MINISTRY OF EDUCATION OF THE REPUBLIC OF BELARUS

Vitebsk State
TECHNOLOGICAL
UNIVERSITY

# EDUCATION AND SCIENCE IN THE 21ST CENTURY

## Articles of the VII International Scientific and Practical Conference

October 27, 2022

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## SECTION 1. INDUSTRIAL TECHNOLOGIES AND EQUIPMENT

UDC 7.067

# FEATURES OF TYPOGRAPHY IN TRANSLATED JAPANESE COMICS

# ОСОБЕННОСТИ ТИПОГРАФИКИ В ПЕРЕВОДНЫХ ЯПОНСКИХ КОМИКСАХ

***Abramovich N.*, Prasmytskaya M.***
*Vitebsk State Technological University, Belarus*
*e-mail: Abramovich@vstu.by**
***Абрамович Н.А*, Прасмыцкая М.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: manga, typeset, optical balance, justification, font composition.*
*Ключевые слова: манга, верстка, оптический баланс, выравнивание, шрифтовая композиция.*

*Abstract. The analytical study is devoted to the art of layout and the features of font compositions of graphic Japanese literature, the process of manga translation and typeset. It has been studied how a font composition is built in a visual-text way of communication and the adaptation of ideographic writing to alpha-sound writing is carried out, the layout rules in a text cloud (bubble) are analyzed.*
*Аннотация. Аналитическое исследование посвящено искусству верстки и особенностям шрифтовых композиций графической японской литературы, процессу перевода и набора манги. Изучено, как строится шрифтовая композиция при визуально-текстовом способе общения и осуществляется адаптация идеографического письма к альфа-звуковому письму, анализируются правила компоновки в текстовом облаке.*

The object of the study is the influence of visual balance and optical factors on the layout of text in the development of graphic products, the subject of the study is manga, often called "Japanese comics". The purpose of the study is to identify the influence of optical factors on layout in the visual-text way of communication.

Japanese hieroglyphs are read from top to bottom, while in Latin and Cyrillic the text is placed horizontally, moreover, in the first case, the volume of text characters is much smaller. When adapting the text in bubbles to Latin or Cyrillic, certain layout tasks arise: reading direction, use of punctuation marks, different volumes of alphabetic characters and hieroglyphs, optical compensation of alphabetic characters in bubbles.

Graphic Japanese literature or manga is part of modern mass communication and is characterized by the use of a visual-textual method of communication based on the visualization of information and the reduction of the role of text. Visualization, in this

case, refers to the widespread use of visual means – drawings, photographs and videos – for the transfer of information and the solution of certain communication tasks. Manga occupies an important place in modern Japanese culture, which allows us to consider it as a special type of media content that integrates lexical and visual components, which is an integral part of the national communication system. With the development and wide distribution of Japanese, Chinese and Korean comics, there was a need to translate this literature into European languages, as a result of which teams appeared that translate, re-touch and insert text into manga.

The process of creating a good translation is a painstaking work that consists of several phases. The work process is organized as follows: initially, the Japanese version of the comic is translated in usual text format. Subsequently, the cleaner handles foreign digital comics. This is a person whose task is to clean manga pages from artifacts – unwanted side effects that occur during image processing. In addition, the cleaner removes foreign sounds that indicate actions and restores the background behind them. In conclusion, he removes the text from the bubbles – a cloud with the dialogue of the characters, his/her thoughts, where the text is mainly placed. The main difficulty of the cleaner's work is that it is necessary to restore the image that was behind the text. This can be problematic, since some Japanese characters can take up one third of the entire page (Fig. 1).


Figure 1 – Cleaner work: processed image and original image

Typesetting or lettering is the art of arranging text, drawing letters and setting different fonts on a page, in which typefaces are emphasized. The typographer inserts the translation text into the dialogue clouds prepared by the cleaner, and also decorates the sounds. Since the spelling of eastern characters is fundamentally different from western ones, typographers have to adapt the translation to the standards of alphanumeric writing.

Japanese characters are read from top to bottom, while in Latin and Cyrillic the text is placed horizontally. Therefore, in some cases, if the background allows, typographers expand the dialog cloud vertically. This is done in order to be able to place the entire text in the bubble, because one hieroglyph can contain a whole sentence. A special feature is also that the Japanese read text blocks from right to left. In most cases, manga authors draw a variety of bubbles, that is, in addition to the usual rounded ones, there are irregularly shaped clouds, for example, cropped, placed on the right or left, triangular and others. If we are talking about a standard round bubble, then

the text will be located in the middle. There is such a thing as the geometric center of mass, it is that will be the center of the cloud. However, it is worth noting that the human eye tends to see the compositional center higher than it really is. Thus, when placed in a cloud of text, it is necessary to insert it slightly above the physical center, building a visual balance. Also, one of the basic rules is how the text is arranged in the bubble itself. If the bubble is pulled out, you also need to stretch the area with the text. In order for the finished cloud to look like the original and remain readable, you need to find a middle ground between the number of hyphens and the overall shape of the column with text relative to the cloud. Figure 2(a) shows two text layout options. From an aesthetic point of view, the option on the right looks smarter. Figure 2(b) shows one of the most pronounced violations of the composition – the position of the text in the likeness of a "Christmas tree".


a b

Figure 2 – Better hyphenated form:
a – use of hyphens; b – torn edge without hyphenation

Breaking down text into phrases should be taken seriously. On the one hand, this is a way to simplify reading, on the other hand, to place accents. Thus, the transfer of words to the next line must be done according to the meaning, so that there is a whole statement on each line. You should also follow the rule: "one bubble – one phrase".

You should pay attention to the font size in general and its size in relation to the cloud. In this case, book publishing standards are used. The font size must be legible, no less than 12 points. In addition to this, the height of the font should be equal to the distance between the test and the frame, as shown in Figure 3.


Figure 3 – The ratio of the size and fields of the cloud

The fundamental rule in type is the rule of punctuation compensation. There are two terms that fit under the concept of punctuation compensation – these are "hanging

punctuation" and "optical alignment". "Hanging punctuation" occurs when quotation marks, brackets, bullets are taken out of the dialing line, since punctuation marks have less weight than letters. However, from the point of view of professional layout, it is more correct to use the concept of "optical alignment". It says that punctuation marks have less weight than letters, however, if certain massive punctuation marks are taken out completely beyond the line, then this will, on the contrary, attract attention and serve as an accident. Therefore, punctuation marks are partially taken out of the line. In typewriter, the issue of compensation is exceptional. The difference is that all the text in the manga is centered. Therefore, for visual balance and text placement in the middle, all characters are compensated. It is worth mentioning that punctuation in Russian and Japanese is also different. You need to translate not only words, but also pay attention to signs. You should always put punctuation marks at the end of the text cloud, even if they are not in the Japanese bubble. This makes it more professional when adapted to another language.

Manga, which uses a combination of graphics and text to convey information, is a unique type of content that is very popular and widespread both in Japan and abroad. Given the graphic and content features, manga occupies a certain niche in graphic and text communication, as well as among similar media. Thus, manga translation is a full-fledged art in which you need to learn not only to design complex Japanese stories, but also to control the reader's perception, placing accents and programming their aesthetic vision of typography.

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# MODIFICATION OF MINERAL CLAY AND THE BASIS OF CHITOSAN AND ITS USE IN WASTEWATER TREATMENT AND TEXTILE INDUSTRY

***Alieva M.T.**, Ikhtiyarova G.A., Kholturaeva N.R.***
*Tashkent State Technical University, Uzbekistan*
*e-mail: a.muqaddas5854@gmail.com**

*Keywords: chitin, chitosan, indigo, organosorbent, spectrophotometer.*

*Abstract. This article presents the results of sorption of indigo dye used for purification of textile industry wastewater of Navbahor bentonites modified with chitosan of the Republic of Uzbekistan.*

In recent years, a large amount of waste water has accumulated in industrial enterprises around the world. Cleaning and returning it to the system is one of the urgent problems. However, cleaning is a multi-step process that takes a lot of time. Treatment of industrial wastewater should be carried out taking into account its composition. Waste treatment methods are divided into: mechanical, chemical, physico-chemical and biological types, but when they are used together, the method of wastewater treatment and disposal is called a combined method. The use of this method is determined in each specific case by the nature of pollution and the harmful level of released compounds [1]. One of the methods of chemical cleaning of waste, especially of the textile industry, is cleaning with the help of various adsorbents [2–3]. In this work, the organosorbent obtained as a result of modification named of Navbahor bentonite of the Republic of Uzbekistan with chitosan was used. Industrial wastewater of textile enterprises was taken as an object. When its composition was studied, it was found that it consists of various metal ions, dissolved salts and pigment dye residues.

Indigo dye solutions of different concentrations were prepared for this purpose. The absorbance level of indigo dye was determined on a UV-5100 spectrophotometer at a wavelength of 315 nm. The obtained results are presented in the following table and Figure 1, 2.

Table – Dependence of indigo dye adsorption on solution coconcentration

| Indigo dye, concentration, mg/l | Amount absorbed in adsorption mg/l | Amount remaining in solution after adsorption, mg/l | The absorption concentration of the solution,% |
|---|---|---|---|
| 1 | 0.961 | 0.039 | 96.1 |
| 2 | 1.62 | 0.38 | 81.0 |
| 5 | 3.69 | 1.31 | 73.8 |
| 10 | 5.23 | 4.77 | 52.3 |
| 20 | 7.55 | 12.45 | 37.75 |
| 30 | 10.45 | 19.55 | 34.84 |

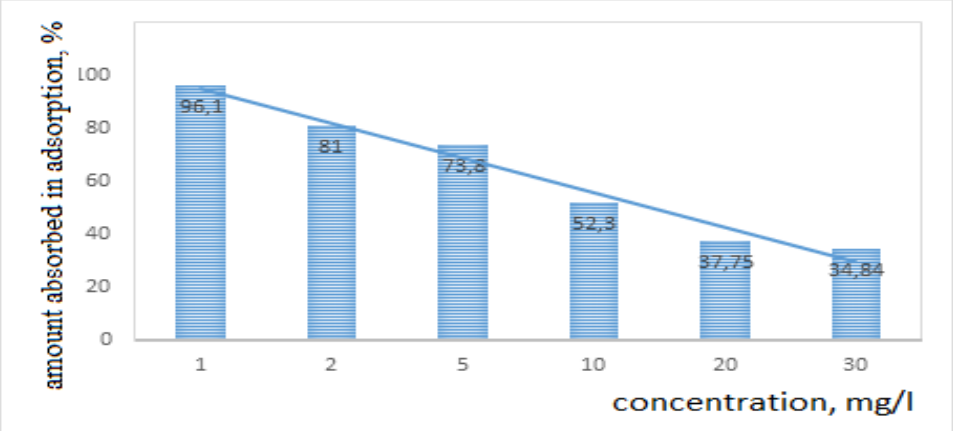


Figure 1 – Dependence of indigo dye solution adsorption on solution concentration

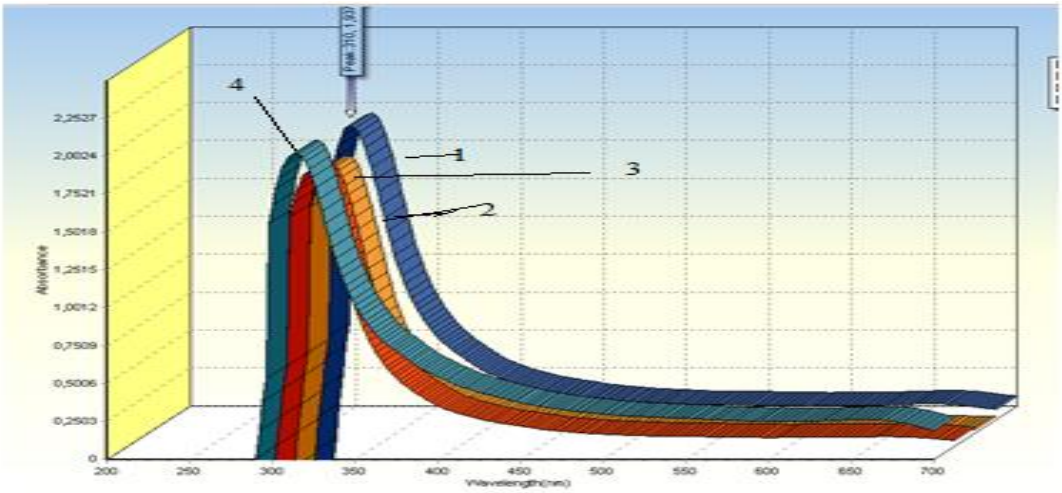


Figure 2 – 1 – BAU adsorbent; 2 – VK+HCl (12 %); 3 – VK+HCl (12 %)+XZ; 4 – WW (waste water)

The results of the obtained analysis show that the amount of adsorption absorption of indigo dye in the prepared solution with a concentration of 1-30 mg/l decreases from 96.1 % to 34.84 %, that is, its absorption capacity can be seen to decrease as the concentration increases. The concentration of indigo dye in 20 and 30 mg/l solutions is almost close, indicating that it has reached its saturation point. In short, it indicates the possibility of using colored dyes from the composition of textile industrial wastewater in the sorption of our organosorbents.

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# RECYCLING AS A CHEMICAL TECHNOLOGY FOR PROCESSING POLYMER WASTE

# РЕЦИКЛИНГ КАК ХИМИЧЕСКАЯ ТЕХНОЛОГИЯ ПЕРЕРАБОТКИ ПОЛИМЕРНЫХ ОТХОДОВ

***Antonova E.L.[1], Sytsko V.E.[1], Kuzmenkova N.V.[1],***
***Shapovalov V.M.[2], Zotov S.V.[2]***
*[1]Belarusian Trade and Economic University of Consumer Cooperation Gomel, Belarus*
*[2]Institute of Mechanics of Metal Polymer Systems named after V.A. Bely of the National Academy of Sciences of Belarus, Belarus*
***Антонова Е.Л.[1], Сыцко В.Е.[1], Кузьменкова Н.В.[1],***
***Шаповалов В.М.[2], Зотов С.В.[2]***
*[1]Белорусский торгово-экономический университет потребительской кооперации, Республика Беларусь*
*[2]Институт механики металлополимерных систем имени В.А. Белого Национальной академии наук Беларуси, Республика Беларусь*

*Keywords: recycling, polymer waste, modifying additives, composites.*
*Ключевые слова: рециклинг, полимерные отходы, модифицирующие добавки, композиты.*

*Abstract. The problems of recycling polymer waste are associated with the growth of polymer production and their processing. The problem of recycling polymer waste generated in solid municipal waste is quite acute. For the efficient recycling of polymer materials, it is necessary to develop new modifying additives that could ensure the compatibility of polymer waste in the composite system. Such additives can be used as special complex concentrates to restore the primary properties of secondary polymer materials. They include primary and secondary antioxidants, phosphites or phosphonites, thermal and light stabilizers of phenolic and amine type, neutralizing active radicals accumulated in the polymer and decomposing peroxide compounds. Using new types of equipment for recycling polymer materials based on polymer waste, it is possible to obtain high-quality products with low cost for industry, construction and agriculture.*

The authors propose a hypothesis that the targeted thermal oxidative destruction of some secondary polymers may be one of the least expensive methods for obtaining

active functional additives capable of participating in the physicochemical processes of modifying other secondary polymers and/or their mixtures. In high-molecular compounds with polar groups, there are significant reserves for the manifestation of physicochemical activity. A decrease in the molecular weight of polymers could increase reserves, forming new active centers for inter- and intramolecular interactions. This can and should be used by creating conditions for obtaining stable compositions consisting of oligomeric fractions, the degree of activity of which is sufficient to manifest the desired effect. Based on the proposed idea, new methods of regulated recycling of secondary polymers could provide new chemical products with high competitiveness in the markets [1].

Due to the growing production of polymer materials in the world, there is a problem of recycling polymer waste, which is a threat to environmental pollution. The volume of polymer waste in Europe is increasing by almost 30 % per year and for every European resident their annual accumulation is approximately 20 kg. To a greater extent, this is due to the specifics of polymer materials that do not undergo rotting and corrosion for a long time, since they decompose extremely slowly under natural conditions and are practically not exposed to micrographs, being a serious source of environmental pollution. [2].

