequate approaches to liquidity risk regulation, which, as world practice has shown, is one of the most significant in the banks' activities, is a main step in their timely monitoring and taking measures to avoid possible crisis phenomena that can negatively affect not only on the financial result of the banking system, but also on the stability of the country's economy, competitive positions in the international arena, the possibility of attracting additional external financial investments, the depreciation of the national currency.

Further studying and understanding of systemic liquidity risk is the first step to effective management and regulation. Systemic liquidity risk is usually associated with the impossibility of fulfilling its liabilities by individual financial institutions, which has a negative impact on all financial system. Systemically important banks, as the main sources of systemic risk development, require tougher control and supervision by the regulator.

International stress tests show a variety of approaches to their construction and conduct, which talking about their adaptability to the features of the countries in which the stress tests are applied, and about the ability to model the most threatening scenarios for every individual country. Taking into account the Basel Committee on Banking Supervision requirements to improve the domestic practice of using this tool will help to assess the vulnerability of banks to possible shocks more qualitatively, promptly and transparently.

And the introduction of a number of these measures will help ensure the stability of the banking system and reduce systemic risks, including in terms of violating the requirements of liquidity of banks.

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CHAPTER 4

MODERN APPROACHES OF INCREASING THE INNOVATION ACTIVITY OF ENTERPRISES

4.1. The main aspects of increasing the innovation activity in industrial enterprises on the basis of their modernization in strict conditions of competition

1. The main characteristic and basic principles of industrial enterprises modernization

The problems of innovation and innovation activity over the last few years have been on focus of political and corporate leaders in most world countries. The special emphasis is placed on countries with a developed market economy. This is evidenced by the issue of the World Economic Forum in Davos, where during the last two years the main focus was on the problems of the Fourth Industrial Revolution and its consequences in all spheres of social activity.

So, it is about accelerating the development of the economy on an innovative basis and finding the most rational ways to solve this problem. The solution to this problem is especially powerful for the Ukrainian economy, since its level of competitiveness is far from the current requirements of economic activity in the conditions of accelerated scientific and technological progress. It's time to identify and implement the main driver for all sectors of the economy of Ukraine and enterprises. It can be the technological and technological modernization of production activities, which will become an important foundation for their dynamic development on an innovative basis and efficient functioning.

Solving this important task requires the clarification a number of important theoretical and methodological provisions related to this problem. First of all, the definition of the concept "enterprise modernization" is being urgent. In general terms, in our opinion, the essence of an industrial enterprise modernization is to develop and implement a set of measures aimed at replacing, improving its activities in accordance with modern requirements of market economy in the conditions of scientific and technological progress. The concept of "enterprise modernization" should orient management to the fact that various types of its activities, in particular material and technical basis, which were characteristic of the past, provide more advanced features and organizational and technical characteristics, materialization of which through implementation innovative-oriented projects will help achieve the goal set by the enterprise. Consequently, it is a question of the concept content of "industrial production modernization" enabled both theoretical and practical understanding of the problem, that is, as an important organizational, economical and technological process, carried out in the

form of system measures aimed at radically re-equipping the enterprise and its subdivisions, which will allow to adjust and increase the of products production with innovative high quality content to meet the needs of the domestic market and thus solve the problem import substitution, as well as to increase the supply of products for export. Thus forming a clear goal of the industrial enterprises development on the bases of modernization of their activities, the main ground of which is the use of modern scientific and technological progress and radical renewal of their material and technical base and the growth of a competitive innovation potential.

Modernization, that covers all spheres of social production activity, should be regarded as an important economic category reflecting a new type of industrial relations, in which the reproductive processes are accelerated, first of all, in the material and technical basis of production on the basis of the latest technologies.

As a result, a new potential for sectors of the national economy and their enterprises economic growth is being formed that will enable to solve a number of problematic issues. It is associated with increased production efficiency and the solution of actual social problems for both the country and individual production collectives.

The general essence of the concept "enterprise modernization" clarification is important not only in theoretical but also in practical value. The comprehensive understanding of the modernization essence, as an important precondition for the innovative development of individual sectors of the economy and their enterprises, enables to highlight and understand the practical side of the problem, which covers a wide range of organizational, technical and economic issues, the implementation of which in concrete production conditions will enable the subjects management to achieve positive results in their activities, as well as to ensure satisfaction of social needs in the necessary products and services. Therefore, the modernization has a clear goal, the implementation of which is aimed at achieving the appropriate management effectiveness and efficiency in the market competition.

The modernization processes acceleration and efficiency depends on a large extent on the basis of these processes, including the following:

1. Systematical and integrated approach. The modernization processes at the enterprise should be aimed at achieving the goal, it is important to involve the leading divisions of the organization, as well as managers. The implementation of this principle depends on the personal motivation of the organization leaders, understanding each employee of the goals of modernization, the awareness of the need for its implementation in modern conditions of management.

2. Sequence. The process of modernization is complex, expensive and long, so it is necessary to conduct it gradually, taking into account the priority of the selected subject in several stages. In the beginning, it is necessary to clearly define the goals and objectives of the modernization, the tools for its implementation, and

then clearly and consistently implement the measures provided by the project into reality. It is important to be prepared for the complexities and problems that arise in the course of its implementation, but the consistency and persistence in the implementation of the modernization project will surely lead to positive results in the enterprise activity.

3. Continuity. Ignoring this principle by management at most domestic enterprises leads to negative consequences in their functioning. In today's changing environment, with high competition and speed of change, it is important to continuously develop the company's potential, update the range of manufactured products, technology and business processes in general, which will enable to be competitive on the domestic and foreign markets in the future.

4. Innovation. The modernization processes must have an innovative content. It should be oriented on the latest technology and ensure the growth of the innovative potential of the enterprise. Openness and access to information in the modern world creates all the conditions for the borrowing by the management of enterprises of best practices and their implementation in main activities.

5. Flexibility and adaptability. In the context of scientific and technological progress in the process of implementing modernization projects, there can be changes. Adaptation of the enterprise should be done with taking into account changes in the external environment as a result of changing the nature of relations with it in the process of its transformation. Preservation of the relative integrity and stability of the enterprise means the ability to participate in the reproduction of material goods and production relations at a qualitatively new level, realizing internal and external relations. Modernization processes are built on optimizing communications with the internal environment. It is necessary to provide optimal combination of external and internal connections, which, despite the contradiction, can be balanced by the actions of managing structures, harmonized at all levels of the hierarchy.

6. Continuity of staff training. The modernization process requires high level of staff skills and competencies. Development of not only professional skills, but also personality characteristics and leadership. The leader must not only perform the tasks he faces, but also profess the philosophy of the company and show his own example of attitude to the case. Modernization processes and the development of innovations are possible only with effective "knowledge management" at all levels: national, regional, and entrepreneurial. We believe that the concept of "knowledge management" should be based on strategies for identifying, creating, storing, transferring and using knowledge.

7. Social orientation (internal and external). When defining goals and tools for modernizing the enterprise and the innovative economy in general, it is important to remember that there are two main dimensions of these processes: 1) the main mission of the organization – to meet the needs of the market and individual

consumers in the best way; 2) create conditions for internal staff that, by satisfying the personal needs of each employee, motivates them to improve their own results, efficiency, initiative and creativity growth.

8. Efficiency evaluating and focusing on positive results. Plans and results of modernization processes should have a clear quantitative measurement. An important role here lies in the formation and continuous monitoring of the system of key performance indicators, which, as a result of the evaluation of the modernization results, should reflect a complete and adequate situation state.

The above principles of modernization should be reflected in specific projects, which should become an important basis for the development of new technological developments.

Therefore, the clarification of the essence of the concept "enterprise modernization" gives a clear orientation of the subject of management the importance of the problem and the significance of its solution in the conditions of scientific and technological progress. As a result, it is important to note that these fundamental methodological principles concerning the problem of modernization of industrial enterprises must find their materialization in concrete projects of its implementation. Consequently, such projects will have not only proper innovative content but also become an important effective tool for accelerating the innovative development of industrial enterprises.

2. The current situation of Ukrainian industrial enterprises innovation development and their compliance with the requirements of accelerated scientific and technological progress

The management experience in developed economies shows that the main problem in this context is the further acceleration of its functioning on an innovative basis. Convincing evidence of this is that current topic has been at the center of the World Economic Forum in Davos for the past two years (2017-2018). The main conclusion of the discussions, global institutions see in the latest technologies of the main driver of development and the main thing for the survival of companies and even entire countries in the current conditions of competition. In this regard, in the countries of Western Europe, South Asia, considerable attention is being paid to conducting research. The costs for their implementation during the period from 1998 to 2013 grew by 4 times, that is, almost twice overtaken by the growth rates of world GDP. Such an increase occurred not at the expense of state funds, but at the expense of business funds. The majority of company executives, among whom a 2017 survey was conducted, believe that the use of innovations significantly increases their sales. They also expect a significant profits increase in the near term.

At a time when in developed countries the innovative potential of their industrial enterprises is dynamically increasing, while GDP growth as a result of

the application of the newest technologies reaches 60-90%, in Ukraine this figure is only 0.7%. Consequently, it can be concluded that at the same level of innovative filling of the hydrocarbons the Ukrainian industry as a whole and its enterprises, in particular, do not have the proper innovation potential for large-scale development of production of products with innovative content, increase of its supplies and the external market, and also for satisfaction needs for import substitution of products in the domestic market. Ukraine occupies not prestigious places in a number of important international ratings. Thus, Global Innovation Index ranked 50th in the global innovation ranking in 2017, while Global Competitiveness Index ranked 85th out of 138. In this situation is influenced by a number of external and internal factors. Among them the prominent place belongs to the macro-environment, economic policy, favorable business conditions, the initiative and professional level of management of its creativity, as well as the development and application of progressive forms of motivation of developers and organizers of the introduction of innovative projects into the practice of industrial enterprises.

Noteworthy is that the comprehensive influence of these factors must be taken into account by management of Ukrainian industrial enterprises in solving problems of accelerating their innovation development. First of all, it is necessary to analyze the current stage of economic development of industry and its potential opportunities at the present stage of management. In this context, general indicators that characterize the activities of industrial enterprises over the five-year period (Table 1) deserve attention.

In spite of a certain recovery in the development of Ukraine's industry in 2017 and the orientation of the industry to the appropriate stabilization and efficiency of functioning, its modern development is far not ideal.

The main indicators of industrial enterprises activity are shown in Table 1 and in the beginning of 2016 there is no dynamics of their positive growth. Along with the decline in the number of large industrial enterprises, the number of small and medium enterprises is decreasing. In a market economy, they play an important role in solving problems of development and products production with innovative content. Practically, the index of production of industrial products does not grow, but its price practically grew. In this situation it is important to note that some enterprises have loosed before taxation account for more than 30% of their total. This trend has been observed for five years. There are also no noticeable changes in the output of industrial products in the total output of the Ukrainian economy, the share of which is on average 40% in actual prices. Relatively low profitability of operating activities of industrial enterprises. For a long time it remains unchanged and there is no definite tendency to increase the added value of industrial products in the total value added of the Ukrainian economy.

Table 1

Main indicators of industrial enterprises activity in Ukraine

N	Indicators	Years				
		2011	2012	2013	2014	2015
1	Number of enterprises, units	47479	43356	49130	42187	42564
2	<i>Large</i>	407	410	382	289	233
3	<i>Medium</i>	5998	5802	5569	4791	4691
4	<i>Small</i>	41074	37144	43179	37107	37640
5	Index of industrial production in% to the previous year	108,0	99,5	95,7	89,9	87,0
6	Producer price index in% to the previous year	119,0	103,7	99,9	117,1	136,0
7	Share of enterprises with losses before tax in %	37	38	37	37	27
8	Profitability of operating activities in %	4,7	3,4	3,0	1,6	0,9
9	Issue of industrial production in the total volume of Ukraine's economy in actual prices, %	43,3	41,2	38,3	38,9	–
10	The cost of industry in the total value added of the Ukrainian economy, %	25,2	24,8	22,7	23,5	23,61
11	Electricity consumption by industrial enterprises, %	74,08	74,6	74,0	73,1	74,0
12	Capital investments in industry, %	34,3	35,2	39,4	39,3	32,1
13	Index of capital investments in %	125,5	107,5	100,3	74,3	80,1
14	Degree of depreciation of fixed assets, %	56,8	57,03	56,9	60,3	76,9
15	Number of enterprises engaged in innovation activity, units	16,79	17,58	1705	1609	824
16	Number of enterprises engaged in innovation activity in % to the total number of industrial enterprises	16,2	17,4	16,8	16,1	17,3
17	Number of industrial enterprises that introduced innovations	1327	1371	1312	1208	723
18	Number of industrial enterprises that introduced innovations in % to the total number of industrial enterprises	12,8	13,06	12,9	12,1	15,2

Source: compiled based on sources of State Statistics Committee of Ukraine, statistical collection "Industry of Ukraine in 2007-2015" / State Statistics Service of Ukraine URL: <http://www.ukrstat.gov.ua>

With the above mentioned general indicators, which characterize the activity of Ukrainian industrial enterprises, their consumption of electricity is practically stable, within the limits of more than 70% to the previous year. Also, capital investments to the Ukrainian industry do not increase, which primarily affects the level of technical and technological base of industrial enterprises. The degree of wear of fixed assets of industrial enterprises is on average 60-70%. Depreciation of fixed assets of industrial enterprises is one of the main factors, which inhibits their involvement in innovation. As can be seen from the table, the number of such industrial enterprises is not increasing and decreasing. Accordingly, the number of enterprises introducing innovations also does not increase. Along with the general analytical indicators characterizing the economic activity of industrial enterprises, it is advisable to carry out a somewhat in-depth analysis of the state of industrial enterprises in the context of their innovation activities (Table 2).

Listed in tab. 2 data characterize the innovative activity of Ukrainian industrial enterprises. Again, we have reason to believe that there is no increase in the number of industrial enterprises that carry out innovation activities, which is evident from the above absolute and relative indicators for 2012-2016.

Table 2

Innovative activity of industrial enterprises

N	Main figures	Years									
		2012		2013		2014		2015		2016	
		Total, units	in % to the num	Total, units	in % to the num	Total, units	in % to the num	Total, units	in % to the num	Total, units	in % to the num
1	Number of enterprises engaged in innovation activity	1758	17,4	1715	16,8	1609	16,1	824	17,3	834	18,9
2	Expenditures spent on conducting internal R&D	214	2,1	215	2,1	189	1,9	151	3,2	232	5,2
3	Expenditures spent on the implementation of R&D by external organizations	134	1,3	114	1,1	94	0,9	70	1,5	103	2,3
4	Purchase of machine equipment and software	1096	10,9	1082	10,6	993	9,9	467	9,8	590	13,3
5	Acquisition of other external knowledge	87	0,9	85	0,8	83	0,8	32	0,7	74	1,7
6	Other types of innovation activity	202	2,0	165	1,6	140	1,4	210	4,4	368	8,3

According to individual experts, the share of innovative-active industrial enterprises in Ukraine during the years of independence decreased by 5 times. The table. 2 data also shows that scarce funds are allocated for conducting the GDR. This also applies to the purchase of new machines and equipment as well as software. According to individual studies in industrial enterprises, the development of new technology over the past 20 years has decreased by 14.3 times.

It should be noted that in the Ukrainian industry, innovation is allocated three times less than in the European Union. For example, in 44.5 times less than in the German industry. Use of outdated technology of high-cost technologies in the production process at industrial enterprises. Slowing down of the development of new technology, insufficient financing of measures aimed at accelerating the innovation activity of industrial enterprises negatively affects their competitiveness and performance of functioning. An extremely important task is to find ways and means of accelerating the pace of innovation activity of enterprises, first of all, to introduce more breakthrough new technologies at enterprises, which will promote the growth of their innovative potential. An organizational form of expression of this important task may be the modernization of industrial enterprises.

3. Organizational and resource support of industrial enterprises modernization processes

It has been noted that the emergence of a crisis situation in which the Ukrainian industry as a whole and its individual sectors and their enterprises turned out to be the cause of a radical change in economic policy. It is accelerating the development of the innovation potential of the industry. This necessitates the search for forms and methods to solve the problem in order to optimally improve the competitiveness of Ukrainian industry and its enterprises, to organize the production of innovative products with high added value, which corresponds to international quality standards, is competitive on the domestic and foreign markets in the optimal terms. One of the cardinal directions for solving this problem can be radical modernization of both the industry and its individual enterprises.

However, it should be noted that accelerating the modernization of industrial enterprises depends on the influence of a number of external and internal factors. One of the main among them is the extremely low level of ensuring the processes of modernizing enterprises on an innovative basis with the necessary resources, primarily investment and credit. According to analysts, the targeted amount of funds necessary for the process of modernization of industrial enterprises is over 250 billion UAH for the nearest future.

A more substantial analysis of funds may require much more. Obviously, neither the state nor the industrial enterprises at this stage their functioning of such funds is not. Therefore, the solution to the problem must be sought in the area of search for funds from external and internal investors and their rational use.

In the conditions that Ukrainian industrial enterprises operate, the importance of organizational and tactical significance is to determine the priority of their primary modernization. This approach should apply to enterprises in all sectors of the industry. It should be noted that the definition of priority should be considered as an important organizational factor that determines the need for modernization of any other industrial enterprise, taking into account the socioeconomic importance of its team in solving the most urgent production and economic tasks, in particular the production of products that are in demand on international markets, and also provides the need for an internal market in imported products. At the same time, those sectors of industry and their enterprises that can optimize their production activity on the basis of the application of the newest technologies, increase production potential, ensure the production of high quality products that meet international standards, are in high demand and is competitive in the markets. It should be noted that the definition of the priority in modernization concerns not only the enterprises but their production units, which are decisive in the production process of manufacturing products, it will enable the purposeful and rational use of investment and credit resources, direct them to those objects and production factors that should become a decisive factor in organizing production processes with innovative content. Such an approach to solving the problem of accelerating industrial enterprises modernization is also important in that the main volume of measures related to their technical and technological re-equipment is carried out at its own expenses.

At these tasks the attention of the management should be paid, which is designed to ensure that they achieve high technological and technological level and effective functioning. Taking into account the interests of the national economy and its development in the conditions of scientific and technological progress, accelerated modernization should be carried out in the field of domestic engineering, since the products of this industry should be aimed at technical re-equipment of enterprises of other sectors in order to provide them with the use of the latest technologies, put on the proper level of their technical equipment and thus prepare them for the production of competitive products. Particular attention should be paid to re-equipment of food and light industry enterprises that are able to supply their products not only to the domestic market, but also to export.

In this context, the re-equipment of agro-industrial enterprises, which plays an important role in increasing the export potential of Ukraine, is also extremely important.

Solving the problem issues of modernizing the Ukrainian economy requires the improvement of the existing system of innovative processes management. First of all, should be created a clear system of state protectionism for the development of high technologies in the national economy and priority sectors of its development, which provides for the implementation of specific measures to

accelerate innovation at the state level, that is, it should be about creating the appropriate incentives for modernization. In this context, the main factor is the acceleration of depreciation of fixed assets of industrial enterprises, the directing of part of the profit for modernization and innovative processes that are exempt from taxation. Among the number of incentives that will promote the deployment and implementation of modernization should be the introduction of a delay in the payment of import duties, taxes on the importation of equipment in Ukraine, which will be aimed at modernization and creation of new jobs. Such measures are essential for creating conditions conducive to stimulating the inflow of private investment in modernizing the economy.

Foreign direct investment should become an important source, which will gradually create the appropriate conditions for the Government of Ukraine. Also, the volume of public investment in infrastructure projects may grow significantly as a result of creating favorable conditions. Measures to improve the system of crediting the economy, that is, adjusted the rate of government borrowing, which is at 9%. Private investment, foreign investment, public investment and competitive credit resources should become an important foundation for accelerated economic development on the basis of modernization.

The increase of the Ukrainian economy modernization necessitates a dynamic change in the development of the national innovation system. This will affect its structure. In particular, the formation of a powerful innovative infrastructure of the Ukrainian economy, the institutes of which must create the necessary conditions for accumulation of financial resources, development, production of high-tech, high-tech products, competitive on the external and internal markets, becomes a topical task.

The worldwide practice of market economy has gained experience in the formation of innovative structures and the organization of their functioning. They are able not only to carry out scientific research, but also to create new equipment and to ensure its timely sales and service.

Among the structures of innovation infrastructure that are able to provide integration of science and production on the basis of innovation activities include technopolises, technological and science parks, innovation centers, technology transfer centers, business incubators, startups and other types of innovation structures, in particular, information networks of scientific and technical information, expert consulting and engineering firms, etc. In developed countries, these are powerful infrastructure innovation organizations that carry out a wide range of tasks related to the acceleration and efficiency of innovation. The scope of tasks for each of these structures is in some way regulated, based on its functional purpose and potential capabilities.

In the innovation system of Ukraine, an important role should be given to technoparks and technopolises, which are rightly called the main elements of

innovation infrastructure and most widely provide a link between science and production.

A characteristic feature of technological parks is that they can be created in regions based on higher education institutions and scientific institutions. As a result of the integration of such activities, favorable conditions are created for conducting fundamental research in the field of advanced technologies and applied research for innovative enterprises, as well as for the commercialization of scientific ideas and new technologies.

The experience of the functioning of technology parks in a number of developed countries and already existing domestic shows that their main task is to accelerate the processes of development and introduction into the production of advanced technologies, the training of highly skilled engineering and scientific personnel, transformation of education into an innovative, attractive and profitable field of the economy. So, now we should talk about the expansion of innovation infrastructure and, above all, powerful industrial parks, the foundations of innovative entrepreneurship. This will help accelerate the modernization of Ukraine's economy and increase its competitiveness and efficiency.

Improvement of the technological level of enterprises as a result of their modernization is an extremely important factor in the development of their quality of a new production potential, the development and effective use of which makes it necessary to provide such enterprises with highly qualified personnel.

To solve this important task in Ukraine there are corresponding potential opportunities, implementation of which necessitates the decision of a number of organizational managerial problem tasks. One of the most important among them should be the rational use of the potential of the relevant educational institutions. In particular, we are talking about the proper use of the potential of vocational and technical institutions, the vast majority of which specialize in the training of personnel for the manufacturing sector, in which the main share is the needs of enterprises in the industrial sector. As of the beginning of 2016, there were 824 vocational and technical institutions functioning in Ukraine, and 113 more were in the ATO area. In addition to them specialists of various working professions train a number of technical schools and colleges. However, in the labor market there is a disastrous lack of workers, labor groups of industrial enterprises are not replenished by a sufficient number of young professionals who have the latest technology used in industrial enterprises. Especially acute need for such workers is felt by sectors of material production and, first of all, the industry sector. In this context, it is important to note that industrial enterprises have many workers of important professions already in retirement age, and are even closer to such a state.

The degree of the workforce aging is constantly increasing. Statistics shows that by the beginning of 2016, every sixth economically active person in Ukraine is older than 50 years old. Consequently, this indicates that there is a problem of

raising the level of skills required by the modern labor market, that is, the resolution of urgent production needs at individual enterprises and, above all, those applying the latest technologies. The preparation of production personnel of a high professional level requires the solution of a number of problematic issues. In particular, the speech should be about a radical improvement of the material and technical base of vocational schools, since in the existing outdated, equipped with equipment older than 20 years old, it is practically impossible to teach future workers the use of the latest technologies. Using such material and technical base in the educational process, they lower their professional level, even experienced teachers of such institutions. Thus, among the systemic measures related to the training of workers for modernization enterprises, the tasks are to be put to the foreground and they acquire a high professional level already during training in professional institutions, which should be equipped with the most up-to-date technology of domestic and foreign origin, which is used in the educational process. The presence of such equipment in educational workshops, workshops, laboratories and other educational and production structures necessitates the solution of an important next problem. It is a question of a replacement in the formation of teaching staff, such institutions that are called upon to carry out the proper methodological support of the educational process, which takes place on a new modernized basis of professional educational institutions. Therefore, the development of industrial enterprises through modernization necessitates a comprehensive modernization of vocational education institutions. In addition to this new modernization, institutions of vocational education have a clear profile orientation in the training of specialists of a high professional level. In this context, it is important to target such reports to provide specialists of companies operating in certain regions.