Particularly acute is the problem of recycling and disposal of polymer waste generated in municipal solid waste, a significant part of which in many countries is not used for further processing. Most of the polyethylene and polypropylene film waste generated in the municipal sector is heavily polluted and consists of polymers that have undergone destructive changes, which significantly complicates their processing, and in most cases their processing is economically impractical. Another factor constraining the widespread use of polymer wastes, especially heterogeneous ones, is their low entropy of mixing, which does not provide thermodynamic compatibility for most polymers. As a result, when composites are formed on their basis, fibrillation of components is observed. In addition, polymer waste is often formed in solid household waste in the form of osprey, which also does not contribute to the effectiveness of their use in polymer materials technology. The limiting factor of the widespread use of polyolefin waste in the production of products is the occurrence of oxidative processes in them, which can have a significant impact on the change in the structure and properties of the materials obtained. At the same time, the ability of thermoplastic polymer materials to be repeatedly processed without significant deterioration of their properties is one of their advantages. At the same time, polymer waste can be a valuable raw material that replaces primary polymer materials in a number of positions [3].

In general, recycling of polymer waste is determined by three main aspects:

- The organizational and legal aspect, where the most important is the organization of collection and sorting of household waste, as well as legislative acts that stimulate work with waste disposal, both for the population and for industrial enterprises.
- Technical and technological aspect, including hardware and technological support of the recycling process and improvement of the properties of products based

on waste. This is one of the main directions in the use of waste polymer materials, especially heterogeneous, which are inherent in MSW. At the same time, in order to obtain functional products with acceptable performance characteristics from them, it is necessary to develop specialized additives that ensure the compatibility of the components of the mixture and the formation of a homogeneous structure of the final product.

- Ecological and economic aspect is presented by the selection of an assortment of products from secondary raw materials for its rational use in various areas of the national economy, reduction of the cost of secondary raw materials and ensuring environmental safety [4].

In the field of polymer waste recycling, an important document is signed in October 2018 of the Global Agreement on Combating Plastic Pollution. In addition to the refusal to use non-recyclable, disposable and redundant packaging, the existing agreement clearly states the need to introduce innovations that would ensure the safe use of packaging and its recycling by 2025, as well as the expansion of the use of secondary polymers in production [5]. This requires scientific research, primarily in the field of polymer materials science, which will be aimed at increasing the ability of secondary polymers to recover. At the same time, the ability to recover determines the possibility of using polymer waste in production practice. Despite a number of studies in this direction, there is no holistic solution to this problem. In particular, this is typical for polymer waste generated in municipal solid waste, which is due to the lack of sorted polymer materials, their contamination and reduced mechanical and technological characteristics. For more efficient creation of multicomponent polymer systems using secondary polymers, it is necessary to:

- develop modifiers to improve the compatibility of thermoplastic waste, while compatibility should be understood as the ability of two or more polymers to be processed into a single material with properties acceptable for a particular use;
- improve the processes of combining polymer waste with modifying additives during agglomeration and granulation, especially in mixed compositions;
- investigate the features of the performance of the components of mixtures during repeated processing for purposeful regulation of the resistance of the material to thermal, oxidative and mechanical-chemical destruction;
- develop a methodology and analysis of polymer waste generation for reasonable use in the creation of new and improved composites with the best recyclability and mechanical properties;
- create and improve specialized energy-saving processing equipment taking into account the technological features of the preparation and processing of polymer waste.

Solving these problems will make it possible to create new promising multi-component polymer systems based on secondary polymer raw materials. Together with new types of equipment for recycling polymer materials, conditions will be created for the effective disposal of polymer waste and the production of high-quality products based on them with an attractive price for the consumer and reliable work in various

sectors of the national economy, as well as solving issues related to environmental protection.

Thus, the most important task in obtaining technically valuable polymer raw materials from polymer waste is the selection of additives that affect the compatibility of polymer components in the composite system and its operational properties. An equally important task is the creation of specialized energy-saving processing equipment aimed at improving the efficiency of the preparation of polymer waste into secondary polymer raw materials. This will contribute to the economy of primary polymer materials, as well as the preservation of hydrocarbon raw materials for its production. This will ensure the improvement of the environmental situation in the country.

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# DEVELOPMENT OF A METHOD FOR TESTING HEAVY METAL IONS WITH NITRASONIUM REAGENT YELLOW

# РАЗРАБОТКА МЕТОДА ИСПЫТАНИЯ ИОНОВ ТЯЖЕЛЫХ МЕТАЛЛОВ С НИТРАЗОНИЕВЫМ РЕАГЕНТОМ ЖЕЛТЫМ

***Gulboeva D.R.[1], Alieva M.T.[2]***
*[1]Tashkent State Technical University, Uzbekistan*
*[2]Karshi State University, Uzbekistan*
*e-mail: a.muqaddas5854@gmail.com[2]*

*Keywords: immobilization, complex-formation, sorption- spectroscopy, copper.*
*Ключевые слова: иммобилизация, комплекс образование, сорбционная спектроскопия, медь.*

*Abstract. Complex-formation of copperier ions with immobilize nitrazine yellow has been investigated for elaboration of method of solid-phase spectrophotometric determination of ions $Cu^{2+}$ in natural objects. Optimal conditions of immobilization and complex-formation have been determined.*

*Аннотация. Изучен комплекс образования ионов меди с иммобилизованным нитразиновым желтым для разработки методики твердофазного спектрофотометрического определения меди в искусственных смесях, имитирующих реальные объекты. Найдены оптимальные условия иммобилизации и комплекс образования.*

It is known, that the current level of rapid development of industry and technology, pollution of environmental objects with various substances, including heavy and toxic metals require the development of highly sensitive and expressive analytical methods that allow determining their micro quantities. The accumulation of heavy and toxic metals in living organisms, exceeding the permissible limit (MAC) when passing through water, air, food and other objects, can cause various diseases. In particular, some metals and their compounds are toxic if they exceed the MAC. Therefore, the development of sensitive, economical, selective methods for the determination of trace elements of certain metals in various objects is an urgent task today.

In this work, to implement a new spectrophotometric method that meets modern requirements, we chose the optimal conditions for the formation of a complex of metals, in particular, copper and nickel with 2.4-dinitro-azo-1 disodium salt. -naphthol-3.6-disulfosylate. (nitrazonium yellow) and on its basis to develop methods for determining physical-and-chemical properties of these metals.

The results of the experiment were obtained on an optical spectrophotometer, and the concentration of the reagents was studied on a photo colorimeter (KFK-2). The dependence of the optical density of the complex compound on the acidity of the

medium, equal to the optimal pH = 3.5-4.5, was studied, and a universal buffer solution was chosen as the optimal buffer solution.

In our work, it was found that the test method gives unique complex compounds by choosing the optimal conditions for creating and carrying out the reaction under optimal conditions. In order to determine the optimal conditions and increase the selectivity of the reactions, we studied the dependence of the optical density on various factors. The results of the reaction of some metal ions with sodium salt reagent (nitrazonium yellow) 2.4-dinitro-azo-1-naphthol-3.6-disulfoxylate are presented in the table.

Table 1 – Results of the reaction of some metal ions with the disodium salt (nitrazonium gel) reagent of 2.4-dinitro-azo-1-naphthol-3.6-disulfoacid

| № | Cation | The initial color of the cation solution | The solution of the reagent complex with metal ions in water | pH environment | A solution of the complex formed by the reagent with metal ions in ethyl alcohol | pH environment |
|---|---|---|---|---|---|---|
| 1 | Zn | colorless | does not change | pH=3 | does not change | pH=3 |
| 2 | Cu | the apostle | light green | pH=2 | light inky color | pH=2 |
| 3 | Cd | colorless | pink raspberry color | pH=7 | кизарди | pH=7 |
| 4 | Co | pink | pale pink precipitate | pH=2 | pale pink precipitate | pH=2 |
| 5 | Hg | colorless | ink-colored precipitate | pH=2 | light inky color | pH=2 |
| 6 | Pb | colorless | does not change | pH=2 | light yellow(less sediment) | pH=7 |
| 7 | AI | colorless | does not change | pH=3 | does not change | pH=5 |
| 8 | Mg | colorless | orange color | pH=10 | orange color | pH=9 |
| 9 | Mn | colorless | light pink color | pH=7 | light pink color | pH=7 |
| 10 | K | colorless | does not change | pH=5 | raspberry color | pH=5 |
| 11 | Sb | colorless | dark white pink precipitate | pH=7 | dark white pink precipitate | pH=7 |
| 12 | Ni | green | red raspberry color | pH=2 | red raspberry color | pH=2 |
| 13 | Ca | colorless | does not change | pH=4 | does not change | pH=4 |

In conclusion, based on the obtained results, the fact that metal ions form a colored complex with the reagent is the basis for creating a test method.

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# COMPOSITE MATERIALS: TYPES AND PRODUCTION METHODS

# КОМПОЗИЦИОННЫЕ МАТЕРИАЛЫ: ВИДЫ И СПОСОБЫ ПРОИЗВОДСТВА

***Katovich A.V.***
*Vitebsk State Technological University, Belarus*
*e-mail: anton.kotovich97@gmail.com*
***Котович А.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: composite material, composite, matrix, filler, structure.*
*Ключевые слова: композиционный материал, композит, матрица, наполнитель, структура.*

*Abstract. In this article the areas of application of composite materials were considered, the types of composite materials depending on the material of the matrix and the type of reinforcing element were shown. Examples of the most popular materials of the matrix and reinforcing element for each type of composite materials are given. The main stages and methods of composite materials production are briefly described.*

*Аннотация. В данной статье были рассмотрены области применения композиционных материалов, показаны виды композиционных материалов в зависимости от материала матрицы и вида армирующего элемента. Приведены примеры наиболее популярных материалов матрицы и армирующего элемента для каждого вида композиционных материалов. Кратко описаны основные этапы и методы производства композиционных материалов.*

Nowadays composite materials are one of the most demanded materials in many industries. They are most widespread in the construction industry, shipbuilding, aircraft construction, automotive industry, as well as in the production of friction and antifriction parts due to the unique combination of properties, possibility of their

modernization, as well as the variety of composite materials, which allows choosing the best option for specific operating conditions.

Composite materials (composites) represent a matrix, metallic or nonmetallic, in which reinforcing elements are located in a certain way [1].

According to the structure composite materials are divided into three main groups: dispersion-strengthened, fibrous and layered. In dispersion-strengthened composites the reinforcing elements are fine powders introduced into the matrix. In fiber composites both separate strands and ribbons, harnesses, fabrics, nonwoven materials can act as reinforcing agents. Layered composites are obtained by pressing or rolling heterogeneous materials [1, 2].

Various ferrous and non-ferrous metals are used as a metal matrix. Various combinations in layered metal composites lead to a significant change in the characteristics of the composite compared to the use of a single metal. For example, it is possible to significantly vary the composite's thermal conductivity value and its strength [3–7]. In composites with a nonmetallic matrix, various organic and inorganic polymers, ceramics, and other materials can act as a matrix. In most cases thermoplastics and reactoplastics such as epoxy, phenol-formaldehyde, urea-formaldehyde resin and high-temperature, polyester resins, liquid glass, polyamide resin are used as binders.

Powders of various oxides, carbides, nitrides and borides, which are used to improve the strength, thermal and other characteristics of the resulting composite material, are a reinforcing element in dispersion-strengthened composites with a metal matrix [8, 9]. In the case of non-metallic matrix organic and inorganic substances are used as reinforcing agents, for example, wood flour, graphite, talcum, etc. In fiber composites, the reinforcing material may be individual yarns as well as ribbons, harnesses, fabrics, nonwoven materials, fiber and needle-punched mats of various materials, such as carbon nanomaterials, glass fiber, straw of various agricultural plants [1, 8, 10, 11].

In general, the process of obtaining a multicomponent material with a polymer matrix and a fiber reinforcing component can be divided into the following components: 1) preparation of the reinforcing material; 2) preparation of the binder; 3) impregnation of the filler with the binder; 4) molding; 5) curing; 6) removal of excess; 7) quality control.

At the moment, the most popular methods of obtaining composite materials are: the contact molding method, sputtering, molding with an elastic diaphragm, winding method, pultrusion (continuous product manufacturing process), pressing, RTM method (Resin Transfer Moulding) [12, 13].

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## USE OF WASTE GLASS IN CERAMIC PRODUCTS

## ИСПОЛЬЗОВАНИЕ ОТХОДОВ СТЕКЛА В КЕРАМИЧЕСКИХ ИЗДЕЛИЯХ

***Kauchur A.[1], Hrachanikau A.[1*], Manak P.[2]***
*[1]Vitebsk State Technological University, Belarus*
*[2]JSC "Obolsky Ceramic Plant", Belarus*
*e-mail: grec_alex@rambler.ru[1*]*
***Ковчур А.С.[1], Гречаников А.В.[1*], Манак П.И.[2]***
*[1]Витебский государственный технологический университет, Республика Беларусь*
*[2]ОАО «Обольский керамический завод», Республика Беларусь*

*Keywords: cullet, ceramic products, glass, building materials.*
*Ключевые слова: стеклянный бой, керамические изделия, стекло, строительные материалы.*

*Abstract. The article presents the results of a study of the content of man-made products of cullet in ceramic products. As a result of the conducted research, the possibility of using man-made products of cullet in the production of ceramic materials has been found and the main values of the Aggregate grading, the percentage of cullet in the composition of the ceramic mass have been determined, the main problems of a technological and environmental nature have been identified.*

Rational use of natural resources is currently gaining special importance. The solution of this urgent national economic problem involves the development of effective waste-free technologies through the integrated use of raw materials, which simultaneously leads to the elimination of huge environmental damage caused by waste storage facilities. One of the ways to solve this problem is to develop technologies for obtaining building materials based on the use of solid waste, including the use of cullet.

Glass is a solid amorphous material obtained during the supercooling of the melt. Conventionally, the compositions of glasses are expressed as the sum of the oxides of the elements included in them and these glasses are called oxide. All glasses from which containers are made belong to the oxide, since the main oxide is silicon oxide $SiO_2$. The main components of container glass are $SiO_2$, CaO and $Na_2O$; in small quantities, these glasses should contain $A1_2O_3$ and MgO, which favorably affect the basic properties of the glasses. The content of MgO in glass can be increased to 3.0–3.5 %, and $A1_2O_3$ to 3–5 %. In some types of container glass, a relatively small amount of Fe2O3 may be present. Glass containers obtained from semi-white and greenish

glass may contain from 0.15 to 0.3 % and above $Fe_2O_3$. In addition, a significant part of wine and beer bottles, as well as mineral water bottles, are made of painted glass, in which the content of iron oxides is practically unlimited and can be in the range of 1.5–2.5 %. For painting, up to 2.0–2.5 % MnO is introduced into such glass. Typical compositions of such glasses are presented in Table 1.

Container cullet (cullet) is a hard-to-recycle waste that is not exposed to water, atmospheric phenomena (precipitation, solar radiation, temperature changes) and does not collapse under the influence of organic, mineral and biologically active organisms [1, 2].

Table 1 – Typical compositions of cullet

| Grade of glass (OST 21-51-82) | $SiO_2$, % | $Al_2O_3$+ $Fe_2O_3$, % (including Fe2O3 max) | CaO + MgO, % | $Na_2O$ + $K_2O$, % | $SO_3$, % |
|---|---|---|---|---|---|
| BT-1 (colorless) | 72 ± 1.5 | 2.5 ± 1 (0.1) | 11 ± 1.3 | 14 ± 1 | 0.5 |
| PT-1 (semiwhite) | 71.4 ± 2 | 3 ± 1 (0.5) | 11 ± 1.3 | 14.2 ± 0.9 | 0.4 |
| PT-2 (for semiautomatic) | 71.3 ± 2 | 2.5 ± 1 (0.5) | 11 ± 1.3 | 14.8 ± 0.9 | 0.4 |
| ZT-1 (green) | 70.3 ± 3 | 4 ± 1.5 (0.8) | 11 ± 1.3 | 14.3 ± 0.9 | 0.3 |
| KT-1 (brawn) | 71.1 ± 2 | 3.3 ± 1.3 (0.5) | 11 ± 1.3 | 14.3 ± 0.9 | 0.3 |

The cullet uncontaminated (excluding the fight of the glass of cathode ray tubes and fluorescent lamps) consists of the following components: $SiO_2$ – 72.5 %; $Al_2O_3$ – 2.5 %; MgO – 2.5 %; CaO – 7 %; $Na_2O$ – 15.5 %. Aggregate grading of cullet is presented in Table 2.