It should be noted that in addressing this important task, the Ministry of Education and Science of Ukraine places great emphasis on organizing the network of vocational education institutions among the new types of them: regional centers of professional education, professional colleges and lyceums, vocational training centers. It is extremely important that such educational institutions become multidisciplinary and multi-level, the main task of which will be the training of specialists of all professions and specialties for enterprises of different forms of ownership, the needs of specialists in the industrial sectors of a particular region.

This is extremely important in view of the fact that a significant number of enterprises, in order to avoid crises, diversify their activities, which is typical for business in a market environment, accompanied by an expansion of the range and range of products with innovative content, as well as a number of services of production and logistic direction. For example, the family-owned LLC Progress Avto LLC is the leader in Ukraine for the sale of paints and enamels. The enterprise employs more than 500 specialists engaged in the service of cars,

manufactures industrial ceramics, more than 60% of the enterprise's products are exported. The company also manufactures products for the needs of the railway, in particular communication facilities. Along with that, the collective grows grain and has a pig farm for 20 thousand heads.

Here is another example in this context. The “Electron” Corporation, known in Ukraine, includes a number of enterprises and organizations, including the joint-stock company LLC “Xerox-electron”, the financial and leasing company “Electron-Leasing”, the “Polimer Electron” plant, the “Karat” research and production enterprise, the “Electronbudprulad”. Each of them has its own production profile, manufactures products of various structural and technological complexity levels, using various techniques and technologies that should ensure the achievement of international quality standards, that is, to produce competitive products and provide high-quality services. Consequently, an association of such type as the "Electron" Corporation, taking into account the prospects and strategy for its development, may be appropriate to create even its own institution of protest education focused on providing high-level specialists with the skills needed to meet their needs.

An important factor that determines the need for improving software industry professionals who can perform upgrades are also changing the assortment range manufactured their products, especially those industrial enterprises that supply its export. Instead of metal and agricultural raw materials that demand and occasionally will still occasionally use, it is necessary to focus on the output of high added value, which requires the application to its manufacturing of new technologies and therefore attract employees for their development of a high skill level.

At the same time, the specialists of high qualification of enterprises and organizations of innovative infrastructure deserve special attention. This is due to the fact that the innovation infrastructure must develop and increase its potential, taking into account the requirements that apply to such entities in the European Union. In particular, such structures should be focused not only on solving narrow problems regional importance, but also actively engage in the implementation of international programs, for example, such as Horizon 2020. Programs of such a direction make it possible not only to attract domestic scientists to carry out fundamental and applied research, but also to provide them with adequate resources. As a result, favorable conditions are created for the development and operation of such structures, as well as for the activation of economic activity of specific economic entities. As a result of organizing the implementation of such programs successfully combined fundamental and scientific research and their implementation into specific business processes at industrial enterprises. Consequently, this is one and extremely important aspect of the development of enterprises and organizations of innovation infrastructure.

Another no less important aspect of the development of enterprises and organizations of innovation infrastructure is their specific industry-regional orientation. In this context, on the one hand, the existing scientific potential of the region, represented by higher educational institutions and research organizations, should be considered on the one hand, and, on the other hand, the need of those industries, enterprises that are represented in the region relevant innovations and capabilities of their potential before the production of products with innovation filling, which is in high demand and can be competitive on the external and internal markets.

Modernized Ukrainian enterprises can produce and supply, while some already produce and supply high-quality food products, machines, equipment, and light industry products to foreign markets. A significant amount of these goods can be exported to the countries of the European Union. It is worth noting that Ukraine covers more than 1% of this large market. That is, there are real reserves of increased use. This can largely be achieved as a result of the professional training of the relevant management teams of industrial enterprises capable of developing and applying flexible strategies in organizing the export of products and services. Consequently, the development of industrial enterprises on the basis of modernization and their personnel provision necessitates the solution of a number of systemic tasks, which should be based on the general development program of Ukraine and its individual sectors. This will provide an opportunity to clearly identify the main goals of solving the problem, to achieve the rational use of resources aimed at implementing activities related to the innovative development of enterprises on the basis of modernization and providing high-level personnel.

At the same time, in the projects of modernization of industrial enterprises, appropriate measures of the organizational direction should be provided to the proper extent, in particular, to introduce more borrowed innovations, that is, to establish and maintain rational relations with innovative organizations and subjects of innovation infrastructure, to stimulate the increase of the activity of the business environment, the incentive management of enterprises to learn effective interaction with state and local organizations in the legal plane, to master its modern technologies of cooperation through existing online services, to broaden the use of information and communication technologies in solving the problems of innovation development, to organize a goal-oriented training of personnel and to coordinate this process with the strategy of innovative development of enterprises.

To accelerate the growth of innovation activity, and hence the innovative potential of industrial enterprises, there is a need to overcome or achieve a minimum gap or a minimum disagreement between their innovation strategy and business strategy. This will enable them to function effectively in the harsh conditions of competition on the domestic and foreign markets, to accumulate investment resources and to direct them for further improvement of their technical

level by introducing new technologies into production and thus accelerating the growth of their own innovative potential capable of producing high quality products and to function effectively under current conditions of competition.

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4.2. Partnership development between IT enterprises and higher educational institutions in the conditions of innovative changes

1. The importance of partnership relations between IT enterprises and universities

The need for changes in the formation of the partnership relations in modern innovative enterprise, strengthening their influence on the competitiveness of production activities, innovation activities development is beyond doubt.

The practical experience of foreign countries shows that the formation and development of business partnerships positively affects the modernization of the economy and the harmonious business environment development. The transition to a knowledge economy requires rethinking the role of partnership, especially with educational and research institutes. An urgent stimulus for the development of partnerships is the emergence of a knowledge economy and a concentration on innovation.

Participants of the innovation process actively interact with each other through the exchange of financial, material and intellectual resources. The advantages of partnering with universities are:

- university is a stable organization with a well-established organizational structure;
- university is a participant in the educational, scientific and innovation process;
- this organization exists and develops for a long time, has established norms and regulations;
- university is close to the public and society.

The author believes that partnership between businesses and universities should be considered as common work for achieving goals, based on principles of effective interaction and balance of interests in order to address the pressing problems of economic development.

One of the challenges is to establish effective relationships with partners and sales management. After all, the skillful planning of partnerships plays a very important role in the balanced development of the enterprise in the modern environment. Joint projects with universities, job fairs, sponsorship, targeted economic contracts, PR campaign will improve company recognition among youth. Increasingly motivating for the development of such relations is the opportunity to participate in joint European Union grant programs, such as the Horizon 2020, which today is in demand in Ukraine.

Long-term strategic partnership between the innovative IT enterprise and university can be carried out in different ways of interaction: target training and retraining of specialists, realization of technical, research and production tasks with the help of leading lecturers, joint development of standards and programs in the

field of professional education and retraining.

Development of innovations depends on the ability of IT enterprises and universities to collaborate in different directions: technology, design, engineering, etc. It should be added, that development of partnerships with HEIs depends on the country's economic model, political institutions, market and industry needs.

It is important to consider the type of institution as a partner for the development of partnerships. There is a clear classification of types of educational institutions in Ukraine, such as: university, academy, institute, conservatory, college, technical school (college). Each of the above mentioned educational institutions can act as a partner to the innovative enterprise in accordance with the main cooperation goal (scientific and production activities, innovative work, training and retraining of personnel).

Partnership development between IT enterprises and higher educational institutions contributes to the improvement of the educational sector in Ukraine and is determined by the principles of integration into the European and world educational space, the transition to market relations, which drastically affect the role of specialists with higher education.

Practical experience proves that today the functioning of a modern higher education system takes place under conditions of certain uncertainty and the influence of managed and unmanaged destabilizing factors, which leads to complication of the management of the activities of universities and is a risk factor for decision-making. It should be noted that managing partnerships with universities is an active regulation aimed at creating a specific economic environment, consisting of initiation, planning, organization, implementation and control.

One of the points of the mechanism of the “National strategy of the Ukrainian development of education” implementation, based on the partnership between the enterprise and the university, indicates the creation of legal and economic mechanisms for stimulating employers and investors regarding their participation in strengthening the educational and material base of the education system, the development of vocational and higher education institutions and the restoration of the country's labor resources.

Universities development enhances its attractiveness as a partner to the each innovative company. The target groups of UBC are students, academics, business, universities, society and economy of the country (table 1).

As seen from Table 1, the positive impact of UBC may be realized on territory environment through different, direct and indirect, ways.

Knowledge economy development, the growth of requirements for skills and abilities of graduates among employers, innovation and technological changes, require from the higher education essential indicators of socio-economic, cultural development and openness to interaction with enterprises. With this situation, there

are both third world countries and countries with a high level of intellectual development and competitiveness in the world market.

Table 1

UBC development benefits

N	Group	Explanation
1	Students	High level of received education, matching the received knowledge to the needs of employers
2	Business	Innovation activity, marketing, improved performance of business
3	Universities	Modernized equipment, high graduate employment, better reputation of Universities
4	Academics	Modern training programs, financial support for research projects
5	Society	Labor market stability, improved education level of graduates
6	Economy	Economics' development, competitiveness on the global market, growth of GDP, industry development

Source: based on [1].

The partnership between universities with business in the EU countries, it should be noted, became widespread only in 2000-2005. This is evidenced by the holding of a large number of thematic forums and conferences with the participation of leading experts on the subject, representatives of the government organizations, universities and enterprises, the largest of them were: "Universities, business and companies: together we can" forum, which took place on October 2-3, 2014 Rome (Italy); strategic forum "Partnership for the Development of Innovation" in Stockholm (Sweden), March 19 - 20, 2014; forum "Development and growth of innovations" November 27, 2013, Warsaw (Poland).

Among the global priorities of partnership development between enterprises and universities typical are:

- cooperation in joint research and development projects, mostly in innovation aspects;
- the formation and assessment of training programs (in some countries, for example, Germany, Ireland, France, business representatives are also part of the independent national bodies that carry out accreditation of curricula);
- development of mobility among students, doctoral students, lectures and employees of universities;
- life-long learning;
- development of academic entrepreneurship;
- commercialization of joint research.

2. Current situation in partnership relations between the IT enterprises and universities in Ukraine

According to the World Bank, Ukraine is one of the countries with low per capita income and economic development. Therefore, there is a growing need for innovative development of the country, as well as the formation of effective partnerships between IT enterprises, universities, research institutes and the state. In order to implement effective partnership relations, it is advisable to pay attention to the following aspects: factors of influence and barriers of partnership relations, peculiarities of cooperation enterprises with higher educational institutions.

The process of developing partnerships between enterprises and universities over the past 10 years has spread throughout Ukraine. An analysis of the economic and political situation has shown that there are certain preconditions for cooperation between enterprises and universities, which are related to:

- globalization and the European direction of development of the country;
- negative influence on the economy of the country in the military-political conflict in the East of Ukraine;
- increase in the level of integration of the economy into the system of international division of labor;
- high level of import of high-tech goods and export of low-tech;
- the need for reforms in the educational sphere.

According to the latest trends of the industrial market of Ukraine, the development of information technologies and indicators of growth of certain sectors of the economy, the most relevant in terms of cooperation with universities are enterprises engaged in the following economic activities: information and telecommunication technologies; agricultural production; logistics and transport; power engineering; food technology; biotechnologies and nanotechnologies; military industry.

Foresight of Ukraine's economy for the next 5-10 years showed the results of the influence of certain industries (agrarian, military-industrial, information-communication, energy, nanotechnology) on the growth of the country's economy.

In further research it is necessary to determine the typology of factors that affect the development of partnerships between enterprises and universities (Table 2). It should be noted that the first group of factors includes those to which the partners of the partnership can have influence. The second group includes factors to which the partners can't have influence.

Let's consider the more detailed factors on which partnerships between enterprises and institutions of higher education can have impact. The formation of a partnership communication system allows you to effectively manage the interaction, control its risks. The opportunity to participate in state and international joint educational and research projects allows partners to enter the international market. Ability to study successful foreign experience and its

implementation allows to realize the best foreign practices of the development of partnership between enterprises and universities in Ukraine. Formation of investment attractiveness of an enterprise, introduction of innovations and scientific and technical developments can increase the competitiveness of this enterprise.

Table 2

The main factors influencing the development of partnerships between innovative enterprises and universities in Ukraine

Factors of direct influence	Factors of indirect influence
1. Formation of a complete system of communication partners.	1. Development of the social sphere of Ukraine.
2. Possibility of participation in state and international joint educational and scientific projects.	2. The political situation in Ukraine.
3. Ability to study successful foreign experience and its implementation.	3. Demographic situation in Ukraine.
4. Formation of investment attractiveness of the enterprise, introduction of innovations and scientific and technical developments.	4. The economic situation in Ukraine.

Source: Author's research

For the analysis of the generalized barriers, we interviewed representatives from both sides. To assess the major barriers concerning the development of cooperation with universities the method of expert evaluation on the basis of the existing application was used. One of the most common problems – information and coordination, joint project exposed the negative impact of external bureaucratic procedures.

Representatives identified the next main UBC barriers:

- 1) lack of government strategy of partnership "enterprise – university";
- 2) inadequate regulatory – legal framework, lack of public policies that can support development of cooperation for enterprises and reforms of the law in education;
- 3) high levels of bureaucracy and lack of universities' financial independence; amendments to academic programs take a lot of time;
- 4) different values, product types, speed of adaptation to market conditions, new standards of higher education in IT;
- 5) financial aspects; the impact of the economic crisis on the state of science, education, distribution of state orders;
- 6) lack of information about the possibilities of cooperation with universities, poor organization of the Career Centers.

It should be emphasized that the development of partnership relations with an

institution of higher education should take place taking into account the following macroeconomic conditions: strategic tasks of the Ukrainian economy development; available resource potential of the country and demographic situation; features of territorial development; world development trends.

The analysis makes it possible to conclude that the IT enterprises that have co-operated with higher education institutions for more than one and less than five years (82%) fell into the sample.

At the same time, the analysis of secondary information was carried out and the experience of the employment centers was studied, and the following main forms of work were organized: career days; trainings; seminars; master classes on various aspects of successful employment; organization of excursions to enterprises; organization of internships; creating career pages; search for partial job placement offers; holding conferences; business project contests.

The decisive influence on the need to develop partnerships between the innovative enterprise and the university is the gap between the demand and supply of highly skilled personnel in the field of information technology.

This is primarily due to the fact that there is a big difference between the bureaucratic conditions of the functioning of universities and the constant and dynamic change in the market environment. Therefore, the main motivation for the development of the partnership is to reduce the gap between the curricula in universities and the requirements of enterprises to the skills and knowledge of specialists by:

- joint development of curriculum of disciplines;
- involvement of specialists of companies in teaching disciplines;
- internships for lecturers in companies;
- creation of special training classes and laboratories.

That is, another significant barrier to the development of partnership between enterprises and universities is the economic condition of the country. The economy of Ukraine is in a crisis condition, the main significant negative factor is the military conflict. The high level of inflation and the severity of enterprises' access to financial resources hamper the development of entrepreneurship in Ukraine.

Investigating economic constraints, it should be noted that the main indicators that determine the economic trend of industry decline, market analysts are:

- falling external and internal demand;
- decrease of purchasing power of the population of Ukraine;
- decrease in incomes of the population;
- outflow of investments and termination of contracts with foreign investors;
- limited financing of innovative projects.

Regarding the surveyed enterprises, respondents emphasize that they are often not ready for long-term investment of joint projects from universities and have financial constraints. The coverage of this material may be supplemented by data

from the World Bank, according to which Ukraine lag behind macroeconomic indicators and occupies 105 positions at the level of GDP.

The indices of the quality of education data, the quality of higher technical education, the quality of economic education, the development of an innovation cluster, cooperation between enterprises and universities in joint research, the cost of enterprises for research, education costs according to the World Economic Forum for 2013-2017 [2-4] are given in Table 3.

Table 3

Ukrainian competitiveness indicators according to the World Economic Forum

N	Index	Value		
		2013-2014	2015	2016-2017
1	Education quality	3,6	4,0	4,0
2	Quality of higher technical education	4,6	4,6	4,8
3	Quality of economic education	3,4	3,9	3,8
4	Development of innovative clusters	3,3	3,4	3,5
5	Collaboration between enterprises and universities in joint researches	3,6	3,5	3,5
6	Expenses of enterprises for scientific researches	2,7	3,4	3,3
7	Education expenditures (% of GDP)	6,1	6,0	6,2

Source: Formed by the author; rating (1-min, 7-max), in italics marked the competitive advantages of Ukraine

Given data testify that the quality of higher engineering education in Ukraine is rather high. At the same time, there is a low level of cooperation between enterprises and universities in joint research. As noted earlier, this index of cooperation in developed countries is close to 6. Also, according to the World Economic Forum, according to the level of human capital development in 2015, Ukraine ranked 31st out of 124 countries and is in line with countries such as Hungary, Slovakia, Israel, Italy, Korea, and Poland.

3. Activation of partnership development between IT enterprises and universities

The intellectual potential of the nation is the largest economic resource of Ukraine. This, in turn, means that Ukraine has a high non-material potential and therefore promising areas for economic development will be areas in which intellectual potential plays a major role. These industries include the field of information technology, biotechnology, and telecommunications.

On the basis of the research, the main methodological principles that

contribute to the development of the IT enterprise in the modern information environment in Ukraine are:

- 1) the use of modern technologies and developments in the production of a software product, the development of new methodologies;
- 2) accelerating decision-making processes (speed becomes a decisive factor in the current IT environment);
- 3) individualization of work of workers;
- 4) increase of intellectual capital and knowledge of workers through continuous training and advanced training courses;
- 5) ensuring the development of the organization, through the constant encouragement of employees to intellectual development and certification.

That is, the intellectual potential of the nation is the largest economic resource of Ukraine. This, in turn, means that Ukraine has a high non-material potential and therefore promising areas for economic development will be areas in which intellectual potential plays a major role. These industries include the field of information technology, biotechnology, and telecommunications.

Interest in Ukrainian companies is steadily increasing, as it is in Ukraine that provides one of the best services in the world in terms of quality and price. According to expert estimates, the number of jobs in the industry will increase to 20 thousand annually, and in 2020, the industry will attract 180 thousand IT specialists, which is typical only for this industry in Ukraine today. However, other studies record the decline in the growth of the IT industry, as there was a 6% increase in production in 2016, compared with almost 30% in 2013.

Educational labor resources are crucial for the development of innovative processes and technological production. For today there is a personnel famine of engineering specialties. The overcoming of this factor is possible due to close cooperation between companies and universities, since it enables students to be better trained, the practical level of training and the quality of modern education in general.

The inefficient system of partnership between enterprises and higher education institutions is reflected in the fact that students of the last years attend part-time studies and work in educational time. This is also due to the fact that students lack motivation to complete higher education, however, there is a growing demand for private schools and courses at leading companies and enterprises. To solve this problem, the training of IT specialists is 70% consist of practice in: coursework, laboratory work; diploma projects; industrial and undergraduate student practice. In summary, we note that the level of education has a significant influence on the development of the IT industry. Namely the following categories:

- 1) the quality of training and education of specialists;
- 2) the number of highly skilled teachers;
- 3) university autonomy in the choice of specialization and the number of

students in a particular direction of training.

At the same time, there are positive trends regarding the interaction of Ukrainian universities with major international organizations such as: UNESCO, NATO, British Council, Erasmus, VISBY and others.

The NEFESIE TEMPUS Project, which lasted until September 30, 2016, contributed to synergies in the educational process and innovation activities of enterprises, played a special role in the development of partnerships between IT enterprises and universities.

As an example of the need for technical education workers, it is worth raising the number of IT enterprises. By 2016, there are fourteen IT enterprises in Ukraine with more than 800 employees. The highest demand in IT enterprises of Lviv region is used by employees who graduated from the specialty of computer sciences, software engineering, information security, applied mathematics, system analysis, telecommunications. These training areas allow graduates to obtain professional knowledge of software developers, quality engineers, system administrators, and database engineers. At the same time, leading companies are offering the best students work starting from the third year.

During the study, we paid the maximum attention to considering partnership relations between IT enterprises and universities of Lviv region, and we also discovered what vacancies most often hold graduates of the largest universities in this region. The research took into account the following popular professions: software developer, business analyst, quality engineer, project manager, designer and support engineer. Also, the analysis showed that about 60% of graduates of the IT specialties of universities, Lviv Polytechnic National University, and Lviv National University. I. Franko hires vacancies of the software developer.

The comparative characteristic of the forms of interaction allows making certain conclusions about the priority directions of the partnership relations of IT enterprises from higher educational institutions of Lviv region, which are oriented to the development of the education system and the economy of the region as a whole. Priority areas of interaction include: conducting practices for students in the company's territory; conducting of courses, educational lectures on the territory of higher educational institutions; support for student initiatives, contests, olympiads.

According to the conducted survey, the expectations of innovative IT enterprises from the changes in the activities of higher educational institutions contain the following elements:

- 1) the growth of practical orientation in student learning;
- 2) development of strategic partnership with business and business;
- 3) encouragement to internships and students' practice in IT companies;
- 4) orientation to the international level;
- 5) focus on applied research and development;
- 6) reduction of bureaucratic procedures for making amendments to academic

programs.

Let's add that cooperation between enterprises and universities can develop both within the same oblast and between representatives of different regions of Ukraine.

However, the mechanism of partnership interaction between IT enterprises and universities in Ukraine has not become quite popular due to the following reasons: the unformed regulatory framework of interaction; the absence of specialists and special units that would develop the partnership between enterprises and universities; small experience of development of partnership of this type in Ukraine; economic and educational barriers.

Of particular importance is taking into account the criteria for choosing a university as a partner of an IT enterprise. They should be based on the main mission of the IT enterprise, as well as on the basis of the overall internal (material, labor, financial, information and other resources) and external (competitors, existing partners, customers) of the IT company.

Given the specificity of the University and a large number of factors and barriers to the development of partnerships, it is necessary to develop a methodology for assessing universities as a partner of an IT enterprise. The construction of effective partnerships requires the identification of those university appraisal indicators that are of particular importance to the IT enterprise, as well as the identification of their importance by experts.

In order to evaluate the university as an IT company partner, a methodology for building a university rating that is used by experts can be applied. It is based on a comprehensive analysis of university activities in Ukraine and is widely distributed in statistical information.

An important task in organizing the partnership between the IT enterprise and the university is the ability to manage communications. This is especially true for large outsourcing companies. For such companies, the idea of a partner cannot be fully understood, it can be expensive and require considerable time, labor and financial resources. Therefore, communications management is an important element of partner relations and an instrument of influence on the environment of the enterprise.