Table 2 – Aggregate grading of cullet

| Mesh screen R40/3 on STB ISO 565 | Total solid on mesh sieve, % |
|---|---|
| 180 | 0–0.5 |
| 106 | 0–30.0 |
| 63 | 50–90.0 |
| 40 | 70–100.0 |

Recently, research has been conducted in a number of industrialized countries on the use of glass waste in the manufacture of building and facing bricks. At the same time, the composition of the mixtures included cullet, slag, ceramics, stone or a battle of baked bricks; plastic clay, finely ground cullet or liquid glass were used as a bundle [3]. Also, the cullet is successfully used as an additive in the manufacture of bricks

without making special requirements for its quality. When replacing 50 % of the clay with a cullet, the brick firing temperature can be lowered from 1170 °C to 900 °C. At the same time, the furnace performance increases by ~ 30 %. High-quality bricks are obtained from a mixture: cullet – 30 %, brick waste 60 % and clay – 10 %. Such bricks have a high resistance to weather influences and are suitable for use as facing materials.

Currently, Obolsky Ceramic Plant plans to expand the product range by producing ceramic building mixes using man-made products of industry and the fuel and energy complex [4].

To investigate the possibility of using cullet and glass powder in the production of ceramic bricks as high-temperature additives (melts), a formulation and composition of raw materials based on clays from the local Zapolye deposit have been developed. Experimental samples of ceramic masses have been prepared and manufactured to conduct research on the physical and mechanical properties of ceramic materials using additives based on glass, glass powder. The samples were made in the form of bricks (65×30×15) mm and cylinders with a diameter of 30 mm and a height of 30–40 mm by manually stuffing plastic mass into metal molds. These samples were used to study the main physical and chemical characteristics: water absorption, compressive and bending strength.

The results obtained for determining the basic physicochemical properties of building ceramics samples are shown in Table 3.

Table 3 – Physicochemical properties of pieces building ceramic

| Properties | Percentage of cullet | | | | |
|---|---|---|---|---|---|
| | 0 | 2.5 | 5 | 7.5 | 10 |
| Water absorption, % | 15.67 | 15.97 | 15.94 | 15.50 | 15.10 |
| Compressive strength, MPa | 28.00 | 28.71 | 24.71 | 31.68 | 25.50 |
| Transverse strength, MPa | 12.18 | 10.82 | 10.98 | 11.32 | 12.79 |

Studies of the physical and mechanical properties of prototypes of construction and clinker ceramics using cullet additives carried out at Obolsky Ceramic Plant have shown the possibility of using these wastes as an additive in the manufacture of building materials. It is determined that the produced samples comply with the requirements of STB 1160-99. Based on the conducted research, recommendations have been developed for the use of an additive based on the cullet, glass powder used as an additive to improve the physicochemical properties of construction ceramics products, there should be at least 5 % over 100 % of the composition of the ceramic mass. The main problems of a technological and environmental nature have also been identified, which will be solved during further research and implementation activities. The fraction of glass entering for processing should be no more than 2 mm. Grinding and addition to the ceramic mass should be carried out in closed chambers. The interval between drying and firing in the same furnace is unacceptable.

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## ANALYSYS OF TECHNOLOGICAL PARAMETERS OF PATTERN KNITTED FABRIC

## АНАЛИЗ ТЕХНОЛОГИЧЕСКИХ ПАРАМЕТРОВ РИСУНЧАТЫХ ТРИКОТАЖНЫХ ПОЛОТЕН

***Musaev N.M.**, Gulyaeva G.H., Musaeva M.M., Mukimov M.M.***
*Tashkent Institute of Textile and Light Industry, Uzbekistan*
*e-mail: differ1505@mail.ru**
***Мусаев Н.М.**, Гуляева Г.Х., Мусаева М.М., Мукимов М.М.***
*Ташкентский институт текстильной и легкой промышленности, Узбекистан*

*Keywords: knitting, cotton, silk, technological parameters, thickness, surface density, volume density.*

*Ключевые слова: трикотаж, хлопок, шелк, технологические параметры, толщина, поверхностная плотность, объемная плотность.*

*Abstract. The study and expansion of the technological capabilities of modern knitting machines, the development of new models of knitted fabric from local raw materials on the above machines and the subsequent expansion of the range of knitwear with improved consumer properties is an urgent task today. The article presents the results of the analysis of the technological parameters of patterned knitted fabrics, developed for the effective use of local raw materials and those made from silk*

*and cotton yarn. The samples of investigated cotton-silk knitted fabric were produced on a Mayer knitting machine.*

*Аннотация. Изучение и расширение технологических возможностей современных трикотажных машин, разработка новых моделей трикотажа из местного сырья на вышеуказанных машинах и последующее расширение ассортимента трикотажных изделий с улучшенными потребительскими свойствами, является актуальной задачей на сегодняшний день. В статье приведены результаты анализа технологических параметров рисунчатых трикотажных полотен, разработанных с целью эффективного использования местного сырья и изготовленных из шелковой и хлопчатобумажной пряжи. Образцы иследуемых хлопково-шелковых трикотажных полотен были выработаны на трикотажной машине Mayer.*

The production of linen and lightweight knitwear made from cotton yarn in combination with natural fibers, namely natural silk, helps to improve consumer properties, such as breathability, hygroscopicity, as well as hygienic properties, which allows their use in regions with a hot climate [1, 2].

Studying and expanding the technological capabilities of modern knitting machines, developing new knitting patterns from local raw materials on the above machines and subsequently expanding the range of knitted products with improved consumer properties are an urgent problem today. In order to expand the range of knitted fabrics and to study the effect of the size of the pattern on the technological parameters and the physical-and-mechanical properties of the patterned cotton-silk knitted fabrics on the Mayer 18 gauge double circular knitting machine, 5 variants of patterned cotton-silk knitted fabrics were developed, varying the size of the pattern on the surface of the canvas. The pattern on the surface of the canvas is formed by knitting an elastic series against the background of smooth weaving. Cotton yarn with a linear density of 25 tex and silk yarn with a linear density of 14.3 tex were used as raw materials. The structure of a new structured cotton-silk knitted fabric is presented in Fig. 1 [3].

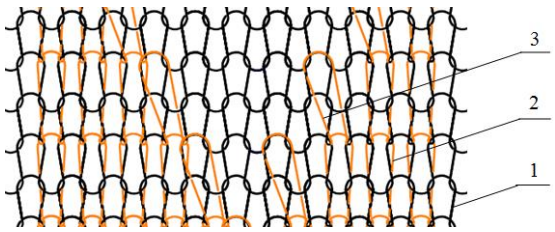


Figure 1 – New structured cotton-silk knitted fabric:
here: 1 – suprem loops formed from cotton thread;
2 – rib loops formed from silk thread; 3 – transferred loops

Based on the results of the analysis, technological parameters such as the loop step, the height of the loop row, the horizontal and vertical density, the length of the thread in the loop are determined. An analysis of the results of studies conducted by many scientists showed that a decrease in the surface density of knitted fabric wear is the

least dangerous for its strength properties, since the absolute value of the strength of knitted fabric is high, during operation, the products are subjected to loads not exceeding 20 % of breaking [4–5].

The decrease in surface density causes damage to the hygienic and heat-shielding properties of the canvas. Therefore, it seems rational to introduce an indicator that would simultaneously characterize both the material consumption of the canvas and its qualitative indicators [6]. Since knitwear is a three-dimensional structure characterized by length, width and thickness, the lightness of this structure should be determined not by a two-dimensional criterion (surface density), but by three-dimensional (volume density).

The surface density of the proposed variants for cotton-silk patterned knitted fabric varies from 110.2 to 139.1 g/m$^2$, the lowest surface density in variant IV of knitted fabric is 110.2 g/m$^2$. The volume density of the patterned cotton-silk knitted fabric variants from 237 to 358.8 mg/sm$^3$, the lowest volume density for variant V of knitted fabrics is 237 mg/sm$^3$. The results of the study showed that the volume density of the developed fabrics of cotton-silk patterned knitted fabric is less compared to the basic fabric (variant I), (Figure 2).

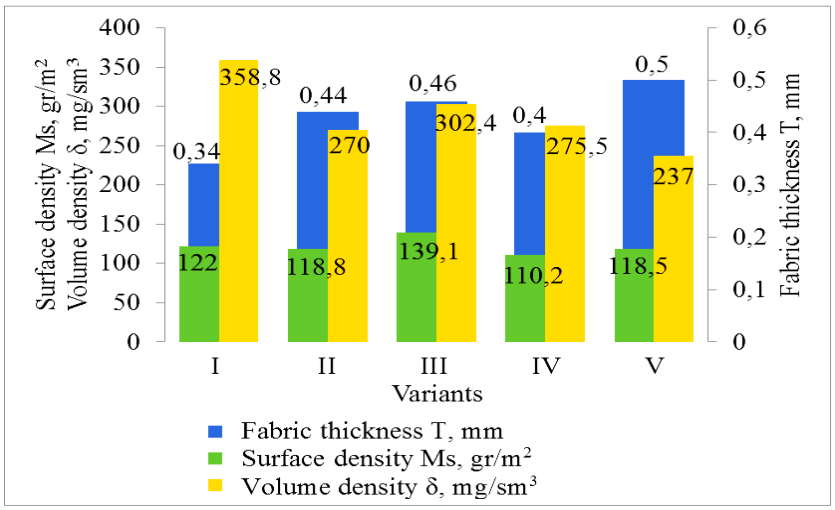


Figure 2 – Histogram of changes in thickness, surface and volume density of cotton-silk patterned knitted fabrics

If the surface density of the base knitting sample is Ms=122 g/m$^2$ and the thickness T=0.34 mm, its volume density is δ=358.8 mg/sm$^3$.

In this case, the absolute volumetric litheness indicators of the canvases compared to the base sample will be as follows (Fig.2):

$$\Delta\delta = \delta_b - \delta = 358{,}8 - 270 = 88{,}8\, mg/sm^3 \qquad \text{(II opt.)}$$

Here: Δδ – absolute volumetric lightness, mg/sm$^3$; δb – is the volume density of the base sample, mg/sm$^3$; δ – is the volume density of the base sample, mg/sm$^3$;

The relative lightness of the developed patterns of cotton-silk patterned knitted fabrics is as follows:

$$\theta = (1 - \frac{\delta}{\delta_b}) \cdot 100\% = (1 - \frac{270}{358{,}8}) \cdot 100\% = 25\ \% \qquad \text{(II opt.)}$$

As can be seen from Fig. 2, 3 the smallest consumption of raw materials in the developed cotton-silk patterned knitted fabrics is required for variant V of knitted fabric, i.e. the volume density of this knitted fabric is the smallest compared to other variants. Reducing the consumption of raw materials in the development of variants II, III, IV, V of cotton-silk patterned knitted fabrics is achieved by reducing the number of rib. knitting loops, since the rapport of cotton-silk patterned knitted fabrics consists of supreme and rib. loops.

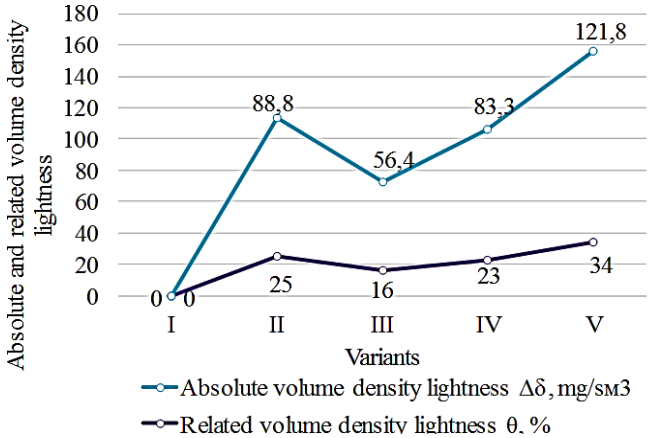


Figure 3 – Graphic lines changes absolute volumetric lightness and relative lightness of cotton-silk patterned knitted fabrics

In conclusion, it can be noted that by changing the size of the pattern on the surface of the cotton-silk patterned knitted fabrics, it is possible to obtain knitwear with desired properties and reduced material consumption.

The developed fabrics of pattern cotton-silk knitted fabrics can be successfully used in the manufacture of lightweight upper products and children's assortment.

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UDC 677.025

# STUDY OF PHYSICAL-MECHANICAL INDICATORS OF NEW PATTERN KNITTED FABRICS

# ИССЛЕДОВАНИЕ ФИЗИКО-МЕХАНИЧЕСКИХ ПОКАЗАТЕЛЕЙ НОВЫХ РИСУНЧАТЫХ ТРИКОТАЖНЫХ ПОЛОТЕН

***Musaev N.M.**, Mukimov M.M.***
*Tashkent Institute of Textile and Light Industry, Uzbekistan*
*e-mail: differ1505@mail.ru**
***Мусаев Н.М.**, Мукимов М.М.***
*Ташкентский институт текстильной и легкой промышленности, Узбекистан*

*Keywords: physical and mechanical properties, breaking load, tensile elongation, air permeability, deformation.*
*Ключевые слова: физико-механические свойства, прочность на разрыв, удлинение, воздухопроницаемость, деформация.*

*Abstract. Today, the textile, clothing and knitting industry is one of the strategically important and rapidly developing sectors of the national economy. Using the technological capabilities of modern double-loop needle knitting machines, the physical and mechanical properties of the newly constructed cotton-silk knitted fabric on the basis of local raw materials were studied. As a result of research work, the range of cotton-silk knitted fabrics and products with high quality and low consumption of raw materials has been expanded.*
*Аннотация. Сегодня текстильная, швейная и трикотажная промышленности являются одними из стратегически важных и динамично развивающихся отраслей народного хозяйства. С использованием технологических возможностей современных двухфонтурных вязальных машин исследованы физико-механические свойства хлопково-шелкового трикотажа на основе местного сырья. В результате научно-исследовательской работы расширен ассортимент хлопково-шелкового трикотажа и изделий с высоким качеством и низким расходом сырья.*

Expanding the range of knitted fabrics, making full use of the technological capabilities of knitting machines, improving the quality of knitted fabrics without

increasing of raw materials is one of the most pressing issues facing scientists in the textile industry today. Efficient production of knitted fabrics from local raw materials has led to the production of knitted fabrics with low consumption of raw materials, as well as air permeability, hygroscopicity, permeability, as well as low elongation, high shape retention properties.

As a result, in order to expand the range of knitted products in the future, the importance of producing cotton-silk knitted fabrics that can meet consumer requirements, low consumption of raw materials, high hygienic, durability and shape retention properties were increased. The structure of a new structured cotton-silk knitted fabric is presented in Fig. 1 [1–3].

Cotton-silk knitwear was produced on a modern double-needle knitting machine. Cotton-silk knitted fabric samples were used as raw materials for cotton yarn with a linear density of 25 tex, as well as spun silk yarn with a linear density of 14.3 tex [4–6].

The effect of the rapport on the new structure of cotton-silk knitted fabrics, as well as changes in the proportions of cotton and spun silk yarn in the fabric, its physical and mechanical properties. According to the conditions and function of targeted use of knitted fabrics, the structure of knitted fabrics is carried out by describing their physical and mechanical properties.

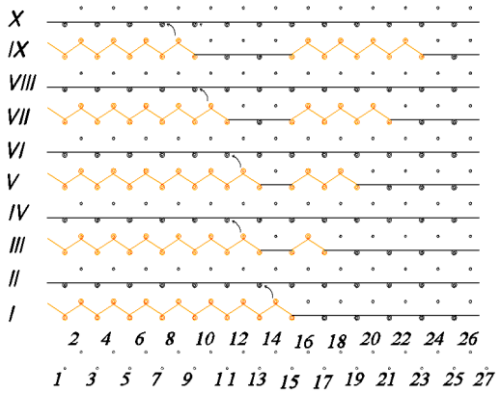


Figure 1 – Graphic record cotton-silk knitted fabric

The physical and mechanical properties of the produced cotton-silk knitted fabrics were tested on modern equipment available in the test laboratory "CentexUz" [7, 8].

The physical and mechanical properties of the newly structured cotton-silk knitted fabric samples were compared with the option I base fabric made from 100% raw cotton.

One of the characteristics of knitwear that creates a comfortable environment for consumers when using knitted products is air permeability.

The air permeability values of the cotton-silk knitted fabric samples were determined on the AR-360 SM air permeability detector at a pressure of 20C 1 atm per $sm^3/sm^2$ sec.