During implementation of certain joint projects due to imperfect communications, the following problems may arise: incomprehensible information exchange format, incomprehensible communication paths, incomplete list of project participants, unclear project stakeholders, unregistered information exchange rules. In other words, it is functional, social, psychological, and cultural obstacles. In order to avoid such barriers, it is important for the company to correctly map identification and analysis cards for project participants. Typically, such a card contains: name, role and position of the participants, contacts, level of responsibility, as well as risks and facts of behavior.

It is necessary to add that the communication register is considered essential in the management of communications. It includes information about participants, timetable for negotiations, communication tools (electronic mail, telephone, electronic communications), basic rules of communication, responsibility of the parties, the level of the need for communications.

In communications management, a communications toolkit is required, consisting of:

- systems of taking into account time, tasks, defects;
- protocols and programs of meetings, presentations of results;
- types and forms of reporting, feedback.

To effectively manage communications, it's worth creating a communications plan for the enterprise. It can be created as a separate document, to act as part of a contract, or to be distributed to different documents and systems.

However, possession of the listed tools cannot guarantee an effective communication process. Important role is also played by the skillful use of them. Management of communications with partners at the enterprise relates primarily to the responsible manager. Therefore, for effective communication, he must be familiar with the communication plan, be able to listen to a different opinion, be able to manage conflict situations, to be productive and positive, and to constantly improve the communication plan. The above impact should be comprehensive and take into account the peculiarities of all parties to the process. It should be noted that it is the effective mechanisms for coordinating the processes of managing the relationship between the enterprise and the higher education institutions that ensure the success of the market and the development of partners.

Summarizing the above, it is important to indicate the main advantages of developing partnerships with enterprises from higher education institutions. Close cooperation is needed to match university programs to the needs of the market and to produce research that is close to technological development, to increase the profits of the country and society.

Consequently, the developed mechanism of interaction between the enterprises and universities will allow to partly solve the problem of the limited resources of the innovative IT company. This in turn will have a positive impact on the investment climate in Ukraine and will contribute to its economic development.

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4.3. The quantitative patterns of Fixed Assets renewal and a statistical assessment of the enterprise's development innovation

The purpose of production's innovative development is to increase the efficiency of the resources' use – financial, material, labor, energy, etc. Many factors contribute to the successful implementation of innovations in the enterprise, including the scientific and technical potential, the production and technical base, the main types of resources, investments and the corresponding management system. The use of correct relationship of these factors lead to a positive result in the implementation of the entire innovation strategy. One of the directions of enterprise's innovative development is its modernization and technical update of fixed capital, efficient use of equipment, which will increase the organizational, technical and economic level of production, help to improve the financial performance of the enterprise and as a result increase its competitiveness.

The need to strengthen the efficiency of the fixed assets' use and effective implementation of policies for their renewal is also conditioned by the high wear degree of the equipment at medium and large enterprises in Ukraine, the inconsistency of production capacity with the requirements for the production of competitive products. In addition, these processes take place against the backdrop of a steady decrease in the loading of enterprise equipment.

Economic development of production is carried out through an innovative upgrade of existing operating equipment. This update, as a focused process, provides a change in the main technical and economic indicators in the specified areas. In economic analysis, for estimating the dynamics of changes, it is accepted to use indicators such as the factors of retirement and renewal of fixed assets, as well as the rate of growth (fall).

Directly the production system, for example, at the enterprise, is characterized by the fact that it contains different types of equipment with its technical and economic parameters and terms of use. The updating of each unit of equipment leads to the changes in costs and outputs, both in a separate production unit and for the system as a whole. If the update has several options and there are several technological units, then we have a significant number of potentially possible strategies for the development of the entire production system, even in the context of constant volumes of production. It should also be taken into account that the costs incurred in the production of products are also quite diverse (labor, energy, material, etc.).

The innovative renewal of fixed assets of production systems has a different dynamics of changes (growth or decrease), as well as restrictions on the attraction of productive resources. For example, the number of employees should always be at the center of attention, since its change is significantly

related to a number of important socio-economic aspects. Also, for a number of companies, the essential requirement is the restriction on the parameters of environmental pollution, ie environmental aspects. When analyzing the results of an innovation update, the problem is that, for example, the volume of output in monetary terms is not determined by individual production units, but only in general. Because of this, indicators such as income, profit, profitability of products and investments cannot be determined at local levels for each production line. Accordingly, when evaluating and selecting innovative update options, the system's overall performance should be used. An analogue of the approach is the so-called cited costs, which use a consistent indicator of regulatory efficiency of capital investments, although component costs are taken for certain types of equipment and even different industries. In this direction, at the level of production systems of enterprises, the development of non-standard approaches to assess the replacement of current capital expenditures with the definition of the resulting effect.

The economic literature contains a number of works relating to the estimation of quantitative patterns of economic growth. At the macro level, the Cobb-Douglas degree function is used to describe the dependence of product dynamics on the change in the two productive resources – labor and capital.

For two contiguous periods of time you can get dependence on the rate of change in the results of these two factors.

The disadvantage of this approach is that the need for stable coefficients of the function is determined at best only on the basis of statistical data. How to take into account the influence of changes, including innovative, in the development of means of labor, remains unknown.

Also, in such models in explicit form, the indicators of retirement and renovation of funds are not taken into account. From this point of view, the formulas of Domar, focused on the constant rate of growth of funds under the conditions of unchanged periods of their exploitation, deserve attention [1].

At the micro level of the type of industrial systems of enterprises, the assessment of one-time innovation changes is carried out in practice through the partial application of balance economic methods with a high degree of intuition and arbitrariness.

In the aspect of the evaluation of the payback of innovative projects, the method of NTV, which essentially contains the time factor and the procedure of discounting is used [2]. But the projects are not sufficiently evaluated in terms of versatility and innovation. At this level, there is a problem of developing theoretical foundations for identifying the laws of innovation updating the means of labor and developing the directions of their use in the practical activities of enterprises.

Thus, it is relevant to study the quantitative patterns of an innovative

upgrade of the production system, which consists of several technologically related units. To do this, it is necessary to find out the interconnection of the growth rates of technical and economic indicators of production activity with the dynamics of costs and parameters of operating and innovative equipment used in the process of innovative renewal of fixed assets.

The main concept of the adopted methodological approach to the analysis of innovation is the operation with the rate of changes in time flow resources. As regards the growth rates of funds, approaches to their determination based on the scheme of updating were discussed in previous works.

In the future, we believe that it is necessary to determine the pace of change in other indicators, due to the growth rate of funds.

Important is the interconnection of the growth rate of production with the growth rates of fixed assets. For one type of funds, as we have established, the following dependence is viewed:

$$n_p = n_f + K_f * K_r, \quad (1)$$

where n_p – the growth rate of output in natural (monetary) measure; n_f – the growth rate of fixed assets; K_f – the coefficient associated with the parameters of the active and the new (innovative) equipment; K_r – fixed asset renewal factor. In the formula (1) coefficient K_f is determined as follows:

$$K_f = \frac{f_2}{f_1} - 1,$$

where f_1, f_2 – indicators of return on assets in the basic and innovative versions of technology.

Depending on the sign of K_f There are various trends in the correlation of the growth rates of fixed assets. If $K_f = 0$, that the return on assets remains constant in the process of innovative replacement, then the growth rates of funds and products will be the same. With a positive meaning of K_f , the growth rate of products is higher than the growth rate of funds. In the version of negative K_f the growth rate of funds exceeds the growth rate of output.

As follows from (1), a special role is played by the rennovation rate K_r , which is generally defined as follows:

$$K_r = \frac{n_f^T}{n_f^T - 1} (n_f - 1), \quad (2)$$

where T – term of use of fixed assets. The coefficient K_r for the steady pace depends on the growth rates of funds and the terms of their use T .

Directly the quantitative values K_r are listed below in Table 1.

Table 1

The value of renovation coefficients depending on the life terms of fixed assets and their growth

T, n_f	1,00	1,02	1,04	1,06	1,08
5	0,2000	0,2121	0,2246	0,2374	0,2505
10	0,1000	0,1113	0,1233	0,1359	0,1490
15	0,0667	0,0778	0,0899	0,1030	0,1168
20	0,0500	0,0612	0,0736	0,0872	0,1019

The analysis of table data shows that for identical service lines, the renovation coefficient is greater for larger growth rates of funds n_f . At constant rates, the renovation rate is lower for longer service life of funds. Simpler interpretation of the influence of selected factors on K_r gives the following approximation found by us:

$$K_r = \frac{1}{T} + 0,63 \cdot (n_f - 1) \quad (3)$$

Calculated by the formula (3) renovation coefficients are given in Table 2. Also in this table is the relative deviation (as a percentage) of the actual values of the update factor calculated from the simplified formula (3).

Table 2

The approximate values of fixed assets' renovation coefficients and relative error

$T \backslash n_f$	1,00	1,02	1,04	1,06	1,08
5	0,2000 (0,00%)	0,2126 (0,24%)	0,2252 (0,27%)	0,2378 (0,17%)	0,2504 (0,04%)
10	0,1000 (0,00%)	0,1126 (1,17%)	0,1252 (1,54%)	0,1378 (1,40%)	0,1504 (0,94%)
15	0,0667 (0,00%)	0,0793 (1,93%)	0,0919 (2,22%)	0,1045 (1,46%)	0,1171 (0,26%)
20	0,0500 (0,00%)	0,0626 (2,29%)	0,0752 (2,17%)	0,0878 (0,69%)	0,1004 (1,47%)

The comparison of the obtained values for the indicator K_r with table data shows, that the largest deviation is 2.29% and this indicates that the approximate formula adequately characterizes the update factor. The importance of the approximate formula lies in the fact that it by virtue of the additivity of the structure transparently reflects the influence of each of the two factors on K_r . The renovation coefficient consists of two components. The first of them is equal to the depreciation rate and is lower for more standard terms of use of

equipment. The second component is proportional to the growth rate of fixed assets with a coefficient of proportionality 0,63. Because of this, the renovation coefficient for larger growth rates of fixed assets is greater.

The close relationship can also be used for further analysis of the renovation. Thus, using dependence (1) one can determine the correlation between the rates of growth of production and funds in the following form:

$$\Delta n_f = \frac{\Delta n_p - \frac{1}{T} \cdot K_f}{1 + 0,63 \cdot K_f}, \quad (4)$$

where Δn_f – rate of fixed assets' increase;

Δn_p – the rate of product's growth.

The structure of this dependence shows that with a positive K_f the numerator of the fraction is smaller than the growth rate of the product, and the denominator is greater than one. Because of this, the growth rate of funds will be lower than the growth rate of production. When K_f takes negative sign, the situation becomes the opposite – the growth rate of funds is dominated by the growth rate of production. For zero value K_f those rates are equal.

The ration of these rates can also be considered:

$$\frac{\Delta n_f}{\Delta n_p} = \frac{1 - \frac{K_f}{T \cdot \Delta n_p}}{1 + 0,63 \cdot K_f}, \quad (5)$$

The analysis of the right side of the ratio shows that in addition to the coefficient K_f a substantial role is played by the product of service life on the growth rate of production. The assessment of the combined effect of a combination of these parameters can be used when choosing replacement options.

Lets illustrate the considered approaches to the analysis of the dynamics of the equipment renewal for the production system of the machine-building enterprise, which consists of four components: I – cutting of billets: 1) manual; 2) mechanical; II – bundle of billets: 1) manual; 2) automatic; III – billets drilling: 1) manual; 2) automatic; IV – workpieces polishing: 1) manual; 2) mechanic. The relevant factory data and the calculation of the required indicators are given in the table 3.

The comparison for different link levels $\frac{f_2}{f_1}$ shows, that only in the fourth installment of the introduction of new equipment leads to an increase in return on assets. In general, it should be expected that replacing manual labor mechanized or automated leads to this trend. Then we calculate the growth rates of funds for all links of the update, assuming that the growth rate of production is 5% per year ($n_p = 1,05$), and the life of the equipment is 5 years.

Table 3

The characteristics of the production system's equipment

F	P	f	$K_f = \frac{f_2}{f_1} - 1$
113 I 2914	1,7	0,0150	-0,8867
463 II 3665	0,5	0,0011	-0,4545
206 III 2012	2,3	0,0006	-0,5385
111 IV 413	0,8	0,0039	0,9206
	3,6	0,0018	
	0,7	0,0063	
	5,0	0,0121	

For each production link the following equation can be used (1) with a specific meaning K_f . So, for the first link we have the following equation:

$$1,05 = n_f - \frac{0,8867n_f^5 \cdot (n_f - 1)}{n_f^5 - 1}$$

The decomposition of this equation is carried out by means of an iterative procedure n_f and a comparison of the left and right parts. For this equation, the result is satisfactory, at which $n_f = 1,8$ (I link).

Similarly, we formulate the equations for the remaining three links and solve the same way. We obtain the following results: for the growth rates of funds: $n_f = 1,2$ (II link); $n_f = 1,25$ (III link); $n_f = 0,9125$ (IV link).

On the first three links the growth rate of funds exceeds the growth rate of output. On the fourth level there is a decrease in the cost of equipment. The reason is that in this line the return on capital increases.

It is of our interest to determine the rate of fund's growth for the production system as a whole. We assume that in the base period the equipment of the lower technical level was used. Then, by drawing up the appropriate balance ratios, aimed at implementing the same production program at all levels, we determine the share of the cost of equipment of each of the links: 0,3473 (I link); 0,4838 (II link); 0,0861 (III link); 0,0829 (IV link). With the growth rates of funds and their shares at separate levels, the growth rate of funds for the whole system is determined. The calculations give the following value: $n_f = 1,39$.

Consequently, for this particular system, a five percent rate of product

growth needs a total 39 percent increase in the value of funds.

In addition to finding the pace of growth of funds, we also calculated the dynamics of the number of employees in separate units and in the entire production system in an analytical manner. The calculations were carried out on the assumption that the unit of equipment was serviced by the same number of employees in the variants of operating and new innovative equipment. Accordingly, as a result of the equipment update, the growth rate of the number of employees will be:

in the first link: $1,8 - 0,9612 * 0,8447 = 0,9881$;

in the second link: $1,2 - 0,8737 * 0,3344 = 0,9078$;

in the third link: $1,25 - 0,8976 * 0,3718 = 0,9163$;

in the fourth link: $0,9125 - 0,7311 * 0,1507 = 0,8023$.

From the calculations it is seen that for each link the growth rate is less than one, that is, there is a decrease in the number of employees. Also, the overall renovation of the equipment led to a reduction in the number of employees by almost 11%. In calculations, the new number of employees in each link was defined as the product of the basic value (up to renewal) and the rate of its growth. The total change in the number for the system as a whole was determined by the method of using elementary balance ratios. Thus, the updating of the operating equipment more productive provided an increase in production volumes while reducing the number of employees.

The obtained results can also be used to assess the innovation of existing production systems when using statistical reporting on the activities of the enterprise. In our opinion, it is important to determine the difference between the growth rates of production and production resources that cause this growth.

In this direction the enterprise of the furniture industry of the private enterprise "Karpaty" was investigated [3]. The enterprise engages in innovative activities in the following areas:

- product that focuses on the introduction of new product models for existing or new markets;
- technological, aimed at introduction of new types of equipment and technologies or improvement of existing ones;
- marketing, which involves entering new markets or expansion of existing ones;
- organizational-oriented to the introduction of new methods of management in various areas of the enterprise.

One of the main directions of innovative development of this enterprise is grocery. The assortment list of PE "Lutsk" Carpathians "includes the following products: bedroom furniture; living room furniture; kitchen furniture; office furniture; children's furniture; woodworking products, etc. Each year, the range of products of the company is updated, that is, new modern models of products

appear and disappear outdated according to the needs of consumers.

As for the technological direction of innovation development, it should be borne in mind that the company applies a full production cycle from sawing and drying wood to the sale of finished products. In the manufacture of furniture only certified, environmentally friendly raw materials and components are used. Production and assembly of furniture are carried out mainly on automatic lines and assemblies, which considerably simplify operations and increase productivity. PE "KPATMF" Karpaty "constantly develops new technologies of production and modern equipment. So, in 2017, a new production line – "DXPS veneering line" – was launched. New equipment was also upgraded and purchased.

In the direction of marketing the investigated enterprise has established itself as a reliable and stable manufacturer of high-quality products, is well oriented towards the needs of consumers and conducts a sufficient analysis of target markets. Also, the company conducts a very effective pricing strategy. Recently, the PP "Lutsk" Carpathians "opened a new store in Lviv's largest shopping center for furniture and goods for the house "Three elephants".

The priority direction of the development of the organizational structure is the creation of a marketing department or at least the post of "marketer", which will allow "unload" sales managers and concentrate their efforts on sales.

Practical implementation of innovative events and projects allowed the company to achieve significant rates of economic growth (Table 4).

Table 4

Initial data and estimated growth rates of activity indicators PE "Karpaty"

Indicator name	Indicator value			Rates of increase, %		Medium growth rate, %	The difference
	2015	2016	2017	2016/2015	2017/2016		
Net income from sales of products, ths. UAH	6504	7866	9393	20,94	19,41	20,17	–
Cost of sales, ths. UAH.	3413	4164	4810	22,00	15,51	18,71	01,46
Gross profit, ths. UAH	3091	3702	4583	19,77	31,09	25,30	–
Fixed assets, ths. UAH	7643	7740	7808	01,27	00,87	01,07	19,10
Accountinted number of workers, people	44	35	32	-20,45	-8,57	-14,72	34,89

**In the last column the difference between the average annual growth rate is shown of net income from sales and the rate of change in production resources*

The analysis of tabular data shows that the average annual growth rates of output and profit in 2015-2017 are respectively about 20% and 25% respectively. This result was achieved with a relatively small increase in fixed assets (approximately 1% annually) and a significant reduction in the number of employees (14.7% annually).

As it was previously noted, a certain quantitative assessment of the innovation of the use of productive resources, in our opinion, can be realized by finding the difference in the growth rates of production and resources used for its production.

As follows from the calculations and data presented in the table, significant innovation is achieved for two types of resources – fixed assets (19.1%) and labor resources (34.89%). There are also somewhat lower growth rates of production costs compared to the growth rates and volumes. Regarding the number of employees, the result is ensured as a consequence of an absolute decrease. This, to a certain extent, resulted in a faster increase in profit compared to the volume of manufactured products. But, as the analysis showed, the company still has reserves for further innovation development.

In general, we can conclude that the study of the dynamics of innovation in the upgrade of equipment requires the development and use of appropriate analytical methods. The orientation to the rate indicators allows systematically to take into account the time factor, the characteristics of the active and innovative technology, the parameters of the resource flows. For production systems that contain several production units, one must first consider individually updates for each of them, since each kind of equipment has its own unique features and jumps of innovation. The analysis also showed that the timing of the use of equipment and indicators of renewal of fixed assets play an important role in the innovation dynamics. The proposed option for determining the update coefficients allows for its simple interpretation. The obtained results should be used in solving problems with the choice of rational options for updating equipment in developing the strategy of innovation development of production systems.

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4.4. Modeling of supply chain management based on outsourcing of logistics functions

Development of the conception of logistics outsourcing is driven by the trends of the economic globalization. Separate organizations become mainstreamed into the worldwide production network.

The processes of supply and marketing become more complicated, too, and the level of logistics knowledge turns into the key factor of success for all the value chain partners. Consumers' increasing demand induces companies to apply such an instrument as outsourcing in their business activities [1].

The outsourcing of logistics functions lies in a transfer of any logistics functions (supply, production, sales) that may be fully or partially separate, and/or of any complex logistical business processes to an external outsourcer company.

All in all, it can be deduced that presently the definitions used in the field of outsourcing (in particular, the outsourcing of logistics functions), as well as the forms of interaction between any members of an outsourcing project have not been definitely established or accepted because partnering relationship within the framework of any particular outsourcing agreements can differ to a considerable extent. This is due to the rapid pace of development of this sector of business and the uprise of some new forms of relationship under the conditions of economic globalization and the legal restrictions imposed by some countries, etc.

The introduction of the term "outsourcing" in management theory is associated with the use of resources of external organizations or providers in the field of information technology. Many specialists assume that outsourcing has spread in connection with the development of information systems and technologies, and refer to the beginning of the "epoch of outsourcing" to the 60-s. XX century, Namely – by 1962, the date of foundation of the Electronic Data System Corporation (EDS). In Germany in 1960-1980, the practice of creating centers for electronic information processing at large enterprises began to be developed, which subsequently began to provide appropriate services to medium and small firms that do not have the necessary technical capabilities.

A Logistic Service Providers is a specialized commercial organization carrying out some particular operations or complex logistics functions (warehousing, transportation, order management, physical distribution, etc.), as well as effecting an integrated supply chain management for its corporate customers.

A classification of logistic service providers including insourcing may be represented as follows:

1PL – First Party Logistics – refers to an autonomous logistics when an organization performs a whole complex of logistical operations on its own;

2PL – Second Party Logistics – presupposes contraction of services of any

monoline logistic service providers (such as carriers, forwarders, customs brokers, insurance companies, warehouses, and cargo terminals that perform separate logistics functions);

3PL – Third Party Logistics – means that all the logistics functions are outsourced to a logistic service provider that gives an all-around logistics support;

4PL – Fourth Party Logistics – is a logistic service provider performing a supply chain management (SCM) for a corporate customer;

5PL – Fifth Party Logistics – means a «virtual logistic service provider» that assumes the functions of a 4PL applying at large the internet and any know-how as a single virtual platform ensuring a more profound and comprehensive interaction and coordination of work with the customers serviced.

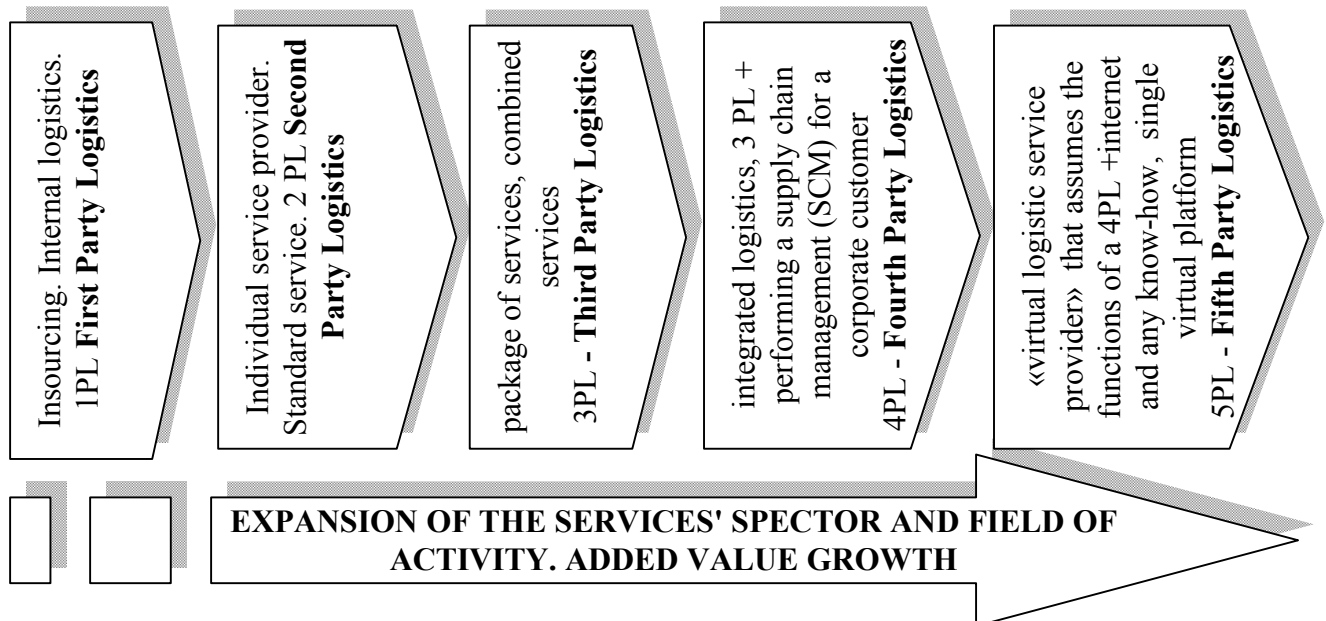


Figure 1. Consistent transformation of providers to a higher level of outsourcing of logistics functions

Considering the quality of services and the range of logistics offer suppliers, it is possible to allocate the following consecutive levels of development of outsourcing of logistic functions for the organization-customer.