The air permeability of the new structured cotton-silk knitted fabric varied from 290.5 to 386.0 $sm^3/sm^2 \cdot sec$. Option I has a minimum air permeability of

290.5 $sm^3/sm^2 \cdot sec.$, while option VI has a maximum air permeability of 56 % cotton and 44% spun silk 386.0 $sm^3/sm^2 \cdot sec$. The air permeability of the newly tested cotton-silk knitted fabric samples tested meets the requirements of the international standard for lightweight top knitwear.

For all knitted fabrics and products, mechanical properties are recognized, including strength, toughness, elongation at break, abrasion resistance and shape retention.

The effect of changes in the amount of silk yarn spun as a raw material and raw material on its breaking strength and elongation at break was studied in the newly structured cotton-silk knitwear samples. The tensile strength and elongation at break were determined using the AG-1 dynamometer. The tensile strength index of the new structured cotton-silk knitted fabric samples ranged from 95N to 123N in height and from 86N to 105N in width (Fig. 2).

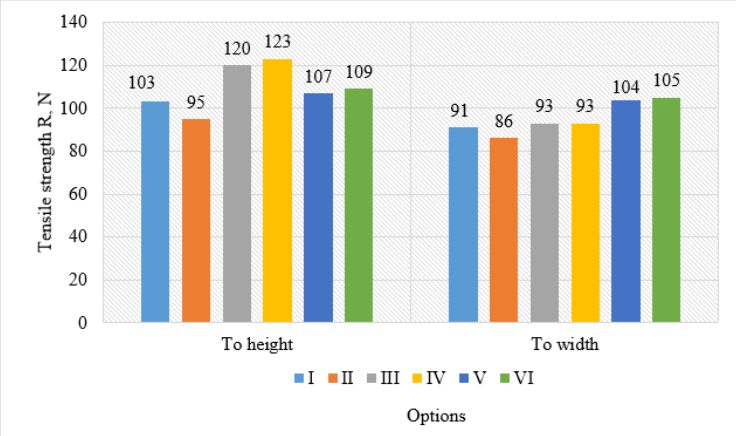


Figure 2 – Histogram of the tensile strength change in the width and height of the new structured cotton-silk knitted fabric samples

The breaking strength index along the height of option II was recorded as the lowest 95N value, and the maximum breaking strength value was recorded in option IV. The tensile strength index for the width of the knitted fabric was 86N in option II, and the maximum tensile strength value was recorded in option IV.

The cotton-silk knitted fabric samples produced meet the standard requirements based on the tensile strength indicators, as the standard requirement in all samples was not less than 80N. The shape retention feature is one of the important indicators for light top knitted fabrics and products. Shape preservation properties also include the elongation index of the tissue at rupture. During the effect of the tensile strength of the fabric, an increase in length, i.e. elongation, occurs, which represents the elongation at break and is expressed in millimeters.

The elongation at break ranged from 83 % to 99 % in height and from 99 % to 130 % in width in the samples.

The analysis of the elongation at break of the newly structured cotton-silk knitwear showed that an increase in the amount of silk yarn in the fabric, as well as a decrease in the number of rib loop in the fabric report, could reduce the elongation at break. The

cotton-silk knitted fabric samples produced have elongation at break, as well as elongation at 6N in accordance with the requirements of groups II and III.

The proportion of longitudinal deformation of the experimental cotton-silk knitted fabric samples ranged from 87% to 93 % along the length, and the proportion of backward deformation across the width varied from 90 % to 95 %.

The introduction represents a reduction in the size of the fabric under the influence of heat and moisture. As a result of the penetration of the fabric, the products may shrink, distorting the shape of clothing parts. The introductory values of the newly structured cotton-silk knitted fabric samples ranged from + 2 % to + 6 % in length and from + 2 % to + 5 % in width (Fig. 2).

From the results of the analysis of physical and mechanical properties of the proposed new structure of cotton-silk knitted fabric can be concluded that due to the use of spun silk yarn in the fabric, as well as changes in the structure of knitted fabric, the tensile strength, air permeability, re-deformation, abrasion resistance indicators increased. Also, the elongation, permeability, and hygroscopicity of the knitted fabric at rupture decreased compared to the basic fabric performance.

As a result of research work, the range of cotton-silk knitted fabrics and products with high quality and low consumption of raw materials has been expanded.

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UDC 677.024.52

# TECHNOLOGY OF ELECTROMAGNETIC FIELD SHIELDING FABRICS MANUFACTURING

# ТЕХНОЛОГИЯ ПРОИЗВОДСТВА ТКАНЕЙ, ДЛЯ ЗАЩИТЫ ОТ ЭЛЕКТРОМАГНИТНОГО ИЗЛУЧЕНИЯ

***Ryklin D.B.*, Dubrouskaya V.A., Kvetkovski D.I.***
*Vitebsk State Technological University, Belarus*
*e-mail: ryklin-db@mail.ru**
***Рыклин Д.Б.*, Дубровская О.А., Кветковский Д.И.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: electromagnetic shielding, Nega-Stat, Bekinox, reflection and transmission coefficients.*
*Ключевые слова: экранирование электромагнитного излучения, Nega-Stat, Bekinox, коэффициенты отражения и передачи.*

*Abstract. The aim of this research is the development of technology of fabrics manufacturing using Nega-Stat® P210 and yarns containing stainless steel fiber Bekinox® and a comparative assessment of their shielding effect in order to be able to use them to create screens that protect against electromagnetic radiation. As an object of research, samples of experimental fabrics of different compositions and two-layer package formed from the experimental fabric were used. As a result of the tests, the influence of a combination of two types of electrically conductive components in the warp and weft on the shielding ability of fabrics and their packages was determined.*
*Аннотация. Целью работы является разработка технологий производства тканей, в структуре которой используются углерододнополиэфирные нити Nega-Stat® P210 и пряжа, содержащая стальные волокна Bekinox®, а также сравнительная оценка их экранирующего действия для определения возможности их использования при создании экранов, защищающих от воздействия электромагнитного излучения. В качестве объекта исследований использовались образцы опытных тканей разного состава и двухслойные пакеты, сформированные из опытной ткани. В результате испытаний определено влияние сочетания двух видов электропроводящих компонентов в основе и утке на экранирующую способность тканей и их пакетов.*

One of the promising methods for developing electromagnetic shielding systems is the use of fabrics with high conductivity. The advantages of textile screens are their flexibility, lower consumption of metals, breathability, lightness and the possibility of obtaining a variety of structures that provide a given set of required properties.

Reducing the specific electrical resistance of fabrics is achieved in several ways: by applying coatings of metals, metal oxides and other conductive materials and by introducing electrically conductive yarns into the structure of fabrics.

Most often, yarns containing metals such as stainless steel or copper are used as a conductive component. Such fabrics, in addition to the shielding effect, are characterized by high antistatic properties, which, however, appear only when products made from them are grounded.

Among other types of conductive yarn, the Nega-Stat® P210 offered by Barnet is of interest. Nega-Stat® P210 neutralizes the surface charges on the base material by induction and dissipates the charge by conduction through grounding. The screening effect of fabrics with this type of yarns has not been studied.

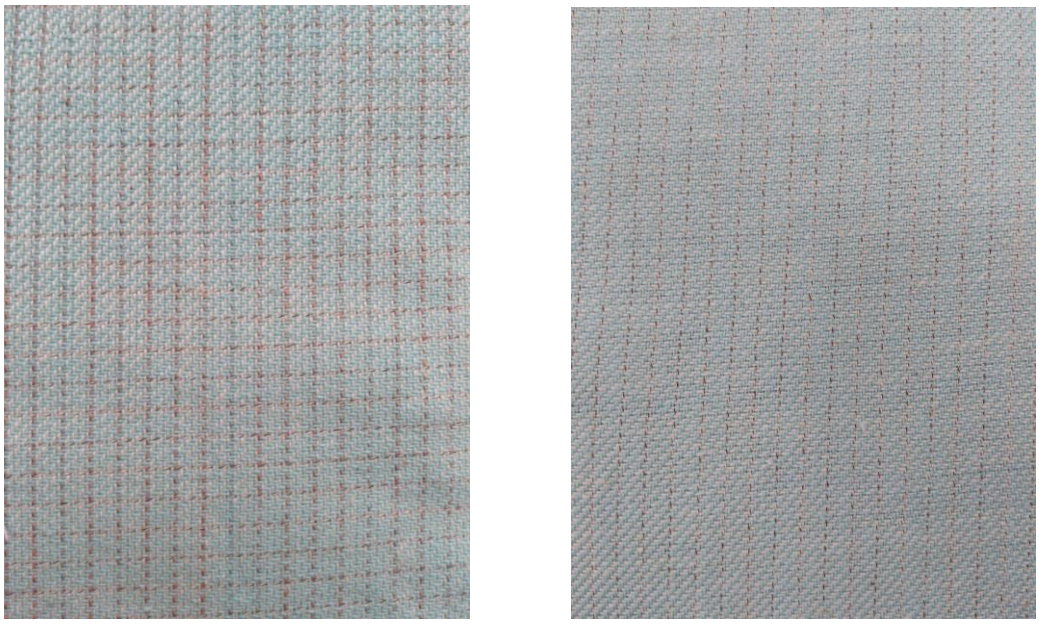
The aims of this research were the development of technology of fabrics manufacturing using Nega-Stat® P210 and stainless steel fiber Bekinox® and a comparative assessment of their shielding effect. The influence of a combination of two types of electrically conductive components in the warp and weft in the composition of the fabric was also determined.

For the research 3 samples of 2/2 twill weave fabrics were produced in which electrically conductive yarns were arranged in the form of a square grid of different sizes. Two types of conductive yarns were used:

− yarn Nega-Stat® P210 twisted with cotton yarn,
− blended yarn 20 tex ×2 (10 % Bekinox®, 90 % Polyester).

Electrically conductive yarns were introduced into the base fabric, in the warp and weft of which cotton yarn 25 tex × 2 was used.

The manufacturing of experimental fabric samples was carried out on a shuttleless weaving loom STB-2-175. In the case of fabric density 17.4 threads/10 cm in warp and 18.0 threads/10 cm in weft, the basis weight of the test fabric samples was about 180 g/m$^2$. Structures of two experimental fabric samples are presented in Figure 1.



a b

Figure 1 – Structures of experimental fabric samples:
a – yarn Nega-Stat® P210 in warp and weft,
b – blended yarn with 10 % fibers Bekinox in warp
and yarn Nega-Stat® P210 in weft

The loom-state fabric was subjected to tests to determine the electromagnetic properties. The determination of the reflection and transmission coefficients was carried out in the frequency range from 0.7 to 17 GHz.

As a result of the research, it was found that fabrics containing only Nega-Stat® P210 as a conductive component do not have a significant shielding effect. However, when combining Nega-Stat® P210 and yarn with 10 % Bekinox® in the fabric structure a sufficiently high shielding effect is achieved.

In the frequency range from 0.7 to 2.5 GHz the transmission coefficients is in the range from 15 to 20 dB. For two layers of fabric the transmission coefficient in the range from 1 to 5 GHz is reduced to 20–30 dB. Significant values of the reflection coefficient (more than 10 dB) are observed in the range from 10 to 13 GHz when the fabric is folded into 2 layers.

For comparison, it can be noted that fabrics with a similar content folded into 2 layers were characterized by a close value of the reflection coefficient and a 5 dB lower value of the transmission coefficient in the indicated ranges.

The results obtained are the basis for the design of fabrics and packages of materials for shielding electromagnetic radiation.

UDC 004.77: 7.012

## FEATURES OF THE COMPOSITIONAL FORMATION OF PAGES OF ONLINE STORES

## ОСОБЕННОСТИ КОМПОЗИЦИОННОГО ФОРМИРОВАНИЯ СТРАНИЦ ИНТЕРНЕТ-МАГАЗИНОВ

***Samutsina N.**, Nesterovich N.***
*Vitebsk State Technological University, Belarus*
*e-mail: samusiya@mail.ru**
***Самутина Н.Н.**, Нестерович Н.Д.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: website, ergonomic features of the site, functional indicators, aesthetic requirements.*

*Ключевые слова: интернет-сайт, эргономические особенности сайта, функциональные показатели, эстетические требования.*

*Abstract. The paper examines the types of online stores, their specifics, as well as ergonomic features. The selection of the most preferred sites of online stores and the comparative characteristics of objects according to functional and aesthetic indications were made.*

*Аннотация. В работе изучены виды интернет-магазинов, их специфика, а также эргономические особенности. Произведен выбор наиболее предпочтительных сайтов интернет магазинов и сравнительная характеристика объектов по функциональным и эстетическим показаниям.*

In the modern world, online sales are becoming one of the most affordable and easiest ways to buy and receive any kind of goods. Against the background of the situation taking place in the world with coronavirus infection, the position of online stores has further strengthened. In conditions of fierce competition for buyers, such resources are trying to increase their attractiveness to customers. This may manifest itself in a greater emphasis on the quality of the service provided, the level of feedback, faster and better delivery, and the design of the site itself. Therefore, understanding the structure and compositional structure of the pages of an online store's website can be a significant help in the future practical activities of any designer.

The purpose of the work is to study the features of the compositional formation of the pages of online stores; the tasks are the following: to identify the classification; to analyze the ergonomics and composition of the main page of the sites; to perform a comparative characteristic of the compositional formation of the pages of websites and online stores.

Based on the tasks set, having performed an analysis of literary sources, without taking into account specific features, such as types of sales or other types of division, in general, the current classification of online stores can be presented in the following form:

− mass-market online stores that have no specific specifics and are aimed at a large number of inexpensive goods;

− narrowly focused online stores that sell only certain types of goods: sports equipment, clothing stores, etc.

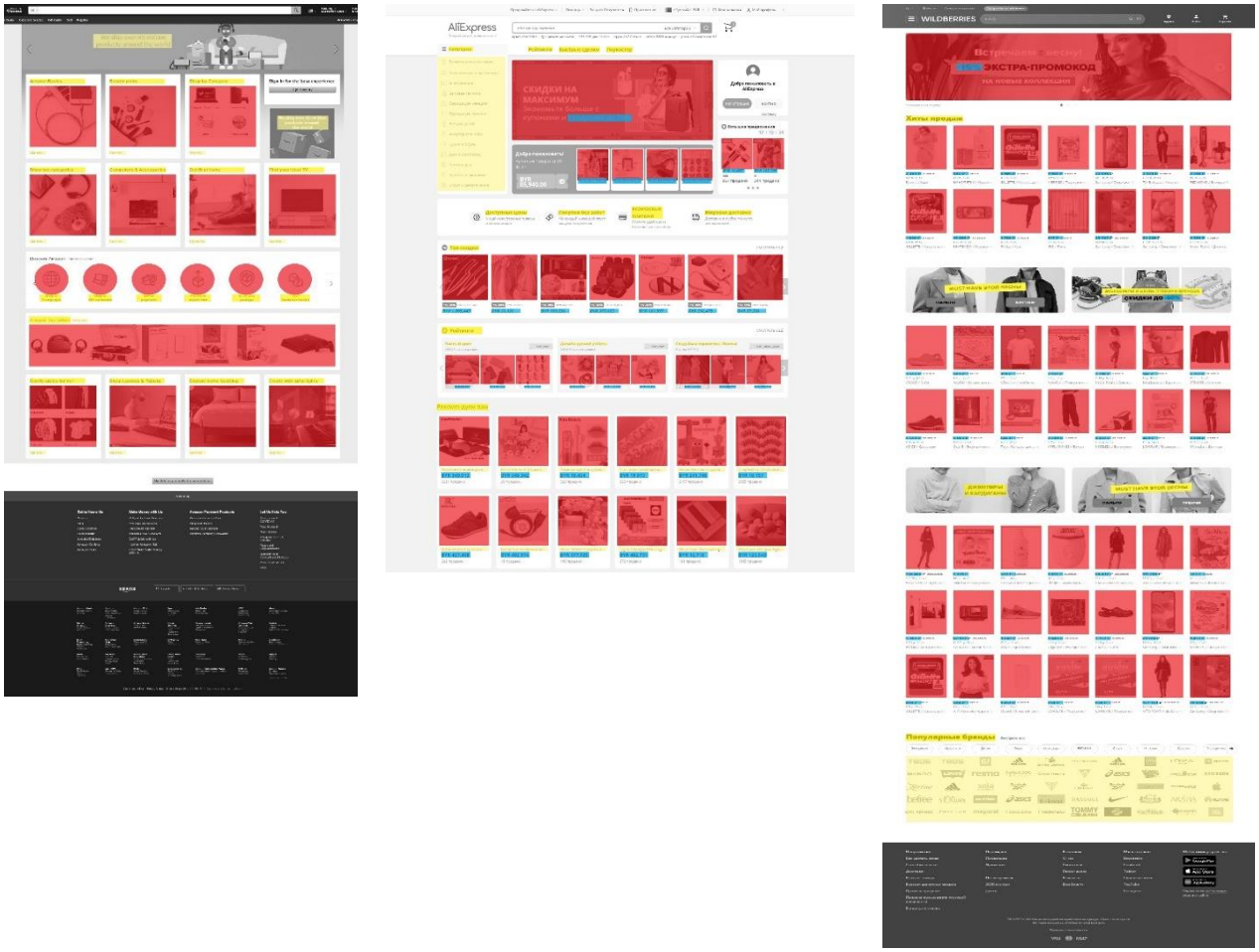
− online storefronts that use the site to display their products and rarely involve online purchases, for example, jewelry auto brands;

− online auctions that do not have a permanent set of goods and are engaged in selling lots to users who can offer the highest price.