In practice, the term “1PL” («first party logistics») refers to any companies that specialize in some separate lines of activity in the field of logistics business. They focus on providing services in carrying out some separate operations upon delivery of cargo: transportation, storage, customs clearance, etc. As a rule, this segment of the logistics business is occupied by carriers, customs brokers, port authorities, stevedoring companies, transloading companies, etc. Freight owners (both consignors and consignees) may enter into any contracts with any first party logistic company, whether directly or through any intermediaries, which are usually determined in practical terms as 2PL-level providers representing the subsequent level of logistic services. Among companies providing services at the 2PL level are any forwarding, or freight forwarding companies that perform the

role of intermediaries between buyers (freight owners) and sellers (1PL providers) of such services.

Table 1

Development of logistics services outsourcing services

Level	1 level	2 level	3 level
The number of logistics functions transferred to the provider	The only function	Several functions	Complex interconnected functions
Sales markets.	Local, regional	Interregional.	Global. Delivery "from door to door"
The nature of the relationship	The contract for the year	Long-term relationship (contract for 3 - 5 years)	Strategic partnership, major contracts
The value of the contract.	Reduction of costs due to partial reorganization and business process reengineering (BPR)	Cost reduction, revenue growth in the expansion of sales markets	Optimization of business processes (in accordance with the ISO 9000 standard)
Provider competence.	A lot of assets. Performing individual operations.	A shift from ownership of assets to ownership of information.	Focus on information management Integration based on IT solutions
Competitiveness	Insensitivity to coping	The cooperation of logistics intermediaries, the formation of strategic alliances	Many large alliances on the market

Source: built by the author according to the data [2]

As opposed to the 1PL-type companies, the 2PL model implies providing complex services in several lines all at once. Thus, it can be illustrated with a situation when cargo is carried by several kinds of transport within a transportation system, customs clearance services being provided, as well. It should be mentioned that today such a business paradigm applied by the domestic forwarding companies is one of the most desirable. Transition to a level of higher quality has resulted in

origination of the term “a third party logistics”, or “3PL”, which refers to any outsourcer companies that sell an integrated service in delivery of cargo on the door-to-door principle accomplishing also all the operations required. Nevertheless, their functions exclude any management of freight traffic: in this case all issues will be assumed by a buyer, i.e. a consignor or consignee.

Depending on functions performed, all 3PL models are classified as:

1) standard (a standard service) ensuring performance of such functions as packaging, storage, and delivery of cargos;

2) service developer (an advanced service), which provides additional services in tracking cargos and transloading in case of an intermodal transportation;

3) customer adapter (a service adapted to a consumer’s needs), which provides complex services, mainly to small-business customers, in an efficient building of a logistic system, but does not develop any new kinds of services;

4) customer developer (an advanced service adapted to a consumer’s needs) encompassing not only an external, but also internal logistics for a customer [1].

A 3PL model implies a whole complex of logistics services, from delivery and cell-based storage to order management and goods tracking. A 3PL provider’s functions include organization and management of cargo shipping, stock record and management, preparation of import and export documents, warehouse storage, cargo handling, and delivery of an ultimate consumer. The task of management of many companies as a single system in logistics should be understood, first of all, as a service for supply chain partners. In theory, there is a settled notion “a fourth-level logistic service provider”, similarly to and as extension of the notion “a third-level logistic service provider”. When a customer deals with a logistic service provider of this type, the former may rely on a comprehensive service and assistance with an adaptation to the ever-changing conditions of the external situation, which is an additional factor for an enhancement of such a logistic service provider’s competitiveness. However, a provider of the 3PL generation does not solve any problems related to freight traffic: this function is still performed by a freight owner.

Therefore, appearance of a 4PL provider on the market of logistics services can be qualified as expected and foreseeable. The term “4PL” was registered for the first time by a consulting company styled Andersen Consulting, now renamed Accenture, in 1996, as having the meaning as follows: “A fourth-level logistic service provider is a supply chain manager that brings together its own resources, capabilities, and technology with the resources, capabilities, and technology of another logistics service provider and manages the same in order to offer a solution of tasks in a supply chain to its customers to the fullest possible extent” [3].

It is important that all the 4PL providers, or fourth-level providers, be by all means involved in a manufacturing process. As a rule, a 4PL provider is a major

logistics service provider having a large infrastructure and advanced supply chain management systems and accomplishing high-technology processes and complicated logistic schemes. In order to achieve the level of a 4PL provider, there are possible ways as follows: a third-level logistic service provider may develop until the level of a 4PL one. A manufacturer of an ultimate product may organize a business on the principle of a 4PL model for solution of any similar tasks. A consulting company may assume the role of a 4PL provider. A company engaged in providing services in the field of IT may become a 4PL provider. A supply chain partner may become a 4PL provider. The evolution of a third-level logistic service provider seems the most appropriate. Given the business contacts with customers established by a company, it will be the most likely. Parallel to planning of their own routes, these companies shall fulfill such tasks as planning of coordination of transport, warehouse and stock management for their customers, as well as shall render any other services implying emergence of a value added. Nevertheless, there may arise some problems with customers, who can misunderstand the new role of such a company: on the one part, a consignor may be doubtful of impartiality of a logistic company; on the other part, today the information technology structure of many potential 3PL logistic providers only reflects the needs of a logistic company itself, but does not allow effecting the overall management, even if there are appropriate interfaces, that may function perfectly well, for exchange of data with customers and subcontractors.

Let us consider some variants:

Variant “Transportation Provider”. A transportation service of the manufacturers of an ultimate product (a holding company) that was rendering cartage services earlier will turn into a 4PL provider. A goods manufacturer, being usually a holding company or a transnational corporation (TNC) or a financial industrial group (FIG), shall found a subsidiary transportation company as a 4PL-level provider. They will implement a partial strategic and day-to-day management for their parent company and, in some cases, will assume in full all the logistic processes related to supply and marketing. They will also organize a horizontal and vertical structure of the system optimizing constantly the processes, providing their information technology structures for carrying out any processes to be implemented, and integrating partially the IT systems of their parent company and those of their previous and subsequent supply chain partners. However, since the management systems of a parent company dominate the systems of any similar logistic service provider, an all-round optimization of the supply chain seems hard to be achieved.

Variant “Consulting Company”. Another opportunity for a start-up of a 4PL provider is there when the tasks related to management and coordination are committed to a consulting company. In many instances, such companies are actively involved in creation of a strategic configuration of a supply chain and

provide backstopping upon deployment and operation of the software for SCM. Besides, consulting companies usually have a proper competence in holding tenders and issuing orders for logistics services for any 3PL and 4PL providers. Commonly, similar tasks form part of a standard service package offered by a consulting firm. Large consulting companies, however, that are engaged in the field of strategic research often become knowledgeable of a whole supply chain, but have little understanding of the business processes. Therefore, only such consulting companies that advise their customers at the level of logistics business processes and manage all the internal processes by means of their own interfaces are in a position to organize management of a whole supply chain. To this extent, they should be involved in development of a strategic vision by their parent company.

Variant “IT Providers”. Software manufacturers and IT providers also stand a chance of becoming a 4PL provider. Supply chain management very often requires specific software with an enormous number of interfaces to integrate the enterprise resource planning systems belonging to supply chain partners. Any know-how in the field of information technologies becomes all the more important for a successful supply chain management. Therefore, IT providers seem to have the best background to solve any and all issues including the functioning of e-commerce, through a supply chain portal. This portal is intended to connect all the partners through the Internet in order to implement any physical processes, which also implies the integration of logistic service providers. Such a portal can also ensure the transparency in the network, which is necessary for an optimum supply chain.

Variant “Synthesis”. This variant implies that a parent company takes over some lines of business activities that already form part of an existing supply chain. It means that some joint ventures may be organized, whether on the basis of any IT firms or any consulting companies and third-level logistic service providers. In this case, the independence of a subsidiary company from its parent one in respect of any specific plans involving its participation in a supply chain and a possibility to avoid any conflict of interests takes shape as the vital task.

The main reason for the development of the tendencies of cooperation in the supply chain in the field of logistics is the clearly increased requirements of customers, which in turn are caused by the growth of logistics costs and the need to concentrate on managing a high level of logistics costs.

In reality, it is already difficult for enterprises to organize optimal servicing and providing customers with supplies without attracting partners in the field of logistics in conditions of pressure from competitors. Therefore, the development of providers becomes important. 5PL – a new level of logistics outsourcing, which arose in the investigation.

Table 2

Characteristics of the services of logistics providers

Types of logistics service providers	Basic services	Examples of companies
“Transportation Provider” Transportation providers owning real assets	Logistics "accommodation" (dedicated logistics). Transportation, centralized transportation, maintenance, routing.	Schneider, Ryder, Hunt, Danzas, TNT, UPS, FedEx, Airborne, DHL
“Transportation Provider” Providers of optimization of transport services that do not have real assets	Integrated logistics. Service-oriented logistics. Focused on technology, reengineering.	CH Robinson, Mark VII, Ryder, UPS Worldwide, Menlo, FedEx
Vendors of value-added warehousing	Integrated logistics and logistics of "placement". Technologies of warehousing and transportation.	Caliber, DSC, Tibbett & Britten, GATX, Exel Logistics, Fiege Group, Menlo
International forwarders, carrying out outsourcing of logistics functions (not having real assets).	Integrated logistics with international forwarding capabilities.	AEI, Circle, MSAS, Kintetsu
“IT Providers”	Packages of logistics programs.	Manugistics, 12/ Intertrans, McHugh, Logility, Extricity, Manhattan

Source: Built by the author according to the data [4]

The latest developments in the field of combining intelligent software maintenance of different levels and localization, in conjunction with the development of strategic partnerships among all participants of logistics chains. In the modern educational and scientific-methodical literature, many authors distinguish. 5PL logistics providers (Fifth Party Logistics) as a separate element in the classification of logistics operators [5].

Under the 5PL, a provider is generally understood to be a logistics operator whose activities are based on the use of a complex of modern information and communication technologies that allow the database of consignors, consignees and transport companies to be interactively operated, plan transportation, dispatch and monitor the execution of orders in a virtual logistics system [6].

Many authors, and in particular A.V. Ivashchenko and D.G. Peysahovich, is

understood by the operator's 5PL provider, which basically manages the flow of information about orders, resources, plans and the actual state of the transport network in the integrated supply chain [7].

If we consider 5PL providers from the point of view of the integration approach, as do Loshnev K.O., Taraskina E.P., Zarudnev D.I., Dikinov A.H., Honchukaeva L.V. and Aitbagin E.R., then under 5PL-provider it is necessary to understand management of all components of the integrated supply chain, and not only information flows.

Such management is understood within the framework of a single information space, using the Internet as a unifying virtual platform. Such a system is also called "virtual logistics" or "Internet logistics" [8].

In this case, the 5PL provider is already defined as a "service company that performs integrated services for managing integrated processes in supply chains on the basis of outsourcing without the use of physical mechanisms for managing material and other logistical flows" [9].

According to Aitbagina E.R. The 5PL provider is a logistic operator that takes over the functions of the 4PL operator and provides deeper and more comprehensive interaction and coordination of the clients' services in real time with extensive use of the Internet [10]. However, this interpretation of the 5PL provider also does not make it possible to separate it as a separate, independent element of the classification of logistic operators. This seems impossible in view of the fact that according to the experience of practitioners themselves, 3PL and 4PL providers themselves several years ago already switched to maximizing the full informatization and virtualization of their activity and without giving up their material and technical base, but, on the contrary, strengthening it and automating it.

Virtualization, informatization and automation of 3PL and 4PL providers has become a routine and necessary practice of the modern market today and does not cause a significant expansion or radical change in the range of logistics services providers, goals and processes of their services, therefore, does not change their species, process or functional composition and does not allow to allocate such kind of "virtual" or "Internet providers" as a new type of logistic operators.

This is also confirmed by the words of Cedric Alambert that the features of Internet commerce and Internet logistics today are mostly related to the positioning of products and services, but business-logistics technologies, developed with traditional formats of sales, largely in e-commerce are simply repeated. Professor Sergeev V.I. first substantiated this point of view in the textbook on supply chain management [11]. He notes that changes related to the development of the Internet and electronic business has a strong impact on various segments of the logistics services market, which as a whole develop integratively.

However, e-commerce is not a new segment or a new criterion for classifying

supply chain management solutions. It leads only to the formation of a wider range of offers of integrated services 3PL and 4PL level in supply chains.

The emergence of this concept is primarily due to the fact that the rapid development of modern information systems and technologies makes it possible to introduce the most powerful and progressive technologies into the sphere of economy, business and logistics service, providing an unprecedented, previously impossible level and scale of data processing that forms the basis To make decisions not only operational level, but also strategic.

These technologies include not only embedded in the field of logistics outsourcing Internet technologies and electronic document management technologies. Changes in strategic logistics planning are primarily related to the introduction of intelligent systems based on neuro-cybernetic data analysis technologies, as well as expert technologies of automated machine management decision-making and impact on subordinate objects.

However, one can add to this that the development of expert systems and neurocybernetics, as well as the ever wider and more active use of cloud computing, distributed computing, remote and distributed databases, will allow the transition to a fundamentally new level of information processing and decision making, consisting in their automation and implementation without any permanent human intervention [12].

Technologies of distributed computing will allow processing practically unlimited volumes of information and, consequently, serve logistic chains and logistic networks of any scale, both national, international, and planetary. This will allow us to cover and integrate logistics networks and supply chains in each country, economic or geographical alliance, as well as on different continents, in the future creating and servicing a single global economic-distributive network of commodity economy. In turn, artificial intelligence technologies will automate the decision-making process in logistics networks of this scale, replacing in this issue the intellectual abilities of a person who in this case will not be physically able to cope with the scale of such activities.

Modern reality can be absolute impartiality and maximum optimality from the point of view of the effectiveness of the functioning of the entire logistics network, the life activity of states and economic unions. The society will be able to approach the optimal food and commodity supply of the national economy and consumer, environmental and energy security and economy. The use of artificial intelligence technologies will solve the problems and eliminate the bottlenecks associated with the issues of interorganizational logistics coordination in supply chain chains and networks arising from the opposite of the interests of the network participants, and will also allow not only the most effective operational accounting, control and planning of the logistics networks, but also to carry out tactical and strategic management of logistics networks based on self-learning expert systems.

At the present stage, the 5PL provider has the opportunity to move from the ordinary link of the logistics supply chain, performing for it a certain list of logistics functions, to a full-fledged entity managing logistics chains and supply chains, to the subject of political and economic management. At this stage, its process and functional composition is changing, the range of services and goals is expanding and drastically changing [13].

The 5PL provider begins to determine the policy of development of the global logistics service, and, consequently, the policy of economic development. With the use of these technologies, the 5PL provider has the opportunity to set the system of co-ordinates of activities for the participants of logistics chains and supply networks, act as an integrating factor, and find a very mobile and constantly changing balance between the multidirectional interests of states, consumers and commercial participants of logistics networks of food and industrial goods.

And, it can be concluded that in this context it is the conceptual changes in the goals, tasks, functions and scope of activity, as well as the place, role and purpose of the logistics provider in the supply chains that allow us to talk about a really new step and a new level in the classification of logistics operators. It is the enumerated possibilities of independent determination of the strategy for the development of logistics chains and supply chains based on a given, chosen political concept and automated compulsion of the participants in the supply chain to execute it, are the basis for distinguishing the 5PL provider as an independent, truly conceptually new and fundamentally different from all previous logistics operators, the provider of the highest level in the classification of operators of logistics outsourcing.

A logistic intermediary represents an essential element in a logistic service provider company because the cooperation with the former allows a company to get any competitive advantage for account of: a reduction in operational logistics costs, overall increase in efficiency of the functioning of a logistics system and, as a consequence, reduction in prime cost of goods; enhancement of flexibility and adaptation of a company to the ever-changing environment; mitigation in logistics risks; reduction in duration of the operational and logistics cycles.

Whereas previously the field of logistics represented, at the most, the classical kinds of logistical services, such as stockpiling, transportation, and cargo handling which take shape as a particular physical operation, now the logistic activities are deemed to include any coherent business processes having a coordinating and strategic nature.

All logistic service providers are divided into classes reasoning from the nature of their activities; it may be operating, coordinating or strategic: monoline logistic intermediaries (transportation companies, forwarding agents, jointly occupied depots, cargo terminals, customs brokers, agents, stevedoring companies, insurance companies, providers of any information and consulting services in the

field of logistics); 3PL providers, which embrace any firms rendering a coherent logistics service for a customer (being a manufacturing company, commercial partnership or a service provider); 4PL providers representing any systems logistics integrators.

Monoline logistics intermediaries focus on the operating activities. A 3PL providers carry on the operating and partially coordinating activities (which means integration and coordination of the operating functions in a single provider). A 4PL providers tackle the coordination and strategic activities (which presupposes a systematic approach to the management of any core logistics business processes, integration and coordination of actions undertaken by a target company and key contracting parties in a supply chain). At present, transportation companies often take on lease or build their own distribution centres, warehouse operators include any transportation departments in their infrastructure, and customs brokers and forwarders offer services in delivery, storage, and batching of the flows of goods. Modern 3PL providers have traversed the course of a synergetic amalgamation of some specific services. 3PL service represents a multidisciplinary adviser offering and implementing appropriate solutions for the supply chain management. Major companies having large turnovers and flows of goods purport to obtain the necessary services from a single provider. The development of a 3PL model has led to the next step – emergence of the 4PL services. 4PL provider addresses the tasks related to a strategic planning, management and control of all the logistics processes of a corporate customer.

Creation of a common information space as an environment for an integrated planning and management of any supply chain interactions and as a tool for perfection of a supply chain management system is fundamental for expansion of the outsourcing of logistics functions. The crucial factor determining the prospects and opportunities a company has in order to develop its models of integrated planning and management of its supply chains on the basis of the outsourcing of logistics functions is the state of the information technologies.

The main objective of managing logistic communications is to provide a favorable attitude to the manufacturer of goods by creating a common motivational field of exchange participants, which is, focused on the rational use of available resources and harmonization the interests of the parties. The modern concept of logistic communications is the concept of integrated logistic communications, actively explored and developed today by the researchers of the problems of interaction of subjects in the logistic.

Methodological weakness of the concept of integrated logistic communications is that it implies the implementation of integration only on instrumentality level, regardless of the set of participants in the interaction and their characteristics (motivation, resource, organizational, technical, innovation, etc.). Depending on our opinion, integration should have a response in the form of

conjugation motives of participants, their resources, actions logistic in satisfaction the needs of consumers differ in their behavior under various conditions of logistic conditions and the particular communication area. The concept of integrated logistic communications, which provides large-scale use of low-budget tools logisting communications, should be transformed into the concept of the integrated logisticing communications [1].

The last implies the creation and development conducive for the initiator communicative environment providing modification of consumer perceptions and behavior of target groups and to achieve the strategic goals of the enterprise. The main objective of managing logisticing communications is to provide a favorable attitude to the manufacturer of goods by creating a common motivational field of exchange participants which is focused on the rational use of available resources and harmonization the interests of the parties. The objectives of the management of logisticing communications in the context of disclosure of key management components by the manufacturer of the goods (its philosophy, mission, vision, features subculture, image, reputation) may include the following: determining the level of permeability of logisticing actions; monitoring of "susceptibility" logisticing efforts with regard to the promotion of products by manufacturer; adjustment of properties and characteristics of integrated communication cycle.

The solution of the challenges in business requires effective management of increasingly complex system of logisticing communications, supporting mutually beneficial exchanges between suppliers, intermediaries, customers and various contact audiences. When the business rises the manufacturer expands the circle of perspective for him the participants of logisticing process, thereby expanding the scope of the entire interaction. In front of a enterprise there is the task of forming its logisticing communications field in the sense in which we have identified and marked economic nature of communication.

This consequence requires consideration of communication tools, determining the boundaries of their applicability and systematization of different scientific approaches to the study of proper communication as the essential foundation for an effective interaction. Introduced new concepts to a better understanding of the components of the communication area, and on this basis provide a framework for consumer benefit and achieve satisfaction exchanges through intensified logisticing process. Achievement the satisfaction with the exchange interaction between the participants can only be achieved in a single motivational field, which established a balance of interests in respect of resources defined by the level of profitability and the desired values of the created product that can satisfy the needs of the target customer segments.

Corporate of logisticing takes the form of an open logistic for dialogue partnership; innovation does not reject the action as a complex resource factor for competitiveness entities increasing in the process of establishing constructive

communication between them. The mechanism of interaction management links the determining factors in the context of a single communication cycle, a custom adaptation of business structures to logistic requirements [3].

Changing the amount and composition of logisticking communications, and an array of quality broadcast through them information, we proposed a mechanism for adjusting the behavior of consumers in the direction favorable to the enterprise. As part of the anthropocentric approach cognitive dimension of consumer behavior acquires the properties of instrumental function. Priority is given to understanding rather than explanation or prediction. Under the influence of factors of different orders it generates a set of alternatives to buying. Mass logisticking is targeting producers to logistic segments, taking into account the profile of the user and their responses to the impact of the enterprise. Personalization of communications by the company assumes knowledge of consumer reaction and adequate assessment of the proposed values. The company creates the conditions for access to the individual through the activation of the tools of logisticking communications. At the same time, the company is building its information field through memorization of response of the consumer and stores this information in one of its subsystems. Differentiation of target groups of consumers on the factor "type of competitive behavior" [11] makes it necessary to differentiate the content and logisticking channels broadcast information aimed at consumers (modification of consumer perceptions and behavior) and logistic agents (modification of the Counterparty on the activities of the enterprise). Simulation of communication processes is developing mainly representatives of social and humanitarian sciences and engineering in the direction of building models on the basis of analogy, while the area of economic and mathematical modeling remains largely unexplored. Offer relevant solutions in this field allows you to expand the scientific tools in the management of the enterprise communication, increase its precision and focus, identify typical application situation of communication tools in competitive strategy and conduct scenario of economic-mathematical calculations to assess the feasibility and effectiveness of the investment of resources in the communicative sphere of business.

Management of many companies as a single system requires: introduction of a common management platform; determination of all tasks, rights, and duties to be vested in a single management towards any supply chain partners that are legally and financially independent businesses. Companies owning real assets possess or acquire, by way of hire purchase leasing, any vehicles, warehouses, etc.

Those companies that contract the outsourcing services enter into agreements with any other providers of services, whether in a full or partial scope, in the field of physical distribution. Firms rendering any information services represent a type of companies not having any physical assets and carrying on the business of intermediaries in optimization of the logistical systems of any other companies and

interacting with any other firms or companies that have real assets, on a contractual basis. The criterion of segmentation of the market, the so called logistics assets, does not exclude the third variant, either: one's own logistics capacities and outsourcing. In this context, depending on the actual conditions of a company's business activity on the market of logistics services, it is not always possible to put into operation all the logistics capacities.