The following ergonomic guidelines can be distinguished when designing websites: the principle of internal and external, the presence of empty space, the hierarchy of the information structure of the site pages, the presence of a clear columnar, modular, collage or any other grid, a clear allocation of the main target elements, effective and aesthetic work with typography. It is important to pay attention to longer work with the user, their return to the resource, retention and promotion of the product among other users.

The face of any website is its main page, its content. Since the most profitable stores at the moment are stores with a wide list of products, such as the flagship of online commerce "Amazon", the fast-growing "Ailexpress", which gives customers a low price and a wide range, and a store based in the CIS countries, "Wildberries".

The analysis of the main pages of the websites of the online stores under consideration was carried out (Figure 1). The following analysis elements are highlighted in color: red – photo-video material, yellow – text information of the first order, light yellow - text information of the second order, blue – numerical information, discounts, stock prices.



a b c

Figure 1 – Home page: a – "Amazon", b – "Aliexpress", c – "Wildberries"

Having performed a comparative characteristic of the compositional formation, it was found that the Amazon home page maintains a certain visual rigor and is made according to a standard 12-column grid, all the main cards are made in the same size and style, which allows the visitor to decide for himself what is more important for him. The product photos are well chosen, the presence of two lines of text with the content of the visual block and its category. There is no information about prices or discounts on the page and there is a slider that talks about the features of the company and its achievements. It is made in the shape of a circle, which helps to defuse and weaken the severity of square photos with straight, visually sharp corners. The same role is served by a simple vector illustration made in warm colors, together with the colors of the header and the basement of the site, the design of the main page copies the color scheme of the store's logo.

AliExpress immediately turns the main page into a virtual counter, with endless scrolling of goods. A large area is allocated along the borders from the main content, which subjectively is not the best solution due to the small size used on the page. Visually, the site corresponds to a 12-columnar grid, but at the same time it is violated by the specific location of differently sized cards and information blocks. The structure of the page itself can be visually divided into 2–2.5 information blocks without much

difficulty: a standard banner with information about discounts and temporary offers, a catalog of categories and an offer to register or log into an existing account.

The website of the Wildberries online store, which has several analog stores on the territory of the Republic of Belarus, has a minimalistic methodological solution. The first block is a large banner advertising discounts and new products integrated into a triple slider. This is followed by a block of product cards, combined under the general feature "Sales hits". The main page ends with a large list of brands that the online store cooperates with or that can be purchased on it. A significant visual and compositional element of the site is its header, this can be judged based on its larger size relative to the rest of the site content. At the same time, the header itself is made relatively minimalistic, in the brand colors, as well as the footer. The emphasis on design here is more on the visual part. The text information on the cards is completely removed, except for the price and rating, allowing the user not to be distracted by additional information.

Based on the research work carried out, it can be said that most marketplace sites, when working with users, pay attention not to design methods or basic ergonomic requirements, but to marketing. Among the sites under consideration, the most high-quality from an ergonomic point of view is the site of the Wildberries store, this is due to the attention of developers to the design of pages. Amazon and AliExpress have weak and poor-quality page design, but this is compensated by working with the audience and marketing. It can also be concluded that the design and ergonomics potential of all such sites is limited by default, due to the fact that they should be sufficiently simple and understandable to any user, so as not to scare them away, avoid too complex compositional solutions and textual information, while providing sufficient data to attract a buyer and persuade to make a purchase.

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# DEPENDENCE OF THE ANTISTATIC PROPERTIES OF FABRICS FOR OVERALLS ON THEIR STRUCTURE

# ЗАВИСИМОСТЬ АНТИСТАТИЧЕСКИХ СВОЙСТВ ТКАНЕЙ ДЛЯ СПЕЦОДЕЖДЫ ОТ ИХ СТРУКТУРЫ

***Savochkina V.G.**, Ryklin D.B.***
*Vitebsk State Technological University, Belarus*
*e-mail: veronika1300@mail.ru**
***Савочкина В.Г.**, Рыклин Д.Б.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: fabrics, antistatic properties, structure, electrically conductive components, overalls.*
*Ключевые слова: ткани, антистатические свойства, структура, электропроводящие компоненты, спецодежда.*

*Abstract. The paper presents influence of the location of electrically conductive components, namely Bekinox fibers, in workwear fabric samples on their antistatic properties. The analysis of the obtained results of the specific surface electrical resistance with a normalized and predictable value obtained by the model described earlier was carried out. It has been determined that the model used makes it possible to predict the specific surface electrical resistance of fabrics with sufficient accuracy for practical purposes, however, the choice of the location of the antistatic yarns in the fabric should be carried out taking into account its subsequent use.*

*Аннотация. В работе было определено влияние расположения пряжи с содержанием стальных волокон Bekinox в образцах тканей для спецодежды на их антистатические свойства. Проведен сравнительный анализ полученных результатов удельного поверхностного электрического сопротивления образцов с нормируемым и прогнозируемым значением при расположении антистатических нитей только вдоль утка и в виде сетки. Установлено, что используемая модель позволяет прогнозировать удельное поверхностное электрическое сопротивление тканей с достаточной для практических целей точностью, однако выбор места расположения антистатической нити в ткани следует осуществлять с учетом ее последующего использования.*

At present, industrial development and the emergence of ever new branches of production impose such requirements on textile materials that natural fibers with their properties are no longer able to satisfy. One of them was to develop textiles with

desired properties that are necessary in specific areas of human activity. The ability of textiles to change their properties in the direction necessary for a person turned out to be very important.

Now the development of electrically conductive textiles for technical applications is becoming more and more widespread. The most preferred technology of antistatic fabrics production is the fabrics manufacturing with electrically conductive yarns containing fibers Bekinox.

Fibers Bekinox are stainless steel wire pieces. These fibers are blended with other types of fibers to obtain yarn with antistatic properties. The distribution of the charge occurs due to the structure of the yarns and the fabric of them. The charge instantly "spreads" over the "cells" of the fabrics forming a closed circuit as a result of which it decreases to a non-hazardous value for a person.

The following requirements are imposed on electrical conductors: low density, high specific physical and mechanical characteristics, the possibility of a wide variety of electrical characteristics, resistance to aggressive environment, high adhesion to binders, low thermal coefficient of linear expansion [1].

Requirements for overalls for protection against static electricity are given in standard GOST 12.4.124-83. In accordance with this standard, the specific surface electrical resistance for materials used for workwear should not exceed $10^7$ Ohm. This fabrics sample property is determined according to standard GOST 19616-74. It should be noted that antistatic yarns provide a discharge of static electricity accumulated on overalls by creating a continuous conductive circuit that must be grounded. However, the standard does not contain requirements for the content and location of the electrically conductive component in the test sample.

In the article [2], a model is proposed that describes the influence of the percentage of steel fibers Bekinox $\beta$ (%) on the decimal logarithm of this indicator:

$$lg\left(p_S\right) = 4{,}7 + \frac{4}{10^{3\beta}}. \quad (1)$$

This formula was obtained for fabrics produced on the base of 2/2 twill fabric of warp cotton yarns 25 tex × 2 and wefts blended (cotton/flax) yarn 25 tex × 2. When developing model (1) authors used experimental data obtained for fabric samples in the structure of which antistatic yarns were arranged in the form of stripes along the weft and in the form of a grid. In this regard, it is of interest to determine the influence of the location of the yarn containing electrically conductive components in fabrics on the fabric antistatic properties.

To determine the effect of the location of the electrically conductive component on the specific surface resistance and its deviation from the predicted value, samples were produced on the basis of a 2/2 twill weave fabric using yarn 20 tex × 2 of the following composition: 90 % polyester fiber, 10 % Bekinox. The samples are characterized by an approximately equal content of steel fibers in the fabric, they can be divided into 2 groups:

− samples with the location of the electrically conductive component only in weft with distance between antistatic yarns 0.5 cm;

− samples with the location of the electrically conductive component in the form of a grid of 1 × 1 cm.

The specific surface electrical resistance of fabric samples in the form of rectangular fabric strips 100 × 200 mm in size was determined on the IESTP-2 device under the conditions of the Testing Center of VSTU.

The results of tests of prototype fabrics with Bekinox fibers in comparison with the results of calculations using formula (1) are presented in Table 1.

Experimental fabrics can be considered as antistatic textiles, the studied samples have specific surface electrical resistance less than $10^7$ Ohm.

Table 1 – Test results for samples containing antistatic fiber

| Location of antistatic yarns in the fabric | Weft | | Grid (warp and weft) | |
|---|---|---|---|---|
| Distance between antistatic yarns, mm | 5 | | 10 | |
| Estimated value of Bekinox fiber content, % | 0.46 | | 0.47 | |
| Specimen orientation during testing | Along the warp | Along the weft | Along the warp | Along the weft |
| Predicted value, Ohm | $7.36 \cdot 10^4$ | | $7.17 \cdot 10^4$ | |
| Average value, Ohm | $8.85 \cdot 10^4$ | $1.30 \cdot 10^5$ | $1.72 \cdot 10^5$ | $1.96 \cdot 10^5$ |
| Maximum value, Ohm | $2.37 \cdot 10^5$ | $2.37 \cdot 10^5$ | $1.85 \cdot 10^5$ | $2.64 \cdot 10^5$ |
| Minimum value, Ohm | $2.37 \cdot 10^4$ | $2.50 \cdot 10^4$ | $3.56 \cdot 10^4$ | $9.89 \cdot 10^4$ |

The international standard GOST EN 1149-1-2018 “Occupational safety standards system. Special protective clothing. Electrostatic properties. Part 1. Test method for measurement of surface resistivity” (EN 1149-1:1995) points out that the applied method gives a discrepancy between the measurement results between different testing laboratories up to 10 times, that is up to 1 order. In this regard, the differences between the actual and predicted value can be considered acceptable. However, for a sample with antistatic yarns arranged in one direction, the difference between the obtained and predicted value for the weft is noticeably greater than for the warp. In the case of the sample in which the electrically conductive components are arranged in a grid pattern for both warp and weft, the actual values and the values obtained by formula (1) is quite close. The predicted value for both samples is lower than the actual value.

The scatter in the values of the specific surface electrical resistance for samples containing an electrically conductive component only in warp is within order 1 for the warp and weft. For samples with a grid, the spread of values exceeds order 1, both in the warp and in the weft.

Analyzing the obtained results, we can conclude that the location of antistatic yarns in samples containing an equal amount of electrically conductive components affects the specific surface electrical resistance. Mesh-shaped samples are isotropic; however, the best performance is obtained by a sample with an arrangement of electrically

conductive components only in one direction. The measured values of specific surface electrical resistance of this sample are lower in the warp than those in the weft.

Thus, the obtained model (1) makes it possible to predict the specific surface electrical resistance of fabrics with sufficient accuracy for practical purposes, however, the choice of the location of the antistatic yarns in the fabric should be carried out taking into account its subsequent use.

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## SECTION 2. SOCIAL AND ECONOMIC PROBLEMS OF EDUCATION AND SCIENCE DEVELOPMENT IN THE 21st CENTURY

UDC 338.2; JEL Classification: O14

# STUDY OF DIGITAL TRANSFORMATION OF CHINEESE ENTERPRISES

# ИССЛЕДОВАНИЕ ЦИФРОВОЙ ТРАНСФОРМАЦИИ КИТАЙСКИХ ПРЕДПРИЯТИЙ

***Aliakseyeva A.*, LI Yanxia***
*Vitebsk State Technological University, Belarus*
*e-mail: alekseeva@vstu.by**
***Алексеева Е.А.*, ЛИ Янься***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: digital transformation of enterprises, digitized information, technology upgrading.*
*Ключевые слова: цифровая трансформация предприятий, оцифрованная информация, модернизация технологий.*

*Abstract. This article presents the results of a study of the process of digital transformation of Chinese enterprises. A review of the literature on the problem under study and China's results in the World Digital Competitiveness Ranking is given. An analysis of the state of development of digital transformation was carried out on the example of 30 Chinese enterprises. The analysis of the maturity of the digital transformation of Chinese enterprises was carried out in two dimensions: the basis of digital transformation and the process of digital transformation. Recommendations to further increase the level of digitalization of Chinese enterprises have been developed.*

*Аннотация. В данной статье представлены результаты исследования процесса цифровой трансформации китайских предприятий. Приведен обзор литературных источников по исследуемой проблеме и результатов Китая в Мировом рейтинге цифровой конкурентоспособности. Проведен анализ состояния развития цифровой трансформации на примере 30 китайских предприятий. Анализ зрелости цифровой трансформации китайских предприятий проведен по двум измерениям: основа цифровой трансформации и процесс цифровой трансформации. Разработаны рекомендации для дальнейшего повышения уровня цифровизации китайских предприятий.*

Digitalization is the basic premise and important foundation for Chinese enterprises to realize intelligence, and also an important way to achieve high-quality development of Chinese enterprises. In order to have a comprehensive and clear understanding of

the digital transformation of Chinese enterprises, this paper studies the current situation and problems of the digital transformation of Chinese enterprises in the new era.

In the understanding of Chinese scientists, digital economy is an economic stage, next after the agricultural and industrial, which leads to a large-scale transformation of the economy and to a change in the mode of production of human society, the restructuring industrial relations, reorganization economic structure and lifestyle changes. At the G20 Hangzhou Summit in 2016, China called for the signing of the G20 Initiative for digital economic development and cooperation. In 2017, a report on the work of the Chinese government proposed to "promote digital economy to boost China's growth and ushering in a new innovative era of a growing digital economy." China is not overly focused on digital economy research, but pragmatically and effectively integrates it with the real economy [1].

The essence of digital economy lies in digitization, which takes digitized information as the key resource and uses information and communication technology to realize the digitization of exchanges, cooperation and transactions, and finally promotes the progress and development of economy and society.

Digital competitiveness is gaining more and more attention as a source of competitive advantage at the business and national economies levels. Digital economy performance is a matter of national strategies for achieving economic growth and socioeconomic development. Widely accepted instruments for reporting progress in these areas have been recently developed, including the IMD World Digital Competitiveness Ranking, produced by the IMD World Competitiveness Center, measures the capacity and readiness of 63 economies to adopt and explore digital technologies as a key driver for economic transformation in business, government and wider society. Over the period 2018–2022, China is gradually improving its position in the rankings in all components (Knowledge, Technology, Future readiness) [2].

With China's economy entering the stage of medium-speed and high-quality growth, the digitalization and intelligent transformation of enterprises has become an inevitable choice for industrial reform and economic growth.

Digital development will greatly change the way Chinese companies interact with companies from other countries. Relying on modern information and communication technology, the business cooperation and experience exchange between the two will be more efficient, thus driving the digital development of the whole industry and even the entire national economy, finally promoting the high-quality development of China's real economy, and realizing the smooth transformation and upgrading of the economy.

The scale of investment in informatization and digitalization of Chinese enterprises is gradually increasing, among which hardware investment accounts for the largest proportion. Since the "13th Five-Year Plan", Chinese enterprises have been increasing their input in the field of informatization and digitalization. Among the three types of input in hardware, software and IT services, hardware construction investment accounts for the largest proportion, accounting for 38.7 % of the total investment in 2017.

The current situation and problems of digital transformation of Chinese enterprises were analyzed: the actual need, development foundation and predicament of the digital transformation of Chinese enterprises, analysis on the digital transformation of Chinese enterprises were covered. In order to more intuitively show the development status of digital transformation of Chinese enterprises, we selected 30 enterprises to analyze the maturity of digital transformation of Chinese enterprises from the two dimensions of digital transformation foundation and digital transformation process. In terms of the progress of digital transformation, the assignment method is adopted, and the top-level design, digital transformation of management foundation, business layout and other aspects are selected to measure.

Statistics show that among the 30 enterprises in digital transformation, energy enterprises and manufacturing enterprises account for a relatively high proportion, accounting for 77 % of the whole. In terms of distribution, energy enterprises show a funnel-shaped distribution, and the overall digitization process is relatively high. Manufacturing enterprises present an hourglass distribution, indicating that the digitization process presents a ladder division.

On the basis of management, most enterprises have realized the importance of technology upgrading, among which 76.7 % enterprises have begun to deploy the new generation of technology, and generated 55 benchmarking cases of digital transformation; 63.3 % of enterprises believe that organizational form is very important to digital transformation, of which 46.7% have carried out active layout. Among them, forming a cross-department digital transformation team is the choice of most enterprises; only 50 % of enterprises put forward the construction of digital talents, and only 36.7 % of them made positive corresponding. In the construction of digital culture, most enterprises have not formed a clear concept, only less than 30 % of enterprises put forward a clear idea of the construction of digital culture.

In terms of business layout, most enterprises have upgraded the traditional operation mode through digital technology, and 83.3 % of them have made a comprehensive layout. 63.3 % of enterprises believe that digital transformation can help them conduct better group management and control, and 40 % of enterprises have made initial achievements; 63.3 % believe that digital transformation can optimize business processes and improve efficiency. However, the majority of enterprises are still in the pilot stage, and only 13.3 % of enterprises believe that it has brought significant benefits. In terms of financial benefits, only 10 % of companies believe that the digital transformation brings a clear financial benefit.

Small and medium-sized enterprises (SMEs) in China are the largest and most dynamic group of enterprises and form an important base of China’s real economy. For the medium and long-term development of SMEs and ensure their competitiveness, it is essential to understand their needs for digital transformation. The main difficulties of digital transformation of SMEs in China include: the lack of transformation capabilities for SMEs, which makes them "incapable of transformation"; the lack of compatibility between SMEs (conditions for own development) and digital

transformation; no guarantees for the digital transformation of SMEs, which leads to a decrease in their motivation [3].

In the information age, many Chinese enterprises have only completed the informatization of some key links, which makes them need to start many links from scratch when promoting the digital transformation. Digital transformation requires a large number of technical and complex digital talents. The serious shortage of highly skilled personnel is an important bottleneck restricting the transformation and development of Chinese enterprises [4].

In order to further improve the digitization level of Chinese enterprises, this study puts forward the following five suggestions: First, support data sharing with digital infrastructure construction. On the one hand, China should strengthen the construction of enterprise network facilities, improve the level of infrastructure interconnection and modern services; On the other hand, we attach importance to data sharing across industries, departments, platforms and links. Second, digital management is strengthened by digital system application. On the one hand, we should make use of the new Internet technology and new application to transform enterprises in all directions, from all angles and through all chains. On the other hand, we should gradually improve the digital management and operation of Chinese enterprises. Third, give play to the guiding and supporting role of government and trade associations. Through the overall planning of the government and the active intervention of industry associations, it provides a good and relaxed external environment for the digital transformation of Chinese enterprises. Fourth, digital talent training to improve the digital literacy of employees. On the one hand, Chinese enterprises can adopt the combination of internal training and external recruitment to strengthen the construction of digital talent team; On the other hand, relevant departments should strengthen the training of talents in the field of digital technology. Fifth, build and optimize digital value chain by digital platform. Through building a powerful digital platform, it will help Chinese enterprises deal with their core businesses more efficiently, and truly realize the intelligent, convenient and low-cost operation of Chinese enterprises.

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UDC 339.9

# FEATURES OF FOREIGN ECONOMIC ACTIVITIES OF BELARUS UNDER EXTERNAL RESTRICTIONS

# ОСОБЕННОСТИ ВНЕШНЕЭКОНОМИЧЕСКОЙ ДЕЯТЕЛЬНОСТИ БЕЛАРУСИ В УСЛОВИЯХ ВНЕШНИХ ОГРАНИЧЕНИЙ

***Bandarenka N.***
*School of Business of Belarusian State University, Belarus*
*e-mail: bondnata@mail.ru*
***Бондаренко Н.Н.***
*Институт бизнеса Белорусского государственного университета,*
*Республика Беларусь*

*Keywords: balance of payments, current account balance, export, import, foreign trade.*
*Ключевые слова: платежный баланс, сальдо счета текущих операций, экспорт, импорт, внешняя торговля.*

*Abstract. Foreign economic flows of goods and services are not only the main source of foreign exchange resources in the country but also an important factor in economic stability. At the same time these flows are largely depend on external factors, such as closed borders, the existence of economic sanctions, financial interdependence between countries, etc. The article analyzes the features of the implementation of the main foreign economic operations of the Republic of Belarus from 2014 to the first half of 2022. The analysis is based on data from the National Statistical Committee and the National Bank of the Republic of Belarus.*

*Аннотация. Внешнеэкономические потоки товаров и услуг выступают для страны не только источником пополнения валютных ресурсов, но и являются важным фактором экономической стабильности. В то же время эти потоки во многом зависят от внешних факторов, таких как закрытые границы, наличие экономических санкций, финансовая взаимозависимость между странами и др. В статье рассмотрены особенности осуществления экспортно-импортных операций Республики Беларусь за период с 2014 по первое полугодие 2022 года. Анализ проведен на данных Национального банка и Национального статистического комитета Республики Беларусь.*

The Republic of Belarus is an active participant in international trade, the main element of which is export-import operations with goods and services. The importance of foreign economic transactions with goods and services is due to the fact that, on the

one hand, export earnings are a source of investment and the main source of foreign exchange earnings. On the other hand, enterprises engaged in export-import operations are large taxpayers, providing a significant replenishment of the country's budget.

At the same time, export and import flows of goods and services between countries have a double benefit: for exporting countries, this is a profitable investment, and additional income for importing countries. In addition, effective foreign trade develops social infrastructure, increases demand in the labor market, and provides the population with the imported necessary goods.

During the period 2014–2021, there is an increase in the export of goods of the Republic of Belarus until 2020. The decrease in export volumes in 2020 because of the closure of borders between countries due to COVID-19 pandemic which led to a break in the logistics and transport chains for the supply of goods. The fall in exports of goods in 2020 in the Republic Belarus amounted to 11.4 % compared to 2019. However, in 2021, exports of goods increased by 36.7 % compared to the previous year and amounted to $39.9 billion [1].

The commodity structure of Belarusian exports includes more than 1,000 commodity items. At the same time, the top 5 goods exported from Belarus form almost 70 % of the total exports of the country. The one of the most important export positions is still occupied by oil and refined products, as well as mineral products. However, in recent years, the commodity structure of exports has changed. In 2015, mineral products occupied almost a third of the export of goods, but in 2021 their share decreased to 13.3 % [2]. The reason for this decline is the introduction in 2020 of economic sanctions by European countries. A slight decrease is also typical for the export of products of the chemical industry (from 21.3 % in 2015 to 19.7 % in 2021). But not only the sale of oil products and potash fertilizers determine the trends of Belarusian foreign trade. During the analyzed period, the export of machinery, equipment and vehicles, as well as food products and agricultural raw materials, increased.

According to the Ministry of Foreign Affairs of the Republic of Belarus, the export of Belarusian goods in 2021 is delivered to the markets of 174 states. At the same time 41.1 % of Belarusian export goes to Russia. The European Union is the second largest trading partner of the Republic of Belarus accounting for one fifth of the foreign trade turnover. The key exporting countries of Belarusian products to the EU in 2021 were the Netherlands (5.6 %), Poland (5.2 %), Germany (4.2 %), and Lithuania (3.5 %) [3].

In general, despite the sanctions pressure of Western countries on the Republic of Belarus, in 2021 a growth in exports of goods was observed in almost all regions of the world. To the greatest extent (by $4.1 billion, or 74.4 %), exports increased to the European Union. The increase in exports to Russia amounted to 24.6 %, to other EAEU countries – 25.9 %. Exports to the CIS countries (excluding the EAEU) and Georgia increased by 67.3 %, mainly due to increased supplies to Ukraine. In addition, Belarusian exports to China are growing at a faster pace. Thus, in 2021, the export of Belarusian goods to China amounted to $913.3 million, and the growth rate of exports was 117.5 % compared to 2019 and 128.2 % compared to 2020 [4, 5].

However, despite the increase in export deliveries, a negative trade balance in goods characterizes the Republic of Belarus. For many years, the main reason of negative foreign trade balance is import of the intermediate goods the escalating cost of which is a serious problem for ensuring effective functioning of the real sector in the Republic of Belarus. A significant part of Belarusian imports are energy resources (oil and natural gas), raw materials, metals and metal products, raw materials for chemical production, machine parts as well as technological equipment. The main countries importing to the Republic of Belarus in 2021 were Russia (56.6 % of all imports) and China (9.7 %).

The positive balance in services levels the negative trade balance in goods. The service trade compensates deficiency of the trade in goods in approximately by a quarter. In other words, the active result in the balance of services supplements the currency means earned by the export of goods that, in its turn, reduces the need for research of the means lacking to cover import expenses. During the analyzed period the positive balance of the international trade in services increased almost by two times (from 2,244.9 million dollars in 2015 to 4,561.5 million dollars in 2021) [1].

The analysis shows that the Belarusian service sector has demonstrated resilience to global economic shocks. In 2021, Belarus exported services worth $10.2 billion, which is 16.5 % more than in 2020. Traditionally, the main types of services providing active balance are transport – more than 40 %. Belarus possesses a high transit potential and Belarusian partners actively use it for external relations: the share of the transport services accounts for almost half of the total volume of the Belarusian export of services. In 2021, the share of international traffic in the total volume of freight turnover was about 76 %, and in the total volume of in passenger turnover was 27 %. The drivers of growth in passenger turnover in 2021 were railway (120 %) and aviation (160 %), which provided almost half of the total indicator. This was facilitated by the resumption of international passenger rail traffic between Belarus and Russia – an increase of 3.4 times.

The main consumers of the export of services of the Republic of Belarus were residents of the EU countries, which accounted for 38.4 % of the total export of services (including Poland 8.7 %, Germany 8.5 %). Export of services to the EAEU member states amounted to 19.6 % of exports of all services rendered (including 18.2 % of exports of services to the Russian Federation). US residents provided 14.8 % of total exports of services. Cash proceeds from the export of services for 2021 amounted to $10.1 billion and increased by 14.1 % compared to 2020.

Despite numerous pessimistic forecasts, according to the results of 2021, the foreign trade turnover of the Republic of Belarus increased by 31.9 % compared to 2020 and amounted to 81.7 billion US dollars, including the growth in exports of goods reached 136.7 % compared to previous year) [3]. Moreover, in November 2021, Belarusian exports reached a record monthly volume over the past 10 years (starting from 2012, when special schemes for the export of petroleum products began to operate) [6]. The balance of foreign trade in goods and services in 2021 was positive in the amount of $3.8 billion and improved by $1.9 billion compared to the previous year [3].

The beginning of 2022 was marked by new challenges for the country. Numerous sanctions imposed in February-early March by Europe and the United States provoked a drop in foreign trade turnover by more than 20 % over the month, including 22.9 % in merchandise trade. The largest drop occurred in exports to Ukraine, which until 2022 was the second largest market for Belarusian goods. Moreover, since June 2022, the European market has been closed for Belarusian ferrous metals and products from them, timber, cement, tires, and the logistical possibilities to redirect the export flows of these goods to alternative markets are limited. As a result, according to preliminary estimates, by the end of the year the country will lose about 30 % of Belarusian exports [7]. In addition, there are problems with the export of oil and potassium products.

Despite all external restrictions, for the seven months of 2022, the Republic of Belarus had a positive balance of foreign trade in goods in the amount of $189.6 million (for the same period in 2021, it was minus $1,254.6 million). At the same time, foreign trade turnover with the CIS countries increased by 2.4 %, while with countries outside the CIS it decreased by 20.1 % (to $14 billion). However, the positive balance of foreign trade with non-CIS countries amounted to $53.4 million against $182.5 million in January-July 2021.

It is obvious that the economic restrictions being introduced are of a long-term nature. According to S&P's base case, Belarus' GDP could contract by 15 % in 2022 and then by 5 % in 2023 [8]. In this regard, a set of measures developed by the government of the country is of particular importance in order to minimize damage to the economy. The main priorities of the government's work under sanctions are ensuring the smooth operation of business entities, reorienting export flows, import substitution, and supporting the population. The effectiveness of the planned activities can be assessed in a few years.

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# CHRONICLE OF THE DEVELOPMENT OF ACCOUNTING IN BELARUS IN THE PERIOD BEFORE THE FIRST PARTITION OF THE COMMONWEALTH OF POLAND AND LITHUANIA (1772)

# ХРОНИКА РАЗВИТИЯ БУХГАЛТЕРСКОГО УЧЕТА В БЕЛАРУСИ В ПЕРИОД ДО ПЕРВОГО РАЗДЕЛА РЕЧИ ПОСПОЛИТОЙ (1772)

***Buhayeu A.***
*Vitebsk State Technological University, Belarus*
*E-mail: alexandr.bugaev@gmail.com*
***Бугаев А.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: hypothesis, accounting, physical accounting, prime cost, wealth (capital).*

*Ключевые слова: гипотеза, бухгалтерский учет, учет в натуральном измерении, себестоимость, богатство (капитал).*

*Abstract. Despite the limited information on the state of accounting in ancient Belarus, the author puts forward a hypothesis about the initial impact on the accounting system of the achievements of the peoples who migrated to the territory of*

*modern Belarus in ancient times and who basically formed its ethnic group. The hypothesis is based on the latest data from archaeological excavations in Belarus.*

*Аннотация. Несмотря на ограниченность информации о состоянии бухгалтерского учета в древней Беларуси, автор выдвигает гипотезу об исходном влиянии на систему бухгалтерского учета достижений народов, которые переселились в давние времена на территорию современной Беларуси и которые в основном сформировали ее этнос. Гипотеза основывается на последних данных археологических раскопок на территории Беларуси.*

The development of accounting in ancient times on the territory of modern Belarus coincided with the trends of Sumer, Egypt, Greece and Rome. This was influenced by the migration of peoples from the territory of Sumer (the people of Cimbri), Asia Minor – Hetty and Troy – (the people of Venedi (Veneti), the Black Sea region (Celts-Bastarnae people and later Goth people from Amali clan) from the 10th century BC to 5th century AD, as well as trade relations with certain territories (Egypt, Greece, Rome, Byzantium, etc.) Undoubtedly, the rather wide achievements of the culture (including accounting) of the Sumerians, Hittites, Trojans and other peoples of the above-mentioned southern territories were lost during time of the great migration, which probably lasted for more than a dozen years. Nevertheless, information about the size of the remains and changes in the amount of food, beasts of burden, livestock, weapons and other property (in kind), the number of surviving settlers, in particular warriors, was an important condition for the survival of settlers in a hostile environment during their journey to Europe. Therefore, the accounting system of the ancient ancestors of today's Belarusians was kept up to date for their practical needs condition.

Accounting in that period, of course, was carried out in natural (physical) measurement, on linen scrolls with records in soot ink, which is confirmed by the findings of the latest archaeological excavations (by the way, it was Cimbri people who brought the flax culture to Belarus). The cost of goods produced during this period was not calculated, just as the financial result of a specific barter transaction with local natives was not calculated (the main thing is to get the goods in the required quantity in order to survive the clan).

Later, upon arrival at the place of resettlement, the accounting system existed within the boundaries of individual clans (families), agricultural estates, religious complexes, individual households and artisans, was based on maintaining cards for individual accounts (linen scrolls) with the recording of income and expenditure by type of property. The cost of manufactured goods in its modern sense was not calculated; in this case, only outflows of funds for handicraft activities (wages of hired personnel, expenses of stocks acquired by barter) were taken into account in natural (physical) terms. The property of a clan and other economic units consisted of both goods for sale and personal property of its members, that is, property for entrepreneurial activity was not separated from property for own consumption. Taxes during that period were levied mainly in kind in the form of goods or works.

The results of the activity were calculated only after the end of the agricultural year, that is, after October 31 (after Halloween), but from November 01 – the day of All the Gods of the Cimbri, Venedi (Veneti), Celts-Bastarnae and Goths-Amali people – (in Christianity – All Saints Day) – a new accounting cycle began. To do this, reconciliation was carried out of the actual availability of the amount of property (remains) with the accounting data.