Logistic outsourcing is a consequence of the evolution of a modern enterprise. The change in general methodological approaches to the organization of the production process, systems and management process is associated with such factors as: creating an internal competitive environment; transition from functional to technological specialization; reengineering of production processes; changing the system of internal and external communications; intensification of information exchange; striving to reduce costs. The methodology of logistics outsourcing develops and is reflected in all modern types of organizational structures.

The structure of the process of logistics outsourcing presupposes a strategic and economic justification for the need to delegate authority for certain processes and activities. The choice of the provider of logistics outsourcing services is carried out as a result of the analysis of the available services market.

Modeling the process of logistics outsourcing requires the formalization of socio-economic factors that influence the decision on logistics outsourcing. Modeling the process of logistics outsourcing allows to formulate a general methodical approach to making managerial decisions about the use of certain types of outsourcing.

There has arisen and is becoming more and more popular a new vision of acquisition of the logistics services – the so-called 4PL (Fourth Party Logistics) model.

The 4PL model represents a further development of the 3PL, or Third Party Logistics, concept. In the approach of a 4PL model, a logistics chain is a joint venture of a corporate customer and a logistic service provider that uses the 3PL procedures.

4PL provider is the only link between a customer and many 3PL providers. A 4PL provider becomes an integrator of a supply chain that joins its resources with those of its subcontractors. 4PL providers unite the possibilities of 3PL providers and companies managing the business processes in a manner that a customer receives all solutions related to organization of a supply chain through a centralized contact management system using any managerial and information technology services.

It is these listed opportunities for independent determination of the logistics supply chain development strategy that are the basis for allocating the 5PL provider as an independent, truly conceptually new and fundamentally different from all previous logistics operators, the highest level provider in the classification

of logistics outsourcing operator.

The conducted research showed that coordination and communication should be of great importance at the moment, however, the managers of the company divisions, optimizing the work and costs of their specific sites, do not engage in complex logistics solutions – the organization of continuous and interconnected logistics supply chains that can affect the company's final results in whole.

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CHAPTER 5

PROBLEMS IN COMMERCIALIZATION OF INTELLECTUAL PROPERTY, SCIENTIFIC, AND TECHNICAL DEVELOPMENTS

5.1. Managing Intellectual Property Commercialization: University of Oxford Experience

At the current stage of economic development, in the conditions of change, which brings with it the 4th industrial revolution, the intensification of competition among economic entities, innovation activity is a condition of survival, a guarantee of success and competitiveness on the market.

Universities are the world leaders in research. The scientific research results (hereinafter SRR) are moving to the international market through the implementation of mechanisms for transfer and commercialization of technologies. Ukraine has significant scientific and technical potential, intellectual capital, talented scientists who produce new knowledge, but loses to other countries in the ability to effectively apply and commercialize it. With more than 300 universities and more than 900 research institutes in its assets, Ukraine produces and sells less than 3% of innovative products, ranking 133rd place in the world in terms of GDP per capita in 2017. The formation of the national innovation system in Ukraine is not over yet. There are no effective mechanisms for commercialization of university research, which does not allow to fully join the international market of innovative technologies. In this regard, innovation in Ukraine is estimated in the world fairly low.

The course of Ukraine's integration into the European community, providing innovative development and public welfare of the European level, sets the task of improving the system of management of SRR commercialization in universities. Solving this problem requires a thorough analysis of foreign experience in this field, as well as systematization and improvement of scientific and methodological support for this process with a view to their further application by domestic universities.

Problems of the transfer and commercialization of the intellectual activity results are the subject of research by many domestic and foreign scientists such as G. Androshchuk, A. Butnik-Siversky, S. Valdaytsev, V. Denisyuk, E. Enderson, V. Zinov, P. Ijevsky, S. Illyashenko, O. Kamenskaya, Y. Kapitsa, A. Kosenko, D. Kotsyski, D. Makhnovsky, V. Mukhopad, O. Novoseltsev, G. Olehnovich, G. Patora, P. Pererva, B. Prakhov, D. Sakai, I. Sintaji, L. Fedulova, M. Fonshtein, I. Khomenko, P. Tibulov, A. Cherper, N. Chukhrai, A. Shaposhnikov, M. Shamoshi Veres, K. Shakhbazyan, J. Shumpeter, T. Shchedrin and others [1, 2].

Despite the large number of publications on this topic, a number of important issues remain poorly studied. Practically there are no studies aimed at solving the

problem of improving the management of the process of intellectual property commercialization in universities.

The aim of the research was to study the experience of managing the processes of intellectual property commercialization at Oxford University and to develop recommendations for improving the management of intellectual property commercialization for domestic universities. The achievement of the stated aim provided for the formulation and solving of the following tasks:

- to define the aim, functions, algorithm of implementation the basic business processes to manage commercialization of intellectual property of Oxford University;
- to study the main stages of the development and organizational transformations of the commercialization office of the University's intellectual property;
- to study the distribution of royalties;
- to analyze key indicators and results of the activity of the commercialization office of the University's intellectual property;
- to determine the basic conditions and components of the success of the University's intellectual property commercialization, especially in formation of subsidiaries.

The paper uses a review of scientific publications of domestic and foreign scientists, legal acts, general scientific methods of analysis and synthesis.

Today, in front of universities, the actual problem is the commercialization of its scientific product, its effective implementation on an industrial scale. Different universities solve it differently. Commercialization of scientific developments of leading world universities is the basis of multi-channel financing and competitiveness. All universities, which are in the world TOP-100 rankings, are powerful scientific and educational corporations, centers of scientific knowledge and generators of innovation development. The global trend is the «University 3.0» model, which implies the unity of the system «education – science – innovation – commercialization».

The presentation of the research results requires clarification of terms and concepts.

Intellectual Property (IP) – is secured legal rights to results of intellectual and creative activity in science, industry, art and other fields [1, p. 7].

Objects of intellectual property rights (OIPR) are the results of intellectual, creative activity: inventions, utility models, industrial designs, topographies of integrated circuits, plant varieties, breeds of animals, scientific discoveries, innovative offers, commercial secrets (know-how), literary and artistic works, computer programs, compilation of data, etc. [1, p. 7].

Commercialization of OIPR is a process by which R&D results are transformed into products and services on the market in order to generate revenue

from their sale, licensing or self-use [1, p. 7].

There are such main *forms of commercialization* as: a) obtaining royalties from the use of intellectual property rights; b) creation of new companies based on technologies; c) research contracts with private clients.

The efficiency of technology commercialization is the commercial effect, income from the transfer (use, engagement) of intellectual property for the production and sale of goods and services, taking into account all costs.

Startup-, spinout-, spin-off companies are new, usually small, innovative high-tech enterprises created on the basis of the use of scientific research results and development of a scientific organization [1, p. 7].

Startup, startup company is a newly established company that builds its innovation-based business, has started to enter the market and has limited resources [2].

Spinout-companies are «repulsed» from the parent company, but retain close links with it, unlike the spinoff-companies, which are given greater freedom of action, the ability to independently develop innovative products or organize production. Spinout-companies keep financial and operational links (financial control, administrative service, management support, advisory activity) to the organization that created them [3, p. 38].

Spinoff-companies are a successor companies allocated from the parent company to independent development and market introduction of innovative product or technology. They are most often formed by transforming the parent company's unit into an independent structure [3, p. 38].

The important results of the spin-company's activities are the additional revenue for the parent company's budget, as well as the strengthening of the innovative activity of the founding company, which is especially important for universities. In addition to the implementation of scientific developments, university spin companies are able to create jobs, expand research activities.

Both forms of spin-companies' organization are based on the shareholder mechanism of investment in the company being created. The company-founder has a controlling shareholding in the newly-created firm, and for its successful work can either re-incorporate the firm into its structure, or it is profitable to sell it [3, p. 39].

Most foreign universities have licensing / transfer / technology commercialization offices: Technology Licensing Offices (TLO), Technology Transfer Offices (TTO), etc. The history of their occurrence has more than 40 years and began with the United States and Great Britain. The names are different, but the essence is one. Technology licensing office is an organization or structural unit of the organization focused on integrated and systematic management of the results of scientific research, from the creation of objects of intellectual property right to their commercialization and introduction into economic circulation, mainly

in the form of conclusion of license agreements and / or the opening of startup companies [1, p. 7; 4, p. 72].

Ukrainian universities began to create similar offices / centers about 10 years ago and have not yet gained experience in effective management of intellectual property. At the same time, commercialization of IP is one of the final compulsory stages of the innovation process (Fig. 1).

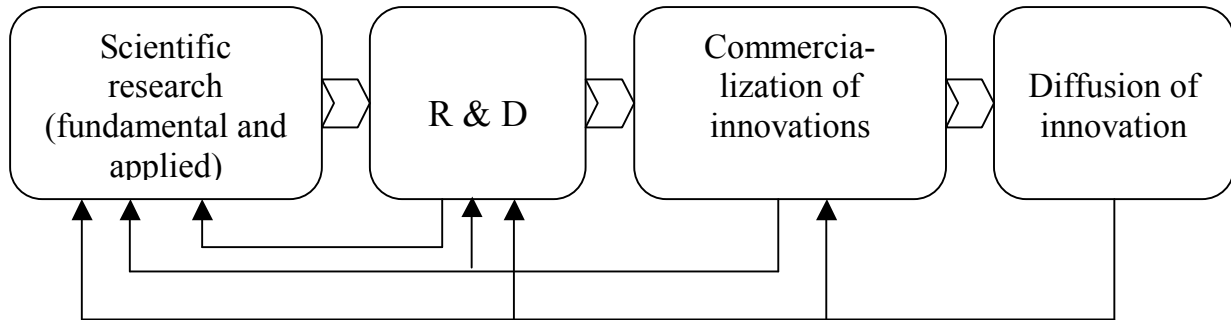


Figure 1. The place of commercialization in the innovation process

University of Oxford in the UK has been steadily leading the world in prestigious university rankings, sometimes giving way, and sometimes outsizing its closest rivals – Cambridge and Harvard. In the ranking of *The World University Ranking* in 2016 and 2017, this university ranked the first place in the world [5]. University of Oxford is one of the leading research universities in the UK, with a research budget of around 220 million GBP annually. It also has a science park and is part of the so-called «golden triangle» of the leading research universities in Great Britain, located in Cambridge, London and Oxford [6].

Innovative activity has been proclaimed by the British government as one of the foundations for the restoration and development of the national economy after the global financial crisis. The priority objective of state policy in this area is to transform Great Britain into a country with the most attractive conditions for business development.

According to the *Global Innovation Index 2017* ranking, published by the Cornell University and INSEAD, as well as the World Intellectual Property Organization (WIPO), Great Britain once again held second place in the world after Switzerland in terms of innovation in 2017, rising from third place in 2013 [7].

Information about the activities of the offices of technological licensing of universities is presented on official sites. There are three levels of market orientation for licensing offices: international, regional, and thematic.

Oxford University Innovation Ltd., established in 1988 as a commercial technology transfer company, originally owned by University of Oxford, has an international focus [6]. *The goal of the company* is to support researchers who wish to monetize their research results. The company carries out the following activities:

- intellectual property licensing;

- creation of new companies;
- consulting services and servicing of concluded contracts.

Examples of research topics at the University of Oxford are given in Table 1.

Table 1

University of Oxford: Research themes examples

Medical Sciences	Maths, Physical, Life Sciences	Social Sciences	Humanities
Cancer	Energy	International Growth	Digital Humanities
Cardiovascular Disease	Healthcare	Government and Leadership	Environmental Humanities
Diabetes, Endocrinology, Metabolism	Advanced Materials	Big Data & Social Media	Medical Humanities
Infection and Immunology	Resource Efficiency	Corporate Governance	Medicine and Conflict
Genomics	Recovery & ICT	Women in Business	Global History
Musculo-skeletal Science	Cyber Security	Training Educators	Cultural Heritage
Neuroscience	Big Data	Social Policy	Culture Transfer & Translation
Reproduction & Development	Robotics	Social Intervention	Practical Ethics

Over time, Oxford University Innovation Ltd. evolved and split into two divisions: *Oxford University Consulting* and *Isis Enterprise*, a private limited liability company that also fully owned by University of Oxford [6].

In the UK, organizations have intellectual property rights created by researchers working in these organizations. The University of Oxford passed *Isis Enterprise* its intellectual property rights, which were implemented by *Isis Enterprise* through the system of new business creation and licensing.

The implementation sequence of the main business processes for the commercialization of scientific researches results (hereinafter SRR) by *Isis Enterprise* is typical for TLO and is shown in Fig. 2 [1, p. 18].

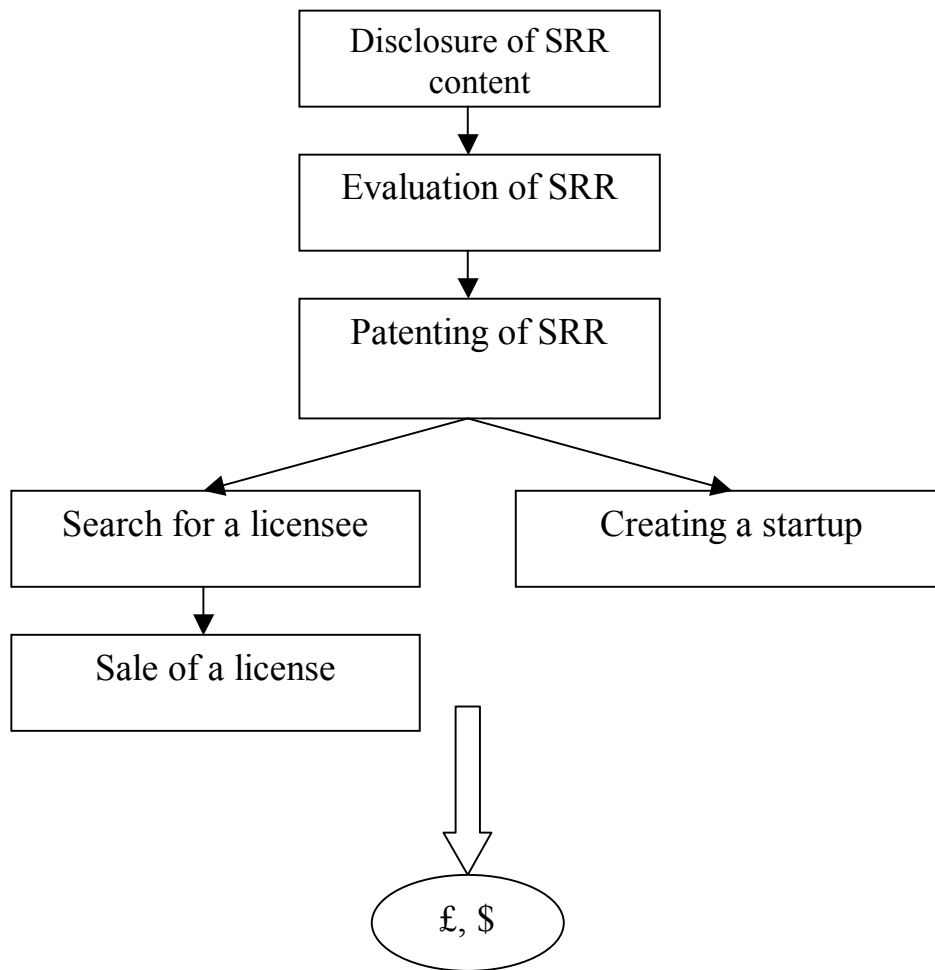


Figure 2. Implementation sequence of the main business processes of SRR commercialization by Isis Enterprise

The algorithm of the SRR commercialization can be described as follows:

The process of commercialization begins with the disclosure by the developers its results of scientific research to the licensing office staff.

The office staff evaluates the SRR for the possibility of their commercialization.

If the development has prospects for commercialization, then a strategy for its legal protection is being developed. If the result of the SRR is the invention or other object of intellectual property, then an application is filed to the national patent office to obtain a law enforcement document – a patent or certificate.

The technological licensing office uses the time from the moment of filing an application for an invention to the moment of obtaining a patent for the search of a potential licensee (buyer of the SRR).

If the licensee is found, then after obtaining a patent pass to the next business process – licensing.

Licensing is an act of SRR commercialization, as the result of the transfer (sale of SRR property rights) the parent organization receives a positive financial

flow, most often in the form of royalty payments.

Another prerequisite for commercialization is the creation of the most perpetual licenses of startup companies. Payments (royalty, dividends, part of the profit depend on the contract with the parent company) for using the SRR by the startup also come to the accounts of the parent organization [6].

To transfer technology, the TLO office uses model contracts. As it's known, the UK, like the Federal Republic of Germany and some other EU member states, have developed and use model contracts for research and development between research institutions and universities and enterprises, as well as contracts for technology (knowledge) transfer with industry partners, which offer different options for acquiring rights and using intellectual property objects.

In the UK, Lambert's Model Contracts were developed by the Lambert Intellectual Property Working Group, created at the initiative of the Treasury of Great Britain in 2003 to strengthen the cooperation of universities and industrial companies [8]. Five Model Collaborative Agreements were developed for research, covering various scenarios for joint work and intellectual property rights between one research institution / university and one industrial / business partner, as well as four model consortium agreements (multilateral agreements) that cover various options for acquiring intellectual property rights and the use of objects of intellectual property in collaborative research involving several parties (more than two).

In the area of licensing, the University of Oxford conducts a clear and transparent policy for distributing royalties: depending on the size of the profits it shares between individual researchers, the ISIS, the department and the General University Foundation and its shown in Table 2.

Table 2

Policy distribution revenues from royalties at the University of Oxford [6]

Total revenue	Researcher	General Fund of the University	Department Fund	ISIS
up to 72 thousand. GBP	61%	9%	0%	30%
72 – 720 thousand. GBP	31,5%	21%	17,5%	30%
more than 720 thousand. GBP	15,75%	28%	26,25%	30%

Over the past eight years, the University of Oxford has invested 14.8 million GBP in patents through the Oxford University Innovation and has received 100 million GBP in exchange for licensing payments. Today Oxford University Innovation manages more than 1,300 patents and patent applications from the

University of Oxford, as well as more than 600 active licensing agreements [6].

Since 1997, Oxford University Innovation has been helping to form more than 80 Oxford University subsidiaries, dramatically increasing the value of university stockpile. Known company spinouts created by it are SummIT (2003), Oxford Immunotec (2002), Velocys (2005) and others. Oxford University Innovation has attracted more than 335 million GBP in direct investment by its companies [6].

Private investment, donations and foundations help to commercialize the University's SRR, namely [6]:

The Oxford University Seed Fund (UCSF) was launched in 1999, starting at 4 million GBP. By the end of 2015, more than 7.5 million GBP were invested in 143 projects.

Oxford Invention Fund (OIF) supports the development of new technologies from Oxford, is a campaign to increase the University's funds and is part of the «Oxford Thinking». Up to this date, raised more than 1.5 million GBP.

The Isis Oxford University Foundation (UOIF) consists of two EIS / SEIS funds for investors run by Advisors Parkwalk. 1st fund is 1.25 million GBP, 2nd is closed. The portfolio consultant is Isis Innovative.

The Business Angels Network of Isis Angels (IAN) consists of 216 registered members. The organization works without a membership fee, meets twice a year and issues newsletters. It often supports startups early on.

With regard to the investment in creating the university spin-offs, according to the data at the end of 2015, 300 million GBP was invested in spin-outs:

from Oxford (MPLS and Medical Sciences Departments), Harwell & Culham Labs.

to new and existing companies working abroad, together with other investors.

Founders-Investors: Invesco, IP Group, Lansdowne Partners, Oxford University Foundation, Wellcome Trust, and Woodford Investment Management [6].

It should be noted that starting from 2000, according to January 2015 (for 15 years), total external investments of 535 million GBP were made at 84 spin-outs of the university, incl. 67 million GBP investment was made in round 1 (at the start-up stage of spin-outs) and 468 million GBP was the investment capital of business angels at an early stage.

Areas of successful spin-outs of Oxford University [6]: Diagnostics; Medtech; Pharma tools and services; Diagnostics of drugs; Other medical services; Industrial applications; Environment and Cleantechnique; Other (including software).

The results of Oxford University Innovation in recent years are highlighted on the company's website [6]. The key is shown in Table 3.

Table 3

Key Performance Outcomes of Oxford University Innovation in 2014-2017

Indicators	Years			
	2014	2015	2016*	2017
1. Gained total income, million GBP	14,5	24,6	22,2	18,7
2. Returned to the University of Oxford and its researchers, million GBP	6,7	13,6	9,6	8,0
3. Number of spinouts created by companies	8	13	21	19
4. Agreements concluded (technology licenses, advisory agreements), units	498	597	855	685
5. Received patents and patent applications for inventions for Oxford researchers, units	2211	2490	2873	3425
6. The amount of research funding won by Oxford researchers with direct support from the company, million GBP	19	25	24	23

Source: compiled by the authors using [6].

** For 16 months (April 15 – July 16).*

As it shown in the Table, in 2017, Oxford University Innovation received a total income of 18.7 million GBP; 8.0 million GBP returned to the University of Oxford in the form of license fees; 19 spinouts of companies were created; 685 deals were concluded; 3425 patents and patent applications for inventions were received for Oxford researchers; research funding has been funded at 23 million GBP [6].

The first 10 years since its foundation, in 1988-97 Oxford University Innovation Ltd had a small staff of three employees. In the course of another 5-6 years, in 1998-2003, the staff increased to 36 people. The key experts of the company perform the functions of project managers. Their level of training and education combines knowledge of research and business management. The budget of *Isis Enterprise*, which was allocated by the University until 2017, was \$1 million annually (additional royalties are added to it).

Organizational changes took place in 2017. *Isis Enterprise* changed the name to *Oxentia*, left the university and became a separate company (Fig. 3) [6].

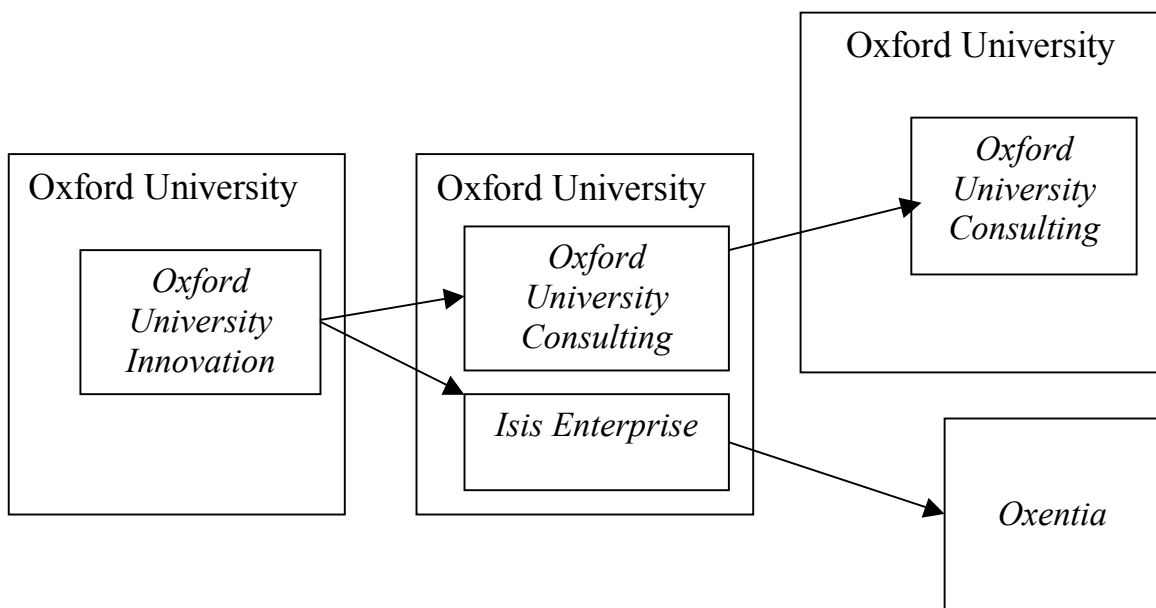


Figure 3. Evolution of Oxford University Innovation Ltd for 30 years

Source: compiled by the authors using [6]

During 2017-18, Oxentia, in terms of brand transformation and the exit from the University of Oxford, has undergone significant changes and development, which has allowed to expand its presence in the UK and in the world.