The increase in the amount of property (without debts at the end of the year) for the agricultural year meant an increase in the wealth of the clan-family and other economic units (subsequently, from the era of capitalism, such an increase as the difference between the value of property and the amount of debts was called capital); the sufficiency of property for the survival of the clan or economic unit was also determined for at least the next year (food in stocks and essentials, including military supplies). During this period of time, the development of accounting was purely practical in relation to the presence of various types of property: the more types of property, the more scrolls.

Gradual transition to the monetary form of tax collection, as well as the expansion of the geography of trade, accompanied by an increase in the delivery time of goods, led, in addition to the already existing accounting in kind, to the need for a monetary valuation of part of the clan's property (primarily purchased from others or intended for sale) at the end of the year, and such a monetary assessment was carried out at the prices of the last fair of the year. This was due to the fact that in the absence of money in payment of taxes, the collectors at its monetary value could accept a certain amount of a particular type of property. In practice, the goods intended for the personal consumption of the clan was not valued in cash (just as now, the household does not evaluate the amount of potatoes in bags in cash, harvested for the winter and grown on a personal plot and not intended for subsequent sale; just as the family is not interested in the value firewood prepared by them for the winter, except for their sufficiency for at least one heating season).

The entry (forced or voluntary) of the ancient clans on the territory of modern Belarus into various state and interstate associations (for example, the Vitebsk and Polotsk principalities, etc.) did not lead to a significant change in the accounting system of individual clans and economic structures. New more efficient options for the structure of accounts (analytics) were adopted into practice, including some accounts for accounting for income for the year. With the unification of the clans into the Grand Duchy of Lithuania, with the expansion of the geography of trade relations and their reorientation, mainly to the West, the penetration of knowledge on accounting and accounting practices from Europe began, followed by the adaptation of useful practical skills for local conditions (the path from the Varangians (Vikings) to the Greeks along the Dnieper to the south was stopped by the capture of Kyiv by the Horde (Orda) in 1240; from the middle of the 12th to the middle of the 17th century, Vitebsk, Polotsk and other cities had close ties with the Hanseatic trade union-League). This became especially noticeable after the creation of the Union of the Principality with the Crown (Poland), when the accounting system began to change based on the implantation of

ideas and techniques from Italy, both through the German states of the Hanseatic League, the Czech Republic and Poland, and through the transfer of accounting practices directly based on the exchange of accounting experience. This was made in connection with the change in tax legislation in the Crown and the Principality after the adoption of the Statute of the Grand Duchy of Lithuania (1529, 1566, 1588).

After the seizure of the territory of Belarus by the Russian Empire, the development of accounting in Belarus did not differ from the trend in the development of accounting in the Russian Empire until the collapse of the Soviet Union in 1991.

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## ECONOMIC ANALYSIS OF BALANCE IN EXPORT-IMPORT COMMODITY FLOWS OF CLOTHES IN EAEU

## ЭКОНОМИЧЕСКИЙ АНАЛИЗ СБАЛАНСИРОВАННОСТИ ЭКСПОРТНО-ИМПОРТНЫХ ТОВАРНЫХ ПОТОКОВ ОДЕЖДЫ ЕАЭС

***Bykau K.***
*Vitebsk State Technological University, Belarus*
*e-mail: krbykoff@mail.ru*
***Быков К.Р.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: balance, export, import, clothing, EAEU, mutual trade, foreign trade, commodity structure, commodity group.*

*Ключевые слова: сбалансированность, экспорт, импорт, одежда, ЕАЭС, взаимная торговля, внешняя торговля, товарная структура, товарная группа.*

*Abstract. The article defines the balance of foreign trade. The analysis of foreign trade in clothing goods of the EAEU in mutual trade with member countries and with third countries was carried out. An assessment is given of the dynamics and changes in the structure of foreign trade indicators in the context of commodity groups and foreign trade partners. The main conclusions of the foreign trade in clothing goods of the EAEU for the development of management decisions are made.*

*Аннотация. В статье дано определение сбалансированности внешней торговли. Выполнен анализ внешней торговли товарами одежды ЕАЭС во*

*взаимной торговле со странами-членами и с третьими странами. Дана оценка динамики и изменению структуры показателей внешней торговли в разрезе товарных групп и внешнеторговых партнеров. Сделаны основные выводы внешней торговли товарами одежды ЕАЭС для выработки управленческих решений.*

Various theoretical and practical aspects of foreign trade, including issues related to the study of foreign trade as a source of balanced economic growth, were considered in the works of domestic and foreign scientists [1]. In our opinion, one of the conditions for a balanced foreign trade is the outstripping growth of exports over imports, which ensures the contribution of the system to economic growth without creating trade and budget imbalances [1]. Let us consider the dynamic and structural changes in the foreign trade of clothing (C14) of the EAEU by trade directions based on the EEC statistical data for 2015–2021 and classifier TN VED EAEU [2]. The methodological approach to the study of foreign trade C14 is based on an economic and statistical analysis of the dynamics and structure of foreign trade indicators.

Intensity of mutual and foreign trade in clothes of the EAEU. The dynamics of C14 mutual trade of the EAEU indicates that the intensity of growth of C14 import flows was higher than export flows compared to 2015. However, as a result of the excess of the value of C14 exports over imports (1.2 times on average), there was a positive balance of mutual trade (Table 1).

Table 1 – Dynamics of EAEU mutual trade in clothing (dollars in millions, $)

| Indicators | Year | | | | | | | In percentage of 2015 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
| Turnover | 1082.0 | 1168.6 | 1484.8 | 1759.1 | 1813.4 | 1614.2 | 1979.9 | 108.0 | 137.2 | 162.6 | 167.6 | 149.2 | 183.0 |
| Exports | 621.2 | 656.2 | 815.7 | 977.2 | 955.0 | 886.7 | 1089.1 | 105.6 | 131.3 | 157.3 | 153.7 | 142.7 | 175.3 |
| Imports | 460.8 | 512.4 | 669.1 | 781.9 | 858.4 | 727.5 | 890.8 | 111.2 | 145.2 | 169.7 | 186.3 | 157.9 | 193.3 |
| Balance | 160.4 | 143.8 | 146.6 | 195.3 | 96.6 | 159.2 | 198.3 | 89.7 | 91.4 | 121.8 | 60.2 | 99.3 | 123.6 |

Source: author's development based on the data of the TN VED EAEU (codes 61, 62, 6309 and 6310) [2].

At the same time, the trade imbalance in C14 foreign trade with countries outside the EAEU increased from 2015 to 2021 (except for 2020), which indicates a significant increase in the negative foreign trade balance by 2015 (Table 2).

Distribution of the total volume of clothing trade by trade areas and the contribution of the EAEU partner countries to the change in the balance of goods. The largest share in the distribution of total C14 trade turnover among the EAEU member states for 2015–2021. Russia occupied 77.5 %, and Belarus occupied the second position – 9.2 %. Their total share in the distribution of the total C14 trade turnover was about 87 %, while in the mutual deliveries of C14 these countries accounted for only 12.8 % (Table 3).

Table 2 – Dynamics of the EAEU foreign trade in clothing goods with countries outside the EAEU (dollars in millions, $)

| Indicators | Year | | | | | | | In percentage of 2015 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
| Turnover | 5975.0 | 6140.2 | 7619.7 | 8316.5 | 8541.1 | 7791.6 | 9391.1 | 102.8 | 127.5 | 139.2 | 142.9 | 130.4 | 157.2 |
| Exports | 179.6 | 206.8 | 254.3 | 277.1 | 296.5 | 249.1 | 298.3 | 115.1 | 141.6 | 154.3 | 165.1 | 138.7 | 166.1 |
| Imports | 5795.4 | 5933.4 | 7365.4 | 8039.4 | 8244.6 | 7542.5 | 9092.8 | 102.4 | 127.1 | 138.7 | 142.3 | 130.1 | 156.9 |
| Balance | -5615.8 | -5726.6 | -7111.1 | -7762.3 | -7948.1 | -7293.4 | -8794.5 | 102.0 | 126.6 | 138.2 | 141.5 | 129.9 | 156.6 |

Source: author's development based on the data of the TN VED EAEU (codes 61, 62, 6309 and 6310) [2].

Table 3 – Distribution of clothing turnover of the EAEU member states for 2015–2021 by direction of trade

| Country – member of the EAEU | EAEU clothing turnover for 7 years | | | | | |
|---|---|---|---|---|---|---|
| | in mutual trade with the EAEU member states and countries outside the EAEU | | including | | | |
| | | | in mutual trade with partner countries | | in foreign trade with countries outside the EAEU | |
| | dollars in millions, $ | in % of total goods turnover within EAEU | dollars in millions, $ | in % of total goods turnover within EAEU | dollars in millions, $ | in % of total goods turnover within EAEU |
| Russia (RU) | 50 125.3 | 77.5 | 4 860.3 | 7.5 | 45 265.0 | 70.0 |
| Belarus (BY) | 5 931.8 | 9.2 | 3 444.3 | 5.3 | 2 487.6 | 3.8 |
| Kazakhstan (KZ) | 4 362.3 | 6.7 | 1 322.9 | 2.0 | 3 039.4 | 4.7 |
| Kyrgyzstan (KG) | 2 343.9 | 3.6 | 687.0 | 1.1 | 1 656.9 | 2.6 |
| Armenia (AM) | 1 911.5 | 3.0 | 585.4 | 0.9 | 1 326.1 | 2.1 |
| Total for the EAEU | 64 674.8 | 100 | 10 899.8 | 16.9 | 53 775.0 | 83.1 |

Source: author's development based on the data of the TN VED EAEU (codes 61, 62, 6309 and 6310) [1, 2].

From Table 3 we see that the largest share of the C14 EAEU trade turnover was concentrated in foreign trade with third countries – 83.1 % (RU share – 70 %). Consequently, the distribution of the C14 trade turnover of the EAEU is characterized by an imbalance, which is due to the high disproportion in the trade turnover of Russia and market orientation with countries outside the EAEU. The most balanced trade turnover of C14 over the past 7 years was demonstrated by Belarus (Table 3).

The value of the negative balance of C14 goods in foreign and mutual trade of the EAEU in 2021 increased by $3.17 billion by 2015 (Table 4).

Table 4 shows that RU made the largest negative contribution to the change in the C14 balance of the EAEU in all areas of trade – by 80.9 %, due to a negative contribution in foreign trade with countries outside the EAEU of about 80 %.

Table 4 – Dynamics of the contribution of the EAEU member states to the change in the balance of clothing goods by direction of trade

| Country – member of the EAEU | Change in the balance of clothing goods in the EAEU, 2021 to 2015 | | | |
|---|---|---|---|---|
| | in mutual trade with the EAEU member states and countries outside the EAEU | | including in foreign trade with countries outside the EAEU | |
| | dollars in millions, $ | contribution as a percentage of the total | dollars in millions, $ | contribution as a percentage of the total |
| Russia (RU) | -2 540.4 | -80.9 | -2 539.0 | -79.9 |
| Kazakhstan (KZ) | -322.5 | -10.3 | -282.9 | -8.9 |
| Kyrgyzstan (KG) | -270.8 | -8.6 | -229.1 | -7.2 |
| Belarus (BY) | -43.4 | -1.4 | -128.1 | -4.0 |
| Armenia (AM) | 36.4 | 1.2 | 0.3 | 0.01 |
| Total | -3 140.7 | -100 | -3 178.8 | -100 |

Source: author's development based on the data of the TN VED EAEU (codes 61, 62, 6309 and 6310) [1, 2].

Based on the results of a study of structural changes in the export-import flows of clothing in the EAEU as a whole and in the context of the EAEU member states by trade areas, the following conclusions were drawn: for 2015–2021. C14 export-import flows across the EAEU are generally characterized by imbalance, since on average 77.2 % of C14 export deliveries were realized in mutual trade; the high dependence of the EAEU partner countries on C14 imports from third countries remains high (91.5 % on average); in the dynamics of the structure of C14 exports in the context of the EAEU member states, the prevailing proportions by trade directions indicate that the export of C14 is most balanced only in AM; in the structure of C14 imports, there are high distortions in all countries, due to a significant share of C14 import flows from third countries, on average from 66.8 to 96.8 %.

Based on the results of the analysis of the commodity composition and commodity structure of clothing in the EAEU in the context of the main commodity groups by trade directions, the following conclusions were made: the commodity structure of export-import flows C14 in the mutual trade of the EAEU in the context of commodity groups over the past 7 years is characterized by a balance, as evidenced by a positive balance mutual trade, including in the context of the main commodity groups 61 and 62 [1, P. 53]; there is an increase in the balance of commodity group 62 to $99.8 million against the backdrop of a decrease in commodity group 61 to $103.6 million in 2021; in the structure of mutual exports of C14, the share of supplies of commodity groups 61 and 62 decreased from 91.8 % in 2015 to 84.7 % in 2021. In the structure of mutual imports between the EAEU partner countries, the share of supplies of commodity groups 61 and 62 decreased from 89.1 % in 2015 to 82.5 % in 2021; in the dynamics

of the structure of mutual exports and imports of C14 EAEU in the context of commodity groups, an increase in the share of goods (6309) – «Used clothing» was observed: the share of exports increased to 1.3 %, and the share of imports – up to 2 % in 2021; the commodity structure of C14 export-import flows in the EAEU foreign trade with third countries by commodity groups is characterized by an imbalance, as evidenced by the negative foreign trade balance in general and in terms of commodity groups over the past 7 years (an excess of the value of imports over C14 exports by an average of 26 times ); in dynamics, there was a steady growth trend in the negative balance of C14 EAEU foreign trade compared to 2015; The largest negative contribution to the change in the C14 foreign trade balance of the EAEU with third countries in 2021 compared to 2015 was made by all commodity groups.

Based on the results of studying the dynamics of the volumes of export-import flows of EAEU clothing and their structure in the context of key foreign trade partners, we made the following conclusions: the value of exports of C14 EAEU increased by $118.7 million (by compared to 2015; in 2021, the following 10 countries were the key buyers of C14 EAEU exports: Ukraine, Italy, Germany, Lithuania, Poland, Latvia, Slovakia, France, Moldova and the Netherlands, on average they accounted for 78 % of all deliveries; in the geographic structure of C14 exports of the EAEU in 2015 and 2021 The largest changes in the share distribution in the total volume of deliveries to third countries were observed in Ukraine (from 14.9 % to 18.9 %), Lithuania (from 13 % to 9 %), Poland (from 9.5 % to 4.7 %) and Moldova (from 9 to 2.2 %); a high level of geographical concentration of C14 exports remains, which indicates a significant dependence of the EAEU on the state of the economies of third countries (five key partners: Ukraine, Italy, Germany, Lithuania and Poland accounted for 63 % of all export deliveries in 2021); the value of EAEU C14 imports from third countries in 2021 increased by $3.3 billion (by 56.9 %) by 2015; The most important C14 importers in 2021 in the EAEU include the following 10 countries: China, Bangladesh, Turkey, Italy, Vietnam, Uzbekistan, India, Cambodia, Pakistan and Morocco, their share is about 85 % of all supplies; the geographical structure of C14 imports of the EAEU indicates the dominant position of China, its share decreased from 43.4 % in 2015 to 36.9 % in 2021; EAEU C14 imports are characterized by a higher country concentration compared to C14 exports to third countries, i.e. In 2021, 73.3 % of all C14 imports came from the first five countries. Consequently, EAEU C14 imports are characterized by even weaker geographic diversification and indicate a high dependence on several supplying countries – China, Bangladesh and Turkey (60.4 % in 2021).

Thus, the results of this study can be taken into account in order to take measures and management decisions (orders, recommendations) aimed at ensuring a balance in the foreign trade in clothing goods of the EAEU.

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## ASSESSMENT OF THE INNOVATION POTENTIAL OF THE REGIONS OF LATVIA, LITHUANIA AND BELARUS CONSIDERING THE RESULTS

***Gladevich J.***
*Daugavpils University, Latvia*
*e-mail: jevgenijs.gladevics@gmail.com*
***Гладевич Е.Г.***
*Даугавпилсский Университет, Латвия*

*Keywords: innovation potential, result, regional aspect.*

*Abstract. World scientists apply several approaches to assessing innovation potential. When studying the potential of innovation from the point of view of the result, the author uses the integral indicator developed by himself. As a result of the research, regions with different levels of development of innovation potential have been determined, the causes of the current situation have been defined and recommendations for further actions to improve the situation have been provided*.