After the transition, Oxentia began expanding its commercialization partnership with British universities: Cranfield University, University of Westminster, Open University, University of Hull and Sheffield Hallam University [6].

In the future, Oxentia plans to develop its training and service offerings in order to meet the global demand for technology transfer and innovation. In 2018, the expansion of the offer of accredited Oxentia technology transfer rates will take place due to the inclusion of new courses: «Commercialization of digital know-how» and «Marketing and technology assessment».

It should be noted that the University of Oxford is still more effective in creating new companies. According to the Higher Education Funding Council for England and the Association of University Technology Managers (USA), at the beginning of 2000 at American universities, every 90 million EUR spent on research led to highlighting one spin-off company, while in the UK this figure was 35 million euros. However, US licensed licensing fees accounted for 3% of research spending (which are the largest in the United States), while in the UK this figure is at 1.1% [9]. It is believed that if US universities are better off using intellectual property, then British universities are more effective in creating new companies.

This is supported by strong government support for small and medium-sized businesses and tax deductions for research and development costs and loans for small and medium-sized enterprises (SMEs) are foreseen annually by the UK

Budget Act. Up to 175% of the qualified research and development costs are allowed to be deducted when calculating taxable profits for SMEs. The size of the tax credit is 24 GBP for every 100 GBP of qualified research and development costs. In order to benefit from tax incentives, SMEs must carry at least 10 thousand GBP (12 thousand EUR) a year in qualified research and development costs [10]. A small and medium enterprise means a micro, small or medium sized enterprise of 500 people, 100 million EUR and 86 million EUR (respectively).

The UK Budget Act also provides incentives for venture financing. The company («investment company») has the right to an investment privilege in respect of the amount of its subscription to another company. Proportional tax for the reporting period will be reduced by 20% [10].

Large companies also have the right to benefit from research and development costs if they amount to at least 10 thousand GBP for 12 months [11].

Individuals who invest in research and development also have the right to a tax deduction, the maximum amount of which is 100 thousand GBP. If a person makes a purchase of know-how, he/she is entitled to a 25% discount from that amount.

In general, the UK's experience in modernizing the small business support system deserves attention. The country has been stable in the top ten countries with the most favorable business climate for the last 10 years. The analysis of British law allowed to identify four main areas of state support for small and medium-sized businesses: financial, labor, innovative, international.

The financial direction is expressed in creating the necessary banking and investment conditions within the country, as well as the most favorable tax regime. For example, in 2013 the Government of Great Britain and the British Business Bank (hereinafter the BBB) allocated more than 250 million GBP. to implement financial support programs that were used by over 8,000 small businesses. The conditions for investing are actively created. The BBB provides assistance to fast growing companies in obtaining investments from 14 funds created by it, amounting to 484 million GBP of state and private venture capital [12, p. 65]. The creation of a favorable tax regime manifests itself in lowering the corporate tax rate for small enterprises from 21 to 20%, and introducing a 19% rate on marginal profit; a temporary increase in the double size of the special incentive for small enterprises for 12 months from April 2014. It allowed 360 thousand enterprises not to pay income taxes; the introduction of a tax exemption for shares allows small, high-risk firms to attract and retain talented professionals [12, p. 66].

In addition, in the UK small and medium-sized enterprises count and declare incomes on a general basis, albeit with some exceptions. Enterprises with an annual income of less than 15 thousand GBP fill out a simple tax return without detailed data on their activities, assets or liabilities [12, p. 66].

In the UK tax regulation system, incentive measures such as progressive tax

rates are introduced – the income tax rate scale, which is based on taxable income. Dependence of the amount of taxes on the amount of profit is expressed in a straightforward progression – the higher incomes, the higher taxes. For small businesses, this is undoubtedly a very favorable system.

Today, thanks to such comprehensive measures by the state to create conditions for the development of small business, the SME sector in the UK is 99%. The Small Business Service (SBS) coordinates the implementation of the UK Small Business Support Task. It was established in 2001, and in 2007 it was transformed from a state agency into the *Enterprise Directorate (ED)*. This agency structure was originally part of the Ministry of Commerce and Industry, which has been transformed into the *Department of Business, Innovation and Skills (BIS)* since 2009 [12, p. 66].

The structure of the UK Small Business Support System after the 2009 modernization is depicted in Fig. 4.

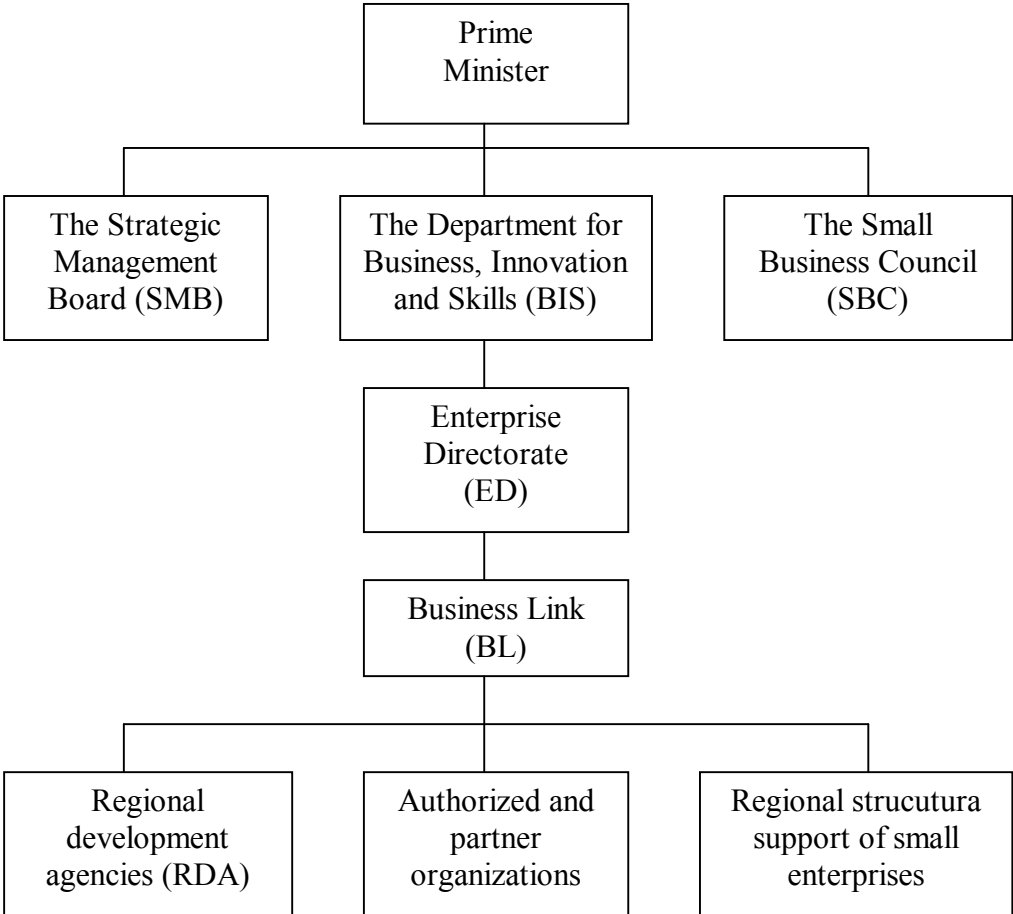


Figure 4. The structure of the UK Small Business Support System after upgrading in 2009 [12, p. 66]

The Directorate of Entrepreneurship was entrusted with the implementation of the Inter-departmental Business Support Simplification Program (BSSP) developed by the Ministry in 2007, the development of proposals for improving the

state policy of stimulating SME. The main purpose of the BSSP Program is to concentrate budget funds on a limited number of most popular SME support programs that provide high socio-economic outcomes.

Government support for small and medium-sized businesses in the UK is carried out in four main areas:

- optimization of taxation;
- minimization of administrative barriers by examination of legislative and departmental normative acts;
- improved access to financial resources;
- providing consulting and legal services.

Taxation is universally recognized, the most effective tool for stimulating and regulating entrepreneurial activity. The lower tax limits for a number of taxes in the UK are set in such a way as to exclude small or medium-sized enterprises from this category or grant them the most favorable terms. For example, VAT is levied only on enterprises whose turnover exceeds 80 thousand. GBP, while one-time payment of VAT is allowed for the whole year. The profit tax rate is 24% for enterprises whose profits do not exceed 500 thousand GBP [12, p. 63]. There are also discounts on taxable amounts on non-current assets associated with investments for small businesses.

Tax privileges are granted:

- when investing in venture capital funds;
- with investments in the construction of business real estate for small businesses;
- enterprises that create new jobs, which is especially important for the development of depressed areas and the general improvement of the economy.

Access to the SME financing is provided by government bodies, credit and financial institutions. Banks, venture and guarantee funds, financial and investment companies are the main sources of SME financing. In all regions, large cities and industrial centers there are branches of 12 authorized credit and financial organizations.

The annual volume of loans for state-owned small business support programs exceeds 6 billion. GBP. Major initiatives in this area include the implementation of the Guaranteed Loans Program for Small Enterprises, introduced in 1981 to provide financial support to the rehabilitation of enterprises that for various reasons cannot receive funding from traditional sources. According to this program, lenders receive a government guarantee, ranging from 70 to 85% of the loan for the respective enterprises [12, p. 63].

As the most effective tools used by the UK Small Business Service to finance SME, one can mention the creation of:

- regional venture capital funds;
- programs to assist small businesses in finding investors;

- programs for the financing of innovative projects;
- programs supporting the export-oriented SME.

Thus, the study of Great Britain's experience of successful small business support indicates the need to centralize the strategic management of the SME sector, the establishment of an evaluation program for state support to SMEs, and the deregulation of small businesses. Adapting this experience to the national economy of Ukraine will help not only to create an effective system for stimulating small business, improve the quality of the business environment of the SME, but also facilitate the creation by Ukrainian universities of small subsidiary innovative enterprises.

As it was noted above, the leading Ukrainian universities began to create similar offices / centers about 10 years ago and have not yet experienced the active commercialization of the SRR.

According to domestic experts, effective commercialization is hampered by: insufficient competence of innovation activity subjects; insufficient financing of innovation activity; shortcomings of the regulatory framework of innovation activity; lack of effective innovation infrastructure, and ineffective innovation management.

One of the main reasons for these barriers is the lack of a systematic approach to managing innovation at both macro and micro levels. Universities, scientific organizations, public administration bodies in Ukraine carry out functions of planning, organization, motivation and control of innovation activity at their discretion [13-15].

The most important condition for the effective organization and management of intellectual property and an obligatory element of a corporate innovation system is the formalization of the management process. It means the definition of functions, the sequence of their implementation, managing factors, resources and participants in this process.

Unfortunately, domestic processes of strategic management in most enterprises are lagging behind in development and do not have a clear definition in the use of objects of intellectual property in comparison with international ones. As a result, the efficiency of management of the company's IT, especially their commercialization, is not high enough. Most domestic universities are in the process of passive commercialization of objects of intellectual property: publicize proposals to alienate or grant permissions for the use of intellectual property rights by publishing copyright and patent law databases, technology transfer networks worldwide (Fig. 5).

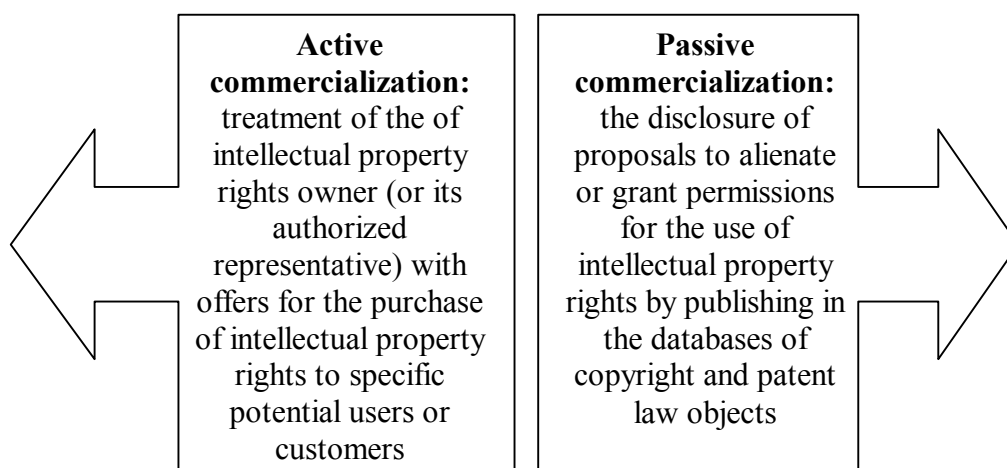


Figure 5. Types of intellectual property commercialization [15, p. 155]

At the same time, active commercialization involves: the appeal of the owner of the intellectual property rights (or his authorized representative) with offers for the purchase of intellectual property rights to specific potential users or buyers, that is, actively promoting their development on the market.

In addition, in Ukraine, the terms of contracts with enterprises concerning intellectual property rights are usually determined individually. There are no established recommendations for acquiring intellectual property rights and the use of objects of intellectual property for different legal relationships between a research institution / university and an enterprise for research and knowledge transfer.

It should be noted that there are steps in direction to improve and develop state policy in the field of development and support entrepreneurship in Ukraine. In the summer of 2018, the Ministry of Economic Development and Trade of Ukraine completes the process of establishing the Small and Medium Enterprise Development Office, a consultative and advisory body under the Ministry of Economic Development and Trade of Ukraine, which was envisioned by the Strategy for the Development of Small and Medium Enterprises in Ukraine until 2020, which was approved by the Government on May 24, 2017 [17]. The SME Development Strategy for Ukraine for 2017-2020 aims to achieve the goal of creating favorable conditions for the opening, running and growth of business and the disclosure of the SME sector potential. It is expected that the Small and Medium Enterprise Development Office will be a transitional stage before the decision on the establishment of a state institution for the implementation of the business development policy.

In order to achieve the goal of the SME Development Strategy in Ukraine, the following strategic goals were identified: 1. Improving the regulatory, institutional and operational environment for SMEs. 2. Improving the access of SMEs to financing. 3. Simplification of tax administration for SMEs. 4. Promotion of

entrepreneurial culture and development of competitive human capital and entrepreneurial skills. 5. Promotion of SME exports. 6. Strengthening the competitiveness and innovation potential of SMEs.

In 2018, by the initiative of the Ministry of Economic Development and Trade, the Council on Intellectual Property was created – an advisory and consultative Governmental body to coordinate the processes of functioning and development of the system of intellectual property legal protection in Ukraine, the organization of the Centers functioning for Technology and Innovation.

Due to the effective management of objects of intellectual property, the University of Oxford has made significant progress in the field of objects of intellectual property commercialization. The efficiency of technologies commercialization by the University in 2017 shows such figures: 685 concluded licensing and consulting agreements; 19 newly created spinouts companies; income from licensing is 8.0 million GBP; total revenue for the year is 18.7 million GBP. Technological licensing and the creation of the university's spinouts of companies are among the most effective ways of commercializing the results of scientific activity in the world.

The development of Oxford University's technological licensing department over a period of 30 years from a small office to two divisions, one of which eventually turned into a small business, as well as a stable provision of income from the university, suggests that such practices are effective and should be implemented in Ukraine.

Recommendations for Ukrainian Universities:

– To pass from passive to active commercialization of intellectual property. The management processes of commercialization of the University's SRR should conduct a separate unit (in the long run it should be a small limited liability company) with specialists who are experts in the management of commercialization projects that will directly engage in an active search for buyers or potential users – licensees for the SRR.

– To develop for the research and technologies (knowledge) transfer agreements on the acquisition of intellectual property rights and the use of intellectual property objects: in relation to previously created objects of intellectual property rights and intellectual property objects that are created by the parties during the execution of research projects, as well as on the rights of access to previously created objects of intellectual property and created during the implementation of the project.

At the state level (at the level of the Ministry of Education and Science of Ukraine and the Academy of Sciences) it is advisable to develop recommendations and model conditions for contracts for the acquisition and use of intellectual property objects and various options for relations between academic institutions, higher education institutions and enterprises on conducting research and transfer of

technology, as well as guides with instructions on choosing the terms of the contract and make it accessible to all Ukrainian research institutions and universities.

In the context of reforming the economy, transforming the tax system, Ukraine should take advantage of the UK's support for small business, centralizing strategic management and deregulation of small businesses, supporting innovation, research and development, which shows that state support for small and medium-sized businesses is a comprehensive program, which includes administrative, financial, tax, informational and advisory activities.

Adapting Britain's experience to Ukraine's national economy will help not only to create an effective system for stimulating small business, improve the quality of the business environment of the SME, but also facilitate the creation by Ukrainian universities of small innovative enterprises, the effective realization of their SRR in the market. Universities of Ukraine are centers of scientific knowledge and should become powerful scientific and educational corporations, generators of innovative development of regions.

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5.2. Evaluation of the effectiveness and efficiency of scientific research results

The development of the market of innovations is a factor of the economic development of country and a guarantee of integration into the world globalization processes. With the aim of effective interaction between representatives of the scientific community, executive authorities and real sector of the economy in the formation and implementation of a unified state policy in the sphere of scientific and technical activity, the Cabinet of Ministers of Ukraine on April 5, 2017 No 226 decreed about the establishment of the National Council of Ukraine for the Development of Science and Technology, which is a permanent advisory panel and is established by the Cabinet of Ministers of Ukraine. The Cabinet of Ministers of Ukraine on August 9, 2017 No 520 approved the composition of the National Council for the Development of Science and Technology.

The main assignment of the National Council of Ukraine for the Development of Science and Technology is to activate and increase the effectiveness of innovative activities of enterprises of Ukraine, which needs state support [1].

Table 1 shows the analytical data on the dynamics of the share of innovatively active enterprises of Lviv Oblast during the period 2007-2017 [2]. The average value of this indicator fluctuates within 12%, however, it had sharply increased in 2015.

Table 1

Innovative activity of industrial enterprises of Lviv Oblast [2]

Year	Share of enterprises that were involved into innovations	Expenditure	Including directions					
			research and development (R&D)	including		acquisition of other external knowledge	acquisition of machines, equipment and software	other expenses
				internal R&D	external R&D			
%		Thousand, UAH						
2007	15,8	272507,9	22186,6	17095,4	5091,2	627,9	229411,5	20281,9
2008	12,1	296662,2	12493,0	10195,9	2297,1	61562,4	221170,6	1436,2
2009	13,0	211070,7	10506,4	7082,2	3424,2	18107,7	182052,3	404,3
2010	13,4	139335,4	7734,5	5862,2	1872,3	17657,0	113473,3	470,6
2011	13,2	162676,8	7869,3	7454,7	414,6	221,8	148192,8	6392,9
2012	13,4	280614,4	10452,5	9053,5	1399,0	268,1	259954,9	9938,9
2013	16,6	257053,9	15719,4	7735,6	7983,8	578,7	232494,4	8261,4
2014	16,4	219754,3	16847,8	13744,6	3103,2	219,2	149875,6	52811,7
2015	19,3	277796,2	48573,9	35825,3	12748,6	1464,9	202756,6	25000,8
2017	15,2	310047,7	52084,4	52084,4	-	3447,0	207509,0	47007,3

In 2017, innovative activity involved 15.2% of the total number of industrial enterprises with an average number of employees of 50 or more [3]. The share of research and development (R&D) expenses in total expenditure was the lowest in 2008 (4.21%), but in 2015 and 2017 it had increased to 17.5% and 16.8%, respectively. But the share of expenses for the acquisition of machines, equipment and software had reached a maximum in 2012 (92.6%) and was at a minimum level in 2017 (66.9%).

So, the majority of innovatively active enterprises of Lviv Oblast prefer to spend expenses on the least risky projects, which are the acquisition of machines, equipment and software.

It is expedient to research also the indicators of implementation of innovations at these enterprises (Fig. 1, Table 1). During the analyzed period 2007-2017 there is a considerable lag in indicators of the share of enterprises that were involved into innovations and the share of enterprises that had implemented innovations. In 2007, there was difference of 6% and in 2017 it was minimal (0.3%).

Table 2

Implementation of innovations at industrial enterprises of Lviv Oblast [3]

Year	Share of enterprises that had implemented innovations, %	Number of implemented new technological processes, units	including low-waste, resource-saving	Number of titles of implemented innovative types of products, units	including new types of machines, equipment, instruments, devices	Share of sales of innovative products in amount of industrial products, %
2007	9,8	54	31	190	52	6,5
2008	8,5	54	22	138	22	3,1
2009	12,1	56	19	152	37	3,5
2010	11,6	63	17	117	31	1,6
2011	9,8	39	9	119	15	1,5
2012	10,8	46	9	115	21	2,1
2013	12,0	47	7	111	16	3,0
2014	12,6	60	13	132	15	2,1
2015	18,4	49	14	251	22	1,9
2017	14,9	41	13	247	19	-

Consequently, not all expenses that were carried out for innovative processes were efficient and effective and were ended by the commercialization in the market of results of innovative processes. In this context, the problem of the gap between the effectiveness of separate stages of the innovative process and the efficiency of innovative activity in general.

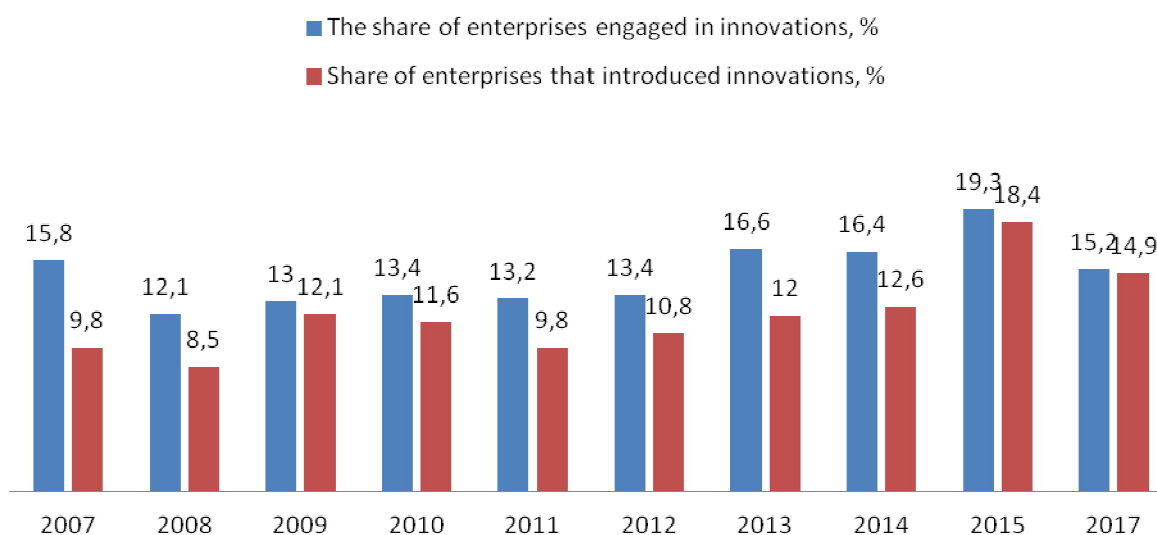


Figure 1. Indicators of the share of innovatively active enterprises and the share of implemented innovations in Lviv Oblast

Source: Compiled on the basis of [3]

The reasons for this dissonance between the indicators of innovative expenses and the indicators of implementation of new technological processes and implemented innovative types of products could be either a low level of the expected effect from the implementation of innovations or a low level of efficiency of the results of scientific developments.