World scientists distinguish several basic approaches, within which innovation is viewed as a change, a set of resources, and a process or a result. The author studies the innovation potential of the regions of Latvia, Lithuania and Belarus considering the results.

The aim of the study is to assess the innovation potential of the regions of Latvia, Lithuania and Belarus considering the results. The following tasks have been set to achieve this goal:

- to determine the structural components of the innovation potential of the regions of Latvia, Lithuania and Belarus;
- to develop methodology for assessing the innovation potential in the regions of Latvia, Lithuania, and Belarus;
- to approbate the developed methodology and with its help to assess the quantitative and structural differences in the innovation potential of the regions of Latvia, Lithuania and Belarus.

Research methods are statistical methods of quantitative data processing and analysis (the method of sum of the coefficients of determination of the largest dependent variable according to the explanatory variable, the method of the linear

scaling principle, frequency analysis, correlation analysis, the method of grouping into quintiles, the cartographic method, etc. statistical analysis methods).

The author evaluates the results of the innovation potential calculations with the help of a self-created integral indicator, the calculation process of which consists of several stages:

- unification of statistical indicators with a linear scaling technique in the interval from 0 to 10, sorting it into stimulants and destimulants,
- selection of determinant indicators of innovation potential from a wide set of available statistical indicators, which excludes indicators with similar or duplicate meaning without reducing the objectivity of the results,
- creating integral index by the selected indicators.

The author evaluates the innovation potential according to the following indicators (Drucker, (2009); D.Kokurin (2001):

- number of innovative companies;
- share of turnover of innovative companies.

The author determines the range of the obtained integral index value in the interval [0;10], dividing the value rows into quintiles.

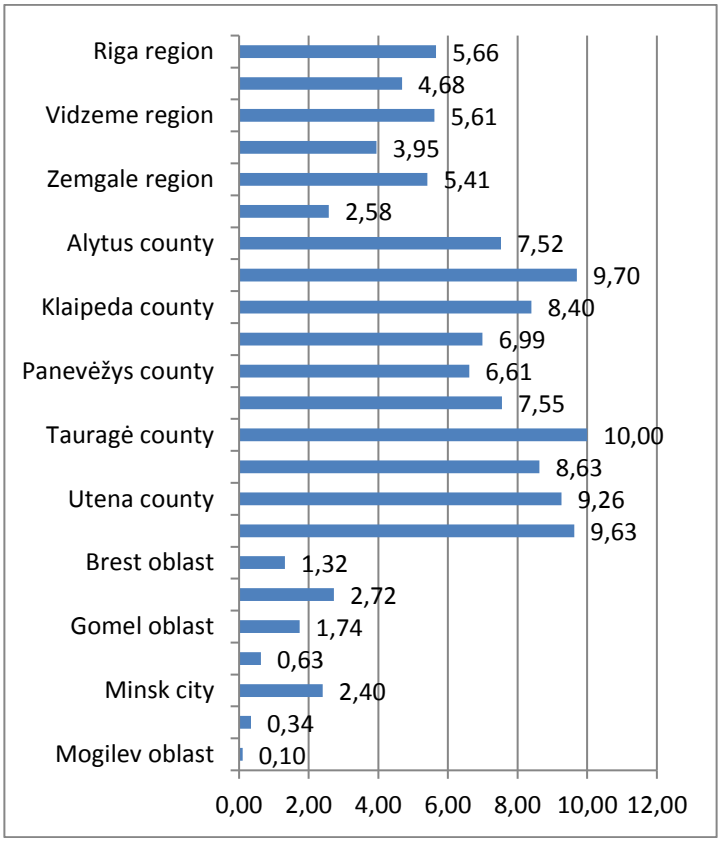


Figure 1 – Assessment of the innovation potential of the regions of Latvia, Lithuania and Belarus

Source: created by the author based on the data of the regions of Latvia, Lithuania, Belarus, using the innovation potential assessment methodology developed by the author

The obtained values of the integral indicator, expressed in normalized values, are divided into quintiles by the author for easier perception and visualization.

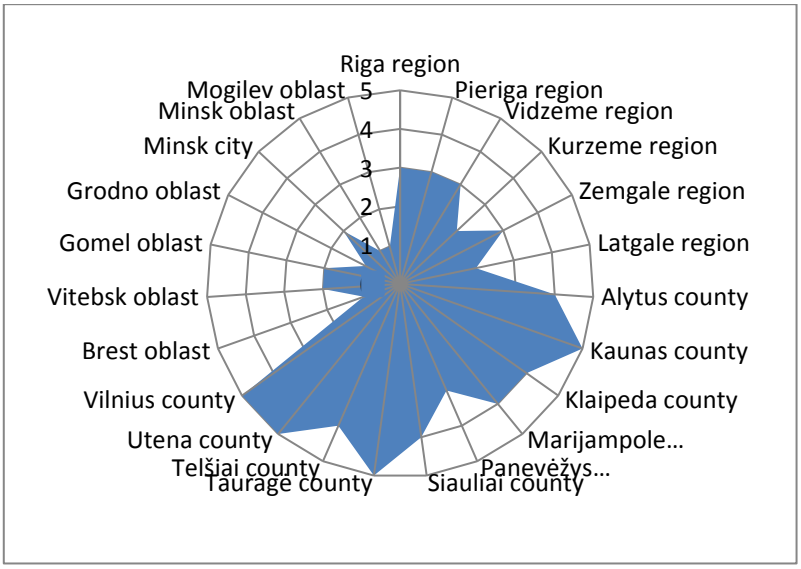


Figure 2 – Map of quintile groups of innovation potential of regions of Latvia, Lithuania, Belarus

Source: created by the author based on the data of the regions of Latvia, Lithuania, Belarus, using the innovation potential assessment methodology developed by the author.

High values of innovation potential are obtained only by the county of Lithuania: Tauragė county (10.00 normalized values), Kaunas county (9.70 normalized values), Vilnius county (9.63 normalized values), Utena county (9.26 normalized values), Telšiai county (8.63 normalized values), Klaipeda county (8.40 normalized values), Šauliai county (7.55 normalized values), Alytus county (7.52 normalized values). Low values of the innovation potential are obtained by: Mogilev oblast (0.10 normalized values), Minsk oblast (0.34 normalized values), Grodno oblast (0.63 normalized values), Brest oblast (1.32 normalized values), Gomel oblast (1.74 normalized values), Minsk (2.40 normalized values), Latgale region (2.58 normalized values), Vitebsk oblast (2.72 normalized values).

The first group of quintiles includes Brest oblast, Grodno oblast, Minsk oblast, and Mogilev oblast. The second quintile group includes Kurzeme region, Latgale region, Vitebsk oblast, Gomel oblast, and Minsk. The third group of quintiles consists of Riga region, Pieriga region, Vidzeme region, Zemgale region, Panevėžys district. The fourth quintile includes Alyta county, Klaipeda county, Marijampole county, Šiauliai county, and Telši county. The fifth quintile includes Kaunas county, Taurage county, Utena county, and Vilnius county.

The highest value of the integral indicator of innovation potential is obtained by Tauragė county (fifth quintile group), and the lowest by Mogilev oblast (first quintile group).

In the counties of Lithuania, the level of innovation potential shows mostly high values, which indicates a well-developed network of cooperation between business representatives, scientific institutions and state administrative institutions and effective use of existing resources. The innovative development of the region is limited by the number of existing resources. In the conditions of available resources, the level of the innovation potential of the region considering the results largely depends on the organization of the innovative activity, that is, on the organization of the transition process, as a result of which the innovative resources turn into an innovative result. The given processes in the regions of Latvia and Belarus must be studied, which will also determine the development problems of the innovation potential of the given regions.

The development of innovation potential in the regions of Lithuania is also facilitated by the implementation of many innovation-promoting projects: Vilnius 2IN, Hack Me if You Can, IT MUST, Intelligent Energy Lab, volunteers project Gedimino legionas etc. Vilnius (European Innovation, 2021) received the third place in the finals of the competition European Capital of Innovation (iCapital), in which 38 cities took part with the number of population not less than 50 000 people. European Capital of Innovation (iCapital) is an annual recognition award given to European cities that best promote innovation.

The highest level of innovation potential has been found in the counties of Lithuania, the average – in the regions of Latvia, and the lowest – in the oblasts of Belarus, which indicates the effective use of existing resources in the regions of Lithuania. In the regions of Latvia and Belarus, the use of resources is difficult. In the given regions, the transition process of innovative resources to the result must also be studied, which will definitely explain and determine the deficiencies and weak points of the innovative development of the regions, and cooperation between science, business and the state must be developed, which will definitely increase the level of innovation potential in the studied regions.

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UDC 41

# THE USE OF FINANCIAL RATIO ANALYSIS TO MEASURE SAMSUNG GROUP PROFITABILITY FOR 2019–2021

# ИСПОЛЬЗОВАНИЕ ФИНАНСОВОГО КОЭФФИЦИЕНТНОГО АНАЛИЗА ДЛЯ ОПРЕДЕЛЕНИЯ УРОВНЯ ПРИБЫЛЬНОСТИ ГРУППЫ САМСУНГ ЗА 2019–2021 ГГ.

***JiangYu***
*Vitebsk State Technological University, Belarus*
*e-mail: kafeconom@bk.ru*
***Цзян Юй***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: financial ratio analysis, profitability, profit, income, ratios, financial statements.*
*Ключевые слова: финансовый коэффициентный анализ, прибыльность, прибыль, коэффициенты, финансовые отчеты.*

*Abstract. In order to illustrate the corporation operating results, and forecast the future profits, to analyze and evaluate the company's business activities and the company's current and historical financial position they use the financial ratios. Based on the financial statements information for 2019–2021, calculated ratios confirmed Samsung Group has strong profitability, strong sustainable development ability and good operating conditions.*
*Аннотация. Для характеристики операционных результатов корпорации, прогнозирования будущей прибыли, исследования и оценки бизнес-активности и прошлого и текущего финансового состояния используются финансовые коэффициенты. Рассчитанные на основе данных финансовой отчетности за 2019–2021 гг., выбранные финансовые коэффициенты подтвердили устойчивую прибыльность Группы Самсунг, устойчивую способность к развитию и хорошие условия для операционной деятельности.*

Financial analysis is a complex work. In order to ensure that the analysis process is rigorous and effective, the financial analysis must go in a reasonable way. For the analysis of corporation profitability, first of all, we should analyze several ratios of enterprise profitability.

We chose five ratios to analyze Samsung profitability as follows:

(1) Gross profit margin
(2) Operating profit margin
(3) Net interest rate on sales
(4) Net interest rate on total assets
(5) Return on equity

The calculation formulas of mentioned above corporate profitability ratios are as follows:

$$\text{Gross margin} = \frac{(\text{sales revenue} - \text{Cost of sales})}{\text{sales revenue}} * 100\% \quad (1)$$

$$\text{Operating profit margin} = \frac{\text{Operating profit}}{\text{operating receipt}} * 100\% \quad (2)$$

$$\text{Net Profit Margin on Sales} = \frac{\text{Net profit}}{\text{sales revenue}} * 100\% \quad (3)$$

$$\text{Net interest rate of total assets} = \frac{\text{Net margin}}{\text{Average total assets}} * 100\% \quad (4)$$

$$\text{Return on equity} = \frac{\text{Profit after income tax}}{\text{Owner's equity}} * 100\% \quad (5)$$

We used the financial analysis method to analyze the time series of the relevant data from the Samsung Consolidated statements of Profit or Loss for the years ended December 31, 2019–2021. Specific is to use data of two or consecutive periods of Financial statements to calculate the same indicators to determine the direction, amount and range; to illustrate the corporation operating results; and forecast the future through the financial ratios; to analyze and evaluate the company's business activities and the company's current and historical position. We have found out the data from the financial statements of the current year, and calculated the data based on the above formulas.

In Table 1 we have presented the results of analysis conducted.

Table 1 – Samsung Group (Samsung) Profitability Data Analysis for 2019–2021

| Ratios | 2019 | 2020 | 2021 |
|---|---|---|---|
| Gross profit margin | 36.09 % | 38.98 % | 40.48 % |
| Operating profit margin | 12.05 % | 15.19 % | 18.46 % |
| Net interest rate on sales | 9.43 % | 11.15 % | 14.27 % |
| Net interest rate on total assets | 6.28 % | 7.22 % | 9.91 % |
| Return on equity | 8.27 % | 9.57 % | 13.08 % |

Based on the above information, Samsung Group has strong profitability, strong sustainable development ability and good operating conditions.

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UDC 330.564.2

# INCOME INEQUALITY IN CHINA: SCALES AND REGULATORY DIRECTIONS

# НЕРАВЕНСТВО ДОХОДОВ В КИТАЕ: МАСШТАБЫ И НАПРАВЛЕНИЯ РЕГУЛИРОВАНИЯ

***Zaitseva O., Li Yashuang***
*Vitebsk State Technological University, Belarus*
***Зайцева О.В., Ли Яшуан***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: inequality, income, China, COVID-19.*
*Ключевые слова: неравенство, доходы, Китай, COVID-19.*

*Abstract. This article presents an analysis of income inequality in China. The study identifies areas of change in inequality as a consequence of the COVID-19 pandemic and authors propose the following directions for regulating income inequality: increase education equality and support human resource policies to increase skills and labour productivity; increase health equality; improve access to labour and financial markets; increase the progressivity of taxes; increase social spending; broaden the base of tax revenues; strengthen progressive non-income taxation; introduce green taxation; increase payout of dividends of SOEs; address the mismatch in revenue and expenditure at the local government level.*

*Аннотация. В статье представлен анализ неравенства в доходах в Китае. В исследовании обозначены направления изменений в неравенстве вследствие пандемии COVID-19, предложены направления регулирования неравенства в доходах, в том числе: обеспечение равенства в образовании и поддержку политики в области человеческих ресурсов; обеспечение равенства в здравоохранении; расширение доступа к рынкам труда и финансовым рынкам; совершенствование прогрессивного налогообложения; увеличение социальных расходов; расширение базы налоговых поступлений; введение «зеленого» налогообложения; устранение несоответствия доходов и расходов на уровне местных органов власти.*

Income inequality refers to the unequal distribution of economic assets (wealth) and income among individuals in a group. The term generally refers to the income gap between individuals or groups in a society, and can also be used to point out international inequality. The issue of the gap between the rich and the poor is related to the concepts of economic equality, equal opportunity and equal outcomes.

The Covid-19 pandemic has exacerbated several forms of inequality within countries. It is still too early for a systematic understanding of the intra-country impact of the crisis on income and wealth inequality due to the lack of real-time data on the distribution of growth across all countries.

However, some data sources help us to understand the interplay between the Covid crisis and inequality within countries. From billionaire wealth records, we observe, for instance, that the gap between the very top of the wealth distribution and the rest of the population has widened dramatically during this pandemic. Between 2019 and 2021, the wealth of the top 0.001 % grew by 14 %, while average global wealth is estimated to have risen by just 1 %. At the top of the top, global billionaire wealth increased by more than 50 % between 2019 and 2021 [1].

In recent years, China's income gap has narrowed as a whole, but the Gini coefficient and the high-low income ratio are still at a relatively high level, the property-to-wage income ratio has continued to rise, and the income growth rate of the middle-income group lags behind that of the high- and low-income groups.

According to data from the National Bureau of Statistics, the Gini coefficient in 2019 was 0.465. The ratio of disposable income of high-income (top 20 %) and low-income (bottom 20 %) groups in 2020 was 10.20, down from 10.97 in 2018. But it is still at a high level; the average high-low income ratio from 2013 to 2020 is 10.64. The property-to-wage income ratio rose from 13.7 % in 2013 to 15.6 % in 2020 [2]. The proportion of property income increased from 2.3 % in 2009 to 8.7 % in 2020. Property income increased by 12.9 % in 2018, much higher than wage income of 8.3 % and operating income of 7.8 % [2].

Evidence demonstrates that serious income inequality can threaten a country’s economic development and social stability. What is more, income inequality can lead to weak consumption and low efficiency, causing economic growth to slow. It can also make it hard for low-income people to bolster their own human capital, trapping them in a debilitating cycle of poverty with little upward mobility.

To solve the current problems of income distribution, China will need a holistic approach that includes designing a comprehensive and effective compensation and distribution policy framework but also the development of timely and equitable policy measures that curb these trends and address the problem of unequal income distribution in a fundamental way.

The following policy recommendations highlight three complementary avenues of reform to balance income distribution in the China: 1. Increase education equality and support human resource policies to increase skills and labor productivity; increase health equality; improve access to labor and financial markets; increase