Other reasons for this may be:

- mistakes in carrying out of marketing researches and justifying of research relevance;
- mistakes of marketing of innovations in general;
- low level of prospects for research results during a useful period of implementation;
- low consumer value of innovative products;
- overestimated indicators of statistical survey.

One of the important directions for preventing or warning the emergence of such negative results is the formation of a mechanism for well-established cooperation among all participants of the innovative process, as it is carried out within the ecosystem of innovation. The level of development of the ecosystem of innovation determines the level of development of innovative activities in the country as a whole, the region and a particular city.

The ecosystem of innovations has a number of features that make it possible to make an analogy of its functioning as a community of living organisms and inanimate components of their environment that interact and form a system, and also ensure the efficiency of its functioning (Fig. 2).

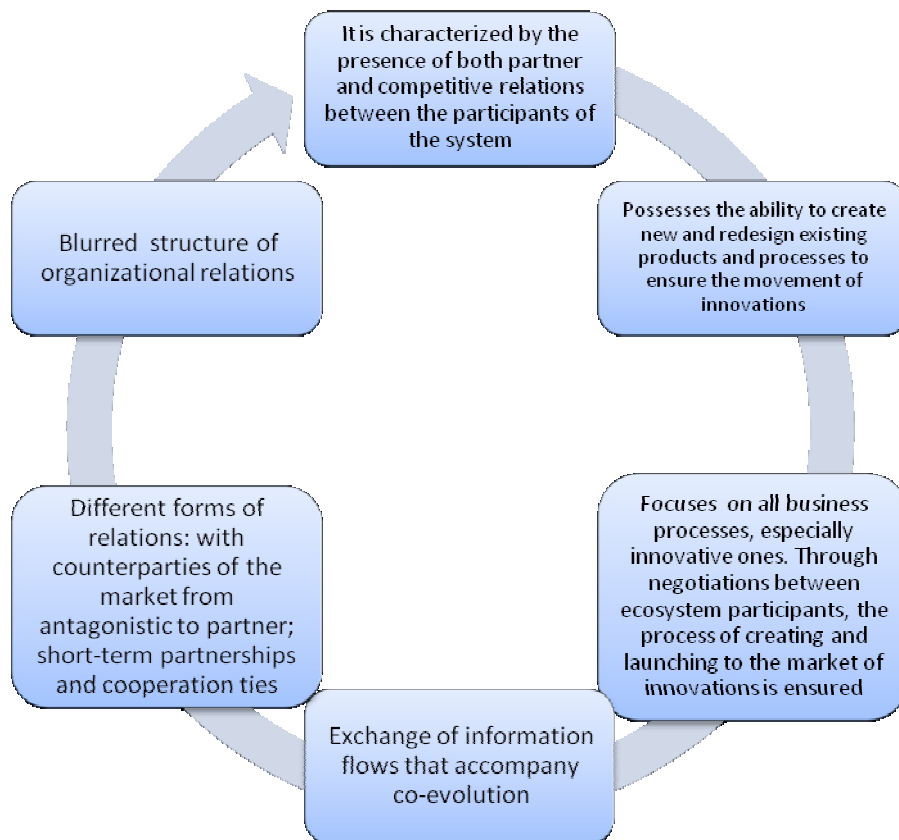


Figure 2. Features of the ecosystem of innovation

Source: Author's research

The ecosystem of innovation is the synergy of the state, business and research environment with the use of organizational, regulatory, educational and methodical, and financial resources and the implementation of a mechanism for transferring knowledge with the goal of transformation into innovative products [4].

The ecosystem of innovations is called “an information system consisting of a community of users and a resource system, which goal is to create the prerequisites for business and innovative activity through long-term self-regulation and development of the human community” [5].

The structural elements of the ecosystem of innovation are all those who participate in the process of creating innovations, the formation of consumer value and the usefulness of innovations, namely: students, universities, entrepreneurs, professionals, private investors, scientific organizations, research centers, investors, funds, industrial enterprises, use innovations for the production of goods and services and the like.

Ecosystem of innovations is considered as a mechanism for the development of innovative activity at different levels, and there are certain requirements to its formation (Fig. 3), the main one of which is the possibility of performing all the jobs and stages of the innovative process in a closed cycle and observing time constraints.

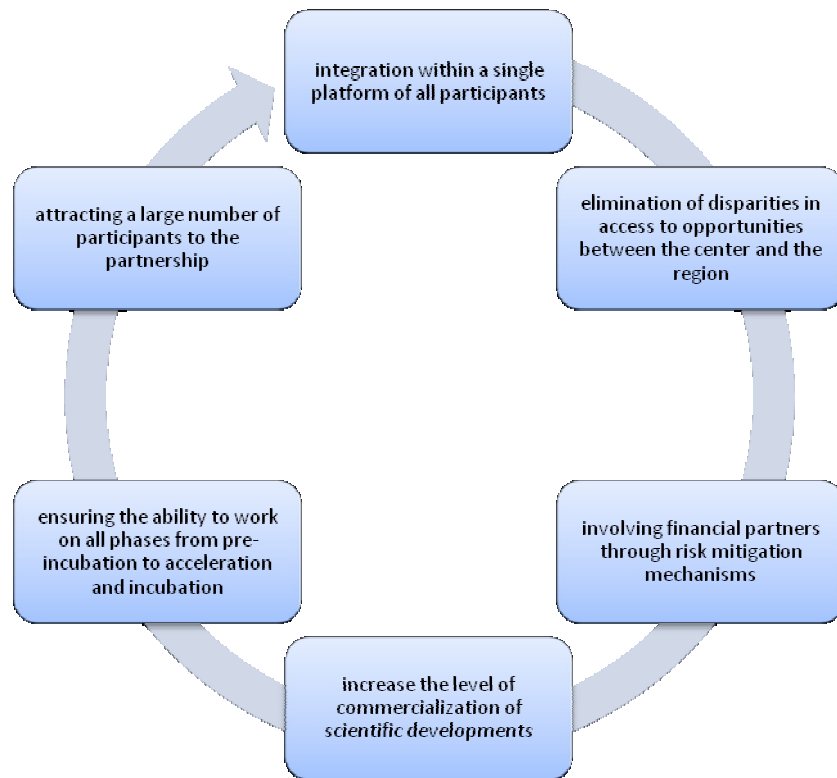


Figure 3. Requirements for the formation of an ecosystem of innovation
 Source: formed on the basis of [4, 5]

The subjects of the ecosystem are all participants involved in the process of creating and commercializing innovations [5].

Establishing active and effective cooperation in the innovative processes between the subjects of the ecosystem should be considered a guarantee of the development of the national innovative system and the economy of the state as a whole.

Collaboration on innovation is called active participation together with other enterprises or organizations in the innovative projects [6]. Possible participants in such a partnership can be a large number of stakeholder groups. Ecosystem ensures the realization of such needs of different participants (Tabl. 3).

Only 34.4% of enterprises, that implemented technological innovations in Ukraine in 2015, cooperated with other enterprises and organizations, including universities, research institutes (14.3%) [7]. This allows us to reaffirm the conclusion about the low level of consumer utility and, consequently, the commercialization of scientific results that are carried out in the process of scientific research.

The scientific result is the new scientific knowledge that is obtained in the process of research and recorded in a certain way (report, scientific paper, review, discovery, regulatory document, etc.).

Table 3

Characteristics of participants of the ecosystem of innovation by the needs for participation in partnerships

Participant	Driving forces and participation needs
For a starter (student, lecturer)	Get the necessary knowledge in the field of innovation and entrepreneurship Get a team, mentor, expertise and investment Develop your own project within the ecosystem
For university	Expand opportunities and increase the efficiency of incubators Raise the prestige of the university and its staff
For a specialist	Find a project and work Demonstrate yourself as an expert or mentor
For a company	Solve their R&D tasks, perhaps on a competitive basis Demonstrate your ability to conduct an examination or implementation of mentoring
For an investor	Find a project and a team, manage a project Project appraisal Risk reduction Find co-investment partners Invest and manage a portfolio
For the state structures	Get an information channel to the community of innovators Invest and manage a portfolio

Scientific and pedagogical, scientific workers carry out research and developments in accordance with national, state, sectoral and other programs and projects, thematic and coordination plans, contracts, tasks (technical tasks), individual plans, are responsible for the quality and timeliness of their implementation, scientific and practical value, social and economic usefulness of scientific and scientific and practical results [8, article 6].

Scientific research is the foundation of innovations, which shapes the idea and determines the level of its practical implementation. Scientific research is conducted to obtain scientific and/or scientific and technical effect. Such research include:

1) Fundamental, which are carried out for the purpose of expanding scientific knowledge, identifying, studying and systematizing the regularities of natural phenomena, irrespectively of their practical application and with the possibility of obtaining both positive and negative results;

2) Searching, that are aimed at analyzing the results of fundamental research in order to determine the feasibility and expediency, as well as ways to use the identified patterns in a particular field of science and technology to create

fundamentally new products, materials, consumer goods, technologies, etc.

The priority value of fundamental science in the development of innovative processes is determined by the fact that it acts as a generator of ideas, opens the way to new fields of knowledge. Funding of fundamental research is mainly carried out at the expense of the state budget or in the framework of state programs or international grants;

3) Applied, that is aimed at obtaining concrete results that are used in developments, designing or directly in the practical activities of enterprises and organizations when creating new types of technique, technology, etc. As a result of applied scientific research, scientific and technical (applied) results are obtained, that is, new or substantially improved materials, products, processes, devices, technologies, systems, new or substantially improved services, new design or technological solutions put into operation, completed tests, developments, that are implemented or can be implemented in social practice [8].

The execution of works at this stage is associated with a high probability of obtaining negative results, there is a risk of losses when investing in applied scientific research.

Financing of applied research works is carried out, first of all, from the state budget, and secondly, at the expense of individual customers: large industrial enterprises, joint-stock companies, commercial funds and venture firms.

Scientific research, according to the norms of statistical observations, are [6]:

– internal research and development – creative systematic development, which is carried out in-house with the aim of increasing the volume of knowledge for the development of new and improved products and processes (including the development of software by the company's own forces, that meets this goal);

– external research and development – the acquisition of scientific and research developments that are carried out by other enterprises (including other enterprises of the group), public or private research organizations and are acquired by the enterprise.

The implementation of research and development and innovative activities in general is accompanied by a high level of risk than other types of activities. Complexity, resource demand and high riskiness and unpredictability of results, potentially high profits of innovative activity determine its economic specificity in the market.

Figure 4 shows the overall dynamics of changes in expenditure indicators and the value of the risk due to changes in the stages of the life cycle of the goods.

Schematic representation of this dynamic serves as a confirmation of the opinion that the most difficult stage is research and development, especially for complex innovation, the creation of which provides for the early research of the efficiency of the technical solution that is taken as a basis for it, the design development of the pre-model sample, its approbation, improvement, development

of manufacturing technology, etc. This process can be trivial and not always successful.

The level of risk of innovation is as high as possible at the stage of developing a new product, due to the uncertainty that is associated with the innovation itself: insufficient information about it and its future profitability, especially in the early stages. Assessing the relative benefits of innovations in the early phase is particularly difficult when it comes to radical innovations. Therefore, a significant number of manufacturers, as practice shows, are not always at risk and prefer improvement innovations. Further growth of risk is assumed at the stage of decline, since initiating the improvement of the existing product is carried out.

Due to the high risk of scientific research, their funding is carried out with the involvement of the state budget of Ukraine. So, in 2016, the total expenditures for research and development by the organization's own forces amounted to 264.8 million UAH, 63.7% of which were the labor costs.

The share of financing of research and development expenditures at the expense of the state budget in 2016 amounted to 56.9%. 38.0% of the total funding was for fundamental scientific research, 26.2% – for applied and 35.8% – for scientific and technical developments.

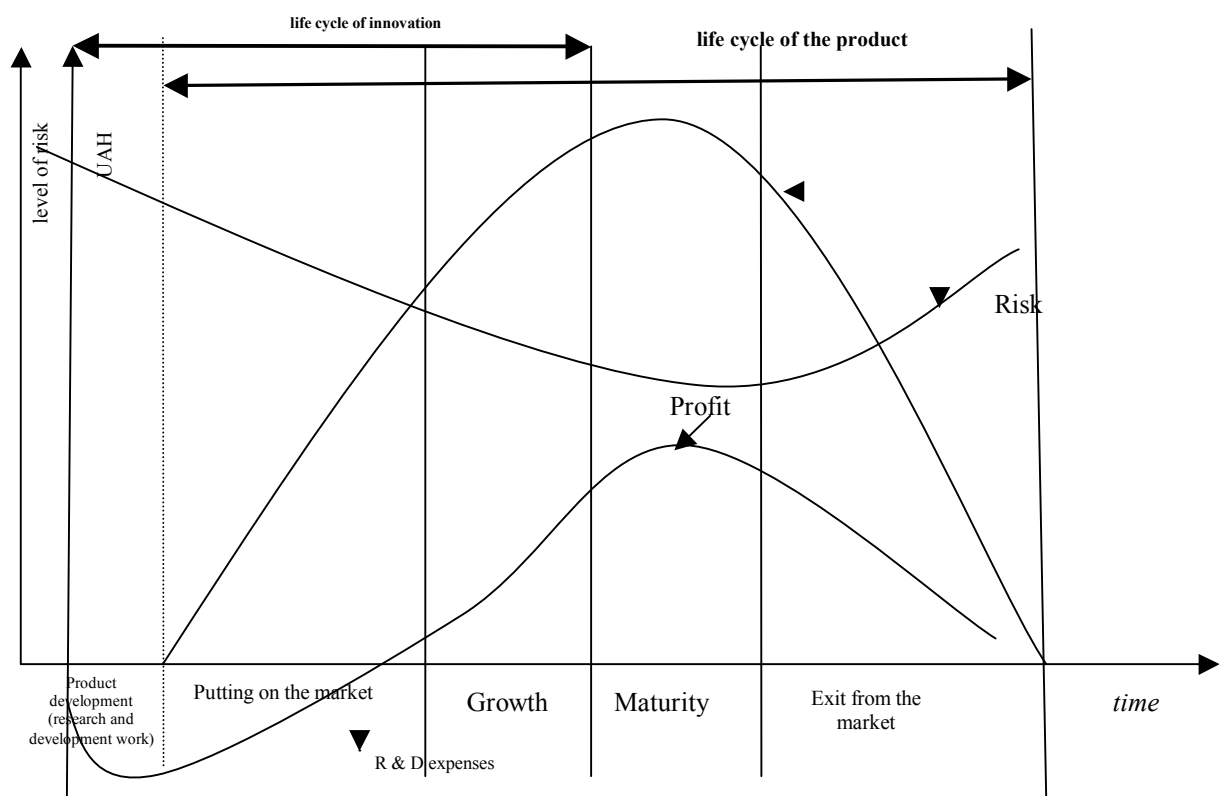


Figure 4. Dynamics of indicators of risk, profit and sales during the life cycle of product [9]

In 2017, the total expenditures for the implementation of research and development by the own forces of organizations amounted to 366.0 million UAH, 60.1% of which were the labor cost. The share of funding for research and

development expenditure at the expense of the state budget was 67.9%. Out of the total amount of financing, 38.8% went for the implementation of fundamental scientific research, 27.0% – for applied, and 34.2% – for the implementation of scientific and technical developments [10].

In 2015, with 10,862 units of products that were created by the general fund of the state budget, more than 50% (5447 units of scientific and technical products) were implemented.

The level of implementation of scientific and technical products by types is more than 54% of technologies, about 53% of methods and theories, about 49% of new types of equipment and 45% of created types of products.

In 2017, 41 new technological processes were implemented. Of the total number of processes, 13 are low-waste and resource-saving. More actively technological renewal of production was carried out by enterprises producing food products, beverages and tobacco products, where 11 new technological processes were implemented, mechanical engineering – 7, manufacturing of wood products, paper production and printing – 6 were implemented.

In 2017, industrial enterprises mastered 247 innovative products, 19 of which – new types of machines, equipment, instruments, devices. Most of all new products were implemented by enterprises producing food, beverages and tobacco products – 152, for the production of furniture, other products, repair and installation of machines and equipment – 58, machine building – 21.

To modernize production processes, Lviv Oblast enterprises acquired 49 new technologies.

The volume of realized innovative products in 2017 amounted to 763.1 million UAH. Most realized innovative products were new only for the company (89.5% of its total volume). The output, which was new to the market, in 2017 was sold at 80.2 million UAH.

The volume of innovative products supplied for export amounted to 92.9 million UAH (12.2% of its total volume).

It is advisable to confirm the statement about a clear trend of a discrepancy between the costs of research and the share of their commercialization. One of the reasons for this situation is the low profitability of the results of scientific developments.

Scientific and (or) scientific and technical (applied) results intended for implementation are called scientific (scientific and technical) products [11].

The scientific and technical (applied) result must have scientific and practical value, social and economic utility [11]. The level of utility of the scientific result determines the level of utility of innovative products, depends on the form of ownership and the conditions for using innovation. Figure 5 shows the place of usefulness of the scientific and technical result in the system of utility of innovations, which is formed at a certain stage of the innovative process.

To ensure a high level of efficiency and effectiveness of scientific research, continuous monitoring and evaluation according to established criteria is extremely necessary.

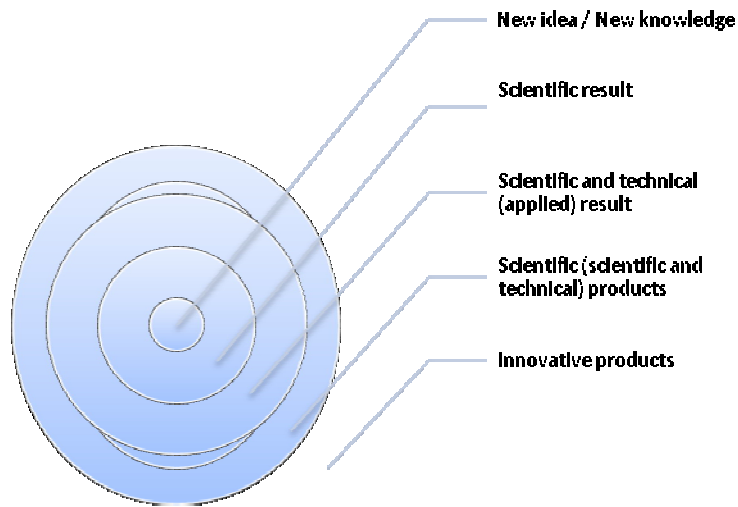


Figure 5. Formation of results by stages of the innovative process
Source: Author’s research

The purpose of evaluation of the results of scientific research is determining the expected areas of application and use of research results and formation a complex characteristic of the results, which are achieved by the using of new approaches to satisfaction of existing or created consumer needs.

To evaluate the results of scientific research, it is expedient to use the indicators of effect, effectiveness and efficiency.

An effect is the achieved result in its material, monetary, social or other dimensions. The effect characterizes the result of the innovative activity of the organization, the outcome of changing the state of a certain object under the influence of an external or internal factor and, above all, innovative.

Effects of innovation cannot in any case be summarized or set certain relationships between them, because they lie in different planes, but are interrelated.

The social effect is inherent in all types of scientific work; scientific effect – in fundamental and applied research; scientific and technical effect – in applied research and R&D; and the technical effect – in developing of scientific works.

The scientific effect goes into scientific and technical, and the last as the information about the new product develops, into technical effect. Scientific, scientific and technical, social, technical types of effect can be assessed through economic indicators. The probability and completeness of the determination of the effect increases with the passage of the scientific idea of the stages of the “research – production” cycle.

Table 4

Interdependence of effects						
Types of effects						
Scientific E_n		Scientific and technical E_{nm}			Technical E_m	
Types of economic effect E_E						
Potential		Expected			Actual	
Stages of an innovative project						
Fundamental research	Applied research		R&D	Developing		Industrial production
100%	15%	85%	100%	30%	70%	100%
Scale of the use of results E_E by stages of the innovative process						

So, in order to justify and evaluate the results of scientific research, it is necessary to take into account and determine all possible effects and consequences that may arise during its development and implementation.

To measure individual types of effect specific indicators are used, that quantitatively or qualitatively characterize the results. Their consideration reflects the poly-motivation of innovation processes. When justifying the effects of innovative activity, firstly, it is necessary to formulate criteria and indicators by which the results of innovative activity can be assessed and, secondly, objectively existing interrelations and hierarchical subordination of the effects of innovative activity should be taken into account.

According to the nature of the impact of scientific and technical developments on the economic activity of the subjects scientific and technical, economic, and environmental effects are distinguished.

In the ISO 9000: 2000 standard, the term of “effectiveness” is disclosed through the degree of implementation of the planned activity and the achievement of the planned results. The indicator of the effectiveness of scientific research is the amount of expenditures for the performance of scientific and scientific and technical works and the volume of performed scientific, scientific and technical works [12]. This approach is used in statistical surveys of innovative and scientific and technical activities in Ukraine.

Efficiency, in contrast to the effect, is a relative value, is determined through the ratio of the effect of innovative activity and the cost of obtaining it. The efficiency of innovations is the resultant value from the development, manufacture and commercialization of innovations, it means the ability of innovations to store a certain amount of labor, material and financial resources per unit of created products, technical systems, structures.

In the process of assessing the efficiency of scientific research, the following principles should be taken into account:

- consideration throughout its life cycle (calculated period) – from pre-investment research to the termination of the project;
- cash flow modeling;
- comparability of comparison conditions for various projects (project options);
- principle of positivity and maximum effect;
- time factor accounting;
- accounting only for forthcoming costs and revenues;
- comparison “with the project” and “without the project”;
- accounting for all the most significant consequences of the project (economic, ecological, social, information);
- accounting for the mismatch of interests of various project participants influences the value of the discount rate;
- multi-stage evaluation carried out at different stages of the development and implementation of the project with varying depth of study;
- accounting for the impact on efficiency of the project of working capital requirements;
- accounting for the impact of inflation and the possibility of using several currencies in the implementation of the project;
- accounting for the impact of uncertainty and risk accompanying the implementation of the project.

The efficiency of the project is characterized by a system of indicators that reproduce the cost-benefit ratio. The efficiency of an innovative project is a category that reflects the project’s relevance to the goals and interests of its participants. That is why the efficiency of the project as a whole, as well as the efficiency of participation of each of its participants, must be evaluated. In theory of innovation a large number of features by which you can group the efficiency of innovations, are distinguished. The most common of them are given in Table 5.

To justify the criteria for the efficiency of scientific research results, various approaches are used, both in statistics and in scientific organizations, directly. In particular, the criteria for the efficiency of scientific and research works is the volume of their products, which is measured by the total number or average number of publications per scientific researcher for the period under research, completed and defended dissertations, completed topics, or delivered reports [13, p. 112].

Table 5

Classification features and types of efficiency of innovations [9]

1. Consequences of obtained results	1.1. Economic – is characterized by the ratio of economic effect (growth in profits, sales of products) and costs associated with achieving this effect
	1.2. Social – is characterized by the ratio of social effect (increase in the level of employment, improvement of working conditions, etc.) and the costs associated with achieving this effect
2. Nature of expenses	2.1. Efficiency of resources – efficiency of production funds, intangible assets, labor resources, working capital
	2.2. Efficiency of costs (consumed resources) – is the efficiency of investment, current and total costs
3. Types of economic activity	3.1. Efficiency of ordinary activities – is characterized by the ratio of results and costs of ordinary activities
	3.2. Efficiency of operational activities is characterized by a correlation of results and costs of operating activities
4. Level of the object of economic activity	4.1. Efficiency of economy in general, the industry, the region
	4.2. Efficiency of the enterprise or its structural subdivision
5. Level of evaluation	5.1. Efficiency at the level of society
	5.2. Efficiency at the enterprise level
6. Evaluation conditions	6.1. Real efficiency is characterized by the ratio of the actual level of results and costs according to accounting data
	6.2. Calculated efficiency is characterized by the ratio of project (planned) indicators of results and costs
7. Degree of increase of effect	7.1. Service efficiency characterizes one-time efficiency
	7.2. Multiplication efficiency characterizes the repeatability of efficiency
8. Purpose of determining	8.1. Absolute efficiency characterizes the ratio of the total value of the result and individual types of expenditure
	8.2. Comparative efficiency is determined by comparing two or more alternatives
9. Type of process	9.1. Efficiency of production processes
	9.2. Efficiency of management
	9.3. Efficiency of investment, marketing, financial activities, etc.
10. Type of effect and significance	10.1. Commercial efficiency
	10.2. Budgetary efficiency
	10.3. Economic efficiency

In 2015, due to the funds of all sources of financing, more than 313 thousand publications were issued, which is 4.5% less than in 2014. The average number of executors of scientific research and development per 1,000 people was 3,560

printed works (in 2014 – 3,439) [14, p. 44].

This approach does not connect the result of scientific research with their implementation and use in the next stages of the innovative process.

Numerous scientific and methodological publications widely use the “only criterion of economic efficiency”. The only criterion of economic efficiency is characterized by indicators of saving of living and exteriorized labor in social production, the sphere of services that are obtained from the use of research results and their comparison with the costs of conducting research [15].

One of the most important indicators of the efficiency of using budget funds that is aimed at financing scientific and technical work remains the amount of implemented scientific and technical products. An important indicator in this regard is the implementation of scientific development in production. According to the decree of the Cabinet of Ministers of Ukraine on August 25, 2004, №1084, starting from 2008, according to the data of the chief administrators of budget funds, the results of the monitoring of the creation and implementation of scientific (scientific and technical) products are analyzed, which is carried out within three years of the creation of scientific and technical products.

The evaluation of the efficiency of innovative projects is carried out in accordance with the requirements of the Methodological recommendations for assessing the efficiency of investment projects on June 21, 1999 N VK 477.

Evaluation of efficiency of developments can also be carried out on the basis of analysis and comparison of indicators characterizing [11]:

- scientific level of development;
- economic, social and environmental importance of development;
- possible ways of commercialization and its economic feasibility.

The scientific result is evaluated by methods of technological audit in terms of indicators of the scientific and technical level of development. Evaluation of scientific and technical level of development is carried out on the basis of criteria reflecting novelty, significance for practice, quality, and compliance with standards [11].

Students of technical specialties of the Lviv Polytechnic also carry out the evaluation of indicators of the efficiency of scientific research results when performing diploma papers, in particular the economic chapter. Depending on the content of the diploma work (scientific or design direction), the implementation of the economic chapter determines the relevant features of calculating the efficiency of design decisions.

The purpose of the economic chapter of the diploma works of scientific direction is to evaluate the scientific and technical efficiency of research and development (R&D), determine the labor intensity, the timing of research, taking into account the costs of labor, material and financial resources, and generally evaluation of the cost price of development on the topic of the diploma work.

An important final task of the economic chapter is the evaluation of the level of scientific and scientific and technical effects.

The scientific effect characterizes the acquisition of new knowledge and reflects the growth of information intended for in-field application. The scientific and technical effect characterizes the possibility of using the results of research in other R&D and provides the information needed to create a new technology.

The evaluation of scientific and scientific and technical effects for the R&D is carried out by using coefficients, calculated by the formulas:

$$k_{h.p.} = \sum_{i=1}^n k_{zh.i} k_{d.i} , \quad (1)$$

$$k_{h.m.p.} = \sum_{i=1}^m k_{zh.i} k_{d.i} . \quad (2)$$

The degree of compliance with the criteria is determined through the values of qualitative indicators that can be expressed quantitatively with the use of conventional units (scores, coefficients, etc.). The list of applied indicators is determined taking into account the branch of science (natural, technical, public).

In evaluation of scientific and scientific and technical effects, various factors that influence its assessment are used.

As factors in evaluation the scientific effect, the following were adopted:

- novelty of obtained or projected results;
- depth of scientific study;
- the degree of probability of success (if work is not completed).

As factors in evaluation the scientific and technological effect, the following are applied:

- prospects of using the results;
- the scale of the possible implementation of the results;
- completeness of the results.

For each of the factors, a numerical value of the significance coefficient is established expertly. In this case, the sum of the coefficients should be equal to 1. The coefficient of the achieved level of the factor is also established expertly, and its numerical value is determined taking into account the quality of the characteristic of the factor and its characteristics. However, its value does not exceed 1.

The maximum possible value of the coefficients of scientific and technological effects is 1. The closer is their value in the first, the greater is the effectiveness of the R&D which is carried out. As a result of the graduation project, students separately determine the estimation for the performance of research, substantiate the selling price (commercialization) of the R&D result and the expected profit.

Fig. 6 and Fig. 7 present a graphical interpretation of the dependencies

between the indicators of the scientific and technological effect and the indicators of profit from the commercialization of the results of scientific research. These graphs were constructed on the basis of the analysis of 21 diploma works of Masters of ITREE of “Lviv Polytechnic”, which were carried out during 2017-2018.

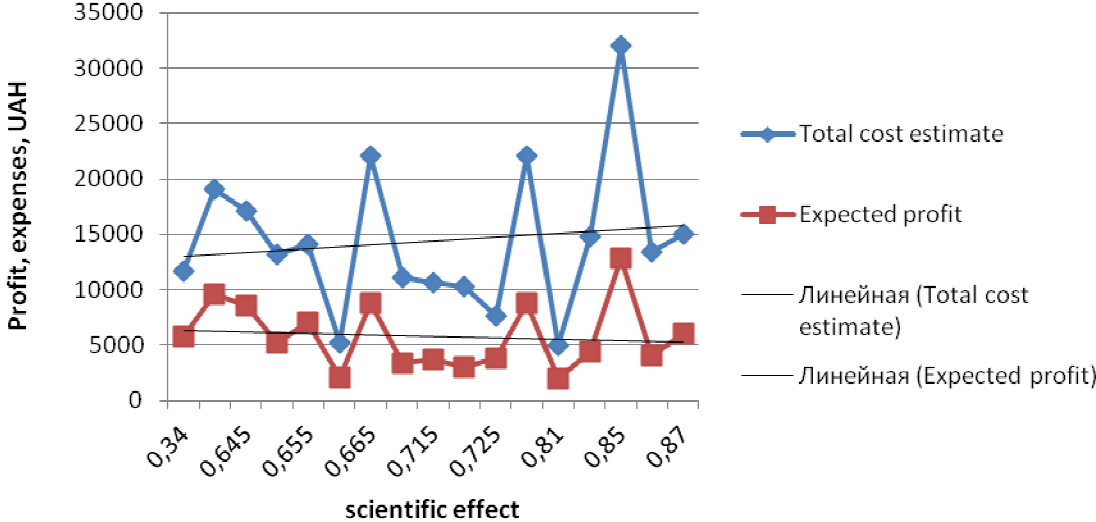


Figure 6. Dependence between indicators of the scientific effect and indicators of profit from the commercialization of scientific research results

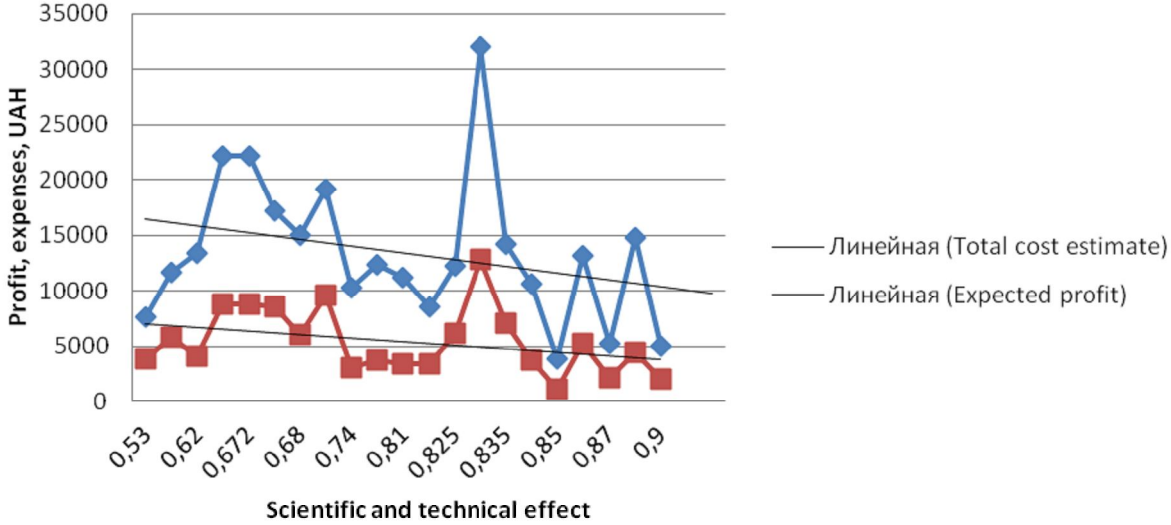


Figure 7. Dependence between indicators of scientific and technical effect and indicators of profit from the commercialization of scientific research results

The above Fig. 6 and Fig. 7 allow us to conclude that there is no correlation between the indicators of the realized costs of scientific research and the indicators of obtained scientific and scientific and technical effects.

We consider this approach to be limited, and it is advisable to improve these groups of indicators.

If the expediency of the presence in the methods of factors of level of novelty of the conducted scientific research results and the depth of scientific research

cannot be questioned, then the measure of probability of success is doubtful. Obviously, the participants in scientific research always consider the high probability of obtaining positive results. Without denying this fact, it is advisable to supplement this factor with an evaluation of the time factor for achieving positive results (Table 6).

Table 6

Points for assessment the time of obtaining a scientific effect

Time of implementation	Proposed value of assessment, points
Within 1 year	10
Within 1-3 years	4
Within 3-5 years	2

It is also advisable to improve the methodical approach for determining the coefficients of significance of the factors of expected effects.

Table 7

Coefficients of significance of factors of scientific effect

Factors	Value of coefficient	Proposed value of coefficient
Time to achieve positive results	0	0,3
Novelty of received or prospective results	0,5	0,4
Depth of scientific research	0,35	0,3

When assessing the factors of the scientific and technical effect, we also recommend the establishment of evaluation of the time factor, but its evaluation should be reduced (Table 8).

Table 8

Points for assessment the time of obtaining scientific and technical effect

Time of implementation	Proposed value of assessment, points
Within 1 year	10
Within 2 years	4
Within 3 years	2

Therefore, the factor “the prospects of using of results” should be assessed in a time dimension. Completeness of the obtained results as a factor must be supplemented with the criterion “the possibility of using of results / commercialization”.

Table 9

Coefficients of significance of factors of scientific and technical effect

Factors	Value of coefficient	Proposed value of coefficient
Time prospects of use of results in subsequent research	0	0,3
Scale of possible implementation of results	0,3	0,2
Possibility of using results / commercialization	0	0,5

For determining the indicators of the efficiency of scientific research, students use formula (3) to calculate the contractual price and (4) justify the expected profit from scientific research.

The contractual price of the result is established by agreement between the customer and implementer and is previously calculated by the formula:

$$P = C * (1 + r), \quad (3)$$

Where P – contractual price, UAH, C – cost price of conducting of R&D, UAH, r – level of rentability of expenses for implementer of R&D, share.

Then the expected profit from the commercialization of the result of scientific research is calculated by the formula:

$$P_r = P - C, \quad (4)$$

Where P_r – expected profit from implementer of R&D, UAH.

Such a definition of profit also requires supplementation with indicators corresponding to the world practice of justifying the expediency of investment. These are payback period of initial investment (τ), profitability index (ε) and net present value of the project (V). A positive feature of these indicators is that when calculating them, the time factor is taken into account, that is, the nature of the change in the cash flows (payments and receipts of the enterprise) during that period (T) for which the efficiency of investments is calculated.

When determining the amount of cash flow, it is expedient to justify the amount of profit through forecasting the magnitude of the useful effect from using the result of scientific research for the development of the following scientific areas or when developing new technical solutions in a particular branch of the national economy.

So, the proposed changes to methodical approach to the determination of scientific and scientific and technical effects will increase the reliability and objectivity of evaluation the results of scientific research.

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Appendix A

Table A.1

Interim calculations of a complex index of competitiveness of retailers in the Western region of Ukraine: relative partial indicators

Competitiveness Indicators	Estimated values of partial indicators						Average for three companies		Normalized values of partial indicators (real values relative to averages) *					
	PJSC “Silpo Retail”		PJSC “Evrotec “Arsen”		PrJSC “Furshet”				PJSC “Silpo Retail”		PJSC “Evrotec “Arsen”		PrJSC “Furshet”	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
<i>1. Group of indicators of efficiency of economic activity (EA)</i>														
1.1. Sales to Expeance ratio (SER)	1.17	1.06	1.03	1.01	1.15	1.2	1.12	1.09	1.05	0.97	0.92	0.93	1.03	1.10
1.2. Fixed-Asset Turnover (FAT)	0.26	0.22	0.18	0.16	0.23	0.21	0.22	0.20	1.16	1.12	0.81	0.81	1.03	1.07
1.3. Income-to-expense ratio (IER)	0.14	0.3	0.22	0.21	0.33	0.22	0.23	0.24	0.61	1.23	0.96	0.86	1.43	0.90
1.4. Labor productivity to Salary ratio (LPS)	1.94	1.93	1.38	1.61	1.29	1.02	1.54	1.52	1.26	1.27	0.90	1.06	0.84	0.67
<i>2. Group of indicators of financial condition of organization (FS)</i>														
2.1. Equity to Assets ratio (EAR)	0.54	0.46	0.37	0.33	0.33	0.38	0.41	0.39	1.31	1.18	0.90	0.85	0.80	0.97
2.2. Current Ratio (CR)	1.05	1.07	0.98	0.93	1.01	1.02	1.01	1.01	1.04	1.06	0.97	0.92	1.00	1.01
2.3. Acid-Test Ratio (ATR)	0.62	0.59	0.25	0.23	0.42	0.44	0.43	0.42	1.44	1.40	0.58	0.55	0.98	1.05
2.4. Current Assets Turnover (CAT)	1.32	1.36	1.22	1.27	1.06	1.25	1.20	1.29	1.10	1.05	1.02	0.98	0.88	0.97
<i>3. Group of indicators of effectiveness of goods' sales organization (EOS)</i>														
3.1. Net Profit Margin (NPM)	0.16	0.35	0.28	0.31	0.38	0.25	0.37	0.27	0.30	0.59	1.15	1.02	1.02	1.39
3.2. Inventory turnover (IT)	4.7	4.2	3.1	3.2	2.7	3.4	0.16	3.50	3.60	1.34	1.17	0.89	0.89	0.77
3.3. Capacity utilization (CU)	0.84	0.87	0.72	0.75	0.83	0.84	0.12	0.80	0.82	1.05	1.06	0.90	0.91	1.04
3.4. Sales promotion efficiency (SPE)	3.15	3.35	2.54	2.61	2.09	2.17	0.35	2.59	2.71	1.21	1.24	0.98	0.96	0.81
<i>4. The indicator of competitiveness (CT)</i>														
4.1. Index of competitiveness of retailers' goods by “price-quality” criteria	1.11	1.15	1.02	1.06	0.95	0.85	1.03	1.02	1.08	1.12	1.00	1.04	0.92	0.83

* For example, the normalized value of Sales to Expeance ratio for “Silpo” in 2017: $SER = 1.06 / 1.09 = 0.97$, that is worse (lower) than the average for three analyzed enterprises.

Table A.2 continuation

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3. Group of indicators of effectiveness of goods' sales organization (EOS)							0.25	0.25	0.983	1.174	0.972	0.967	1.045	0.859
3.1. Net Profit Margin (NPM)	0.217	0.427	0.379	0.378	0.514	0.305								
3.2. Inventory turnover (IT)	0.215	0.187	0.142	0.142	0.123	0.151								
3.3. Capacity utilization (CU)	0.127	0.127	0.108	0.110	0.125	0.123								
3.4. Sales promotion efficiency (SPE)	0.425	0.433	0.343	0.337	0.282	0.280								
4. The indicator of competitiveness (CT)							0.25	0.25	1.081	1.125	0.995	1.040	0.924	0.835
4.1. Index of competitiveness of retailers' goods by "price-quality" criteria	1.081	1.125	0.995	1.040	0.924	0.835								
5. Integrated competitiveness assessment index (CAI)							-	-	1.062	1.163	0.923	0.919	1.014	0.919

* For example, the value of the group indicator for the 1st group (EA) for "Silpo" in 2017:

$$EA = 0.301 * 0.31 + 0.213 * 0.16 + 0.493 * 0.4 + 0.127 * 0.1 = 1.134.$$

That is, "Silpo" in 2017 was quite high efficiency of economic activity (because the indicator is bigger than 1).

** CAI for "Silpo" in 2017: $CAI = (1.134 + 1.218 + 1.174 + 1.12) * 0.25 = 1.163 > 1$.

Consequently, in general, this company is the most competitive among the other competitors.

Appendix B

Estimation of retailers in the Western region of Ukraine on indicators of industry development prospects (Y - axis) for their positioning in the matrix of targeted policy Shell/DPM

Indicators	Mean			Maxim. score (points)
	«Silpo»	«Arsen»	«Furshet»	
<i>1. Segment size and growth rate</i>				
-Temp of growth industry	8.8	6.3	7.5	10
- Phase of demand development (level of influence on innovation)	8.8	9.4	5.0	10
- Market capacity	9.4	7.5	5.6	10
- Purchasing power of buyers	6.3	6.9	4.4	10
Comprehensive component evaluation 1	33.1	30.0	22.5	40
Average component score 1	8.3	7.5	5.6	10
<i>2. Customer needs and behavior</i>				
-Social sector profit rate	8.1	4.4	5.9	10
-Privacy of buyers to TM	5.6	8.1	8.8	10
-Social stability of the sectoral rate of return	7.5	5.6	6.3	10
-Technological barriers to entry in the industry	3.1	6.3	8.1	10
-the level of utilization of branch capacities	8.8	6.3	4.4	10
-Property of products	6.9	5.6	8.8	10
Comprehensive component evaluation 2	40.0	36.3	42.2	60
Average component score 2	6.7	6.0	7.0	10
<i>3. Macro trends</i>				
-Price buyer (meeting this expectations)	8.8	9.4	5.6	10
-Competitive advancement	9.4	5.6	7.5	10
-The value of contractual discipline in the industry	9.4	6.9	5.6	10
-Enterprise suppliers in the industry	10.0	9.4	8.8	10
-The influence of the state on the state of the industry	7.5	7.5	7.5	10
-Image of industry in society	9.4	9.4	9.4	10
Comprehensive component evaluation 3	54.4	48.1	44.4	60
Average component score 3	9.1	8.0	7.4	10
Total score for three components	127.5	114.4	109.1	160
Average score for three components	8.0	7.2	6.7	10
Qualitative evaluation of the obtained average marks	High level	Medium level	Medium level	-

Notes:

* Balance evaluation is performed on average points by polling experts (buyers of relevant retail networks, merchandisers networks, network providers);

** The assessment involves determining the impact of changes in the industry on the retailer's activities;

*** the low level of assessment of the prospects we take up to 5 points (the grade of the score for 3 components, the average - from 5 to 7.5 points. high from 7.5 to 10 points

SWOT components evaluation of PJSC “Silpo Retail”

SWOT COMPONENTS EVALUATION					
Strengths	Grade	Value	Weaknesses	Grade	Value
Product quality	5	5	Low purchasing power of consumers	5	4
Relevant prices to any class of consumers	5	4	Strong competition	5	3
Loyalty program	4	3	Unstable economic situation in the country	5	4
Rational arrangement of goods	4	3			
Efficiency of sales policy	5	5			
Total score	23	20	Total score	15	11
	0.87			0.73	
Opportunities	Grade	Value	Threats	Grade	Value
Opening of new supermarkets	4	2	Change the needs and tastes of consumers	4	3
Extension of trademarks	3	3	Competition	3	3
Attracting new consumers thanks to the positive image of the company	5	5	Inflation	4	4
Total score	12	10	Total score	11	10
	0.83			0.90	

* in tables of Appendices C, D and E maximum score for impact factor = 5, minimum = 1; maximum weight factor = 5, minimum = 1;

"Total" means the average score of the relevant component (S, W, O or T), considering the significance of the underlying factors taken into consideration;

The assessment is used to build a SWOT-“diamond” of the organization concerned.

Appendix D

SWOT components evaluation of PJSC “Evrotec “Arsen”

SWOT COMPONENTS EVALUATION					
Strengths	<i>Grade</i>	<i>Value</i>	Weaknesses	<i>Grade</i>	<i>Value</i>
Production capacity	5	5	Insufficient level of merchandising of goods	5	4
Affordable prices	5	4	No indication of where and what is located	5	5
Efficiency of sales policy	5	5	Insufficient skill level of employees	5	5
Convenient location of supermarkets	5	3	The presence of many competitors	5	3
Total score	20	17	Total score	20	17
	0.85			0.85	
Opportunities	<i>Grade</i>	<i>Value</i>	Threats	<i>Grade</i>	<i>Value</i>
Expansion of retail space	5	3	Closing supermarkets	5	5
Extension of the range of products	4	3	Inflation	4	4
Implementation of the loyalty program	5	5	Low income population	5	4
Total score	14	11	Total score	14	13
	0.78			0.93	

Appendix E

SWOT components evaluation of PrJSC “Furshet”

SWOT COMPONENTS EVALUATION					
Strengths	<i>Grade</i>	<i>Value</i>	Weaknesses	<i>Grade</i>	<i>Value</i>
Loyalty program	4	3	Insufficient qualifications of employees	5	5
Efficiency of sales policy	5	5			
Product quality	5	4			
Large assortment of goods	4	3	Relatively positive image of the retailer	5	3
Social responsibility	4	4	Merchandising of goods	5	3
Affordable prices	5	4			
Total score	27	23	Total score	15	11
	0.85			0.73	
Opportunities	<i>Grade</i>	<i>Value</i>	Threats	<i>Grade</i>	<i>Value</i>
Formation of a positive image	5	4	Reducing the purchasing power of the population	5	4
Expansion of retail space	4	3	Inflation	4	4
Attraction of new buyers due to the popularity of the brand	5	5	The presence of strong competition	4	3
Total score	14	12	Total score	13	11
	0.86			0.84	

SCIENTIFIC EDITION

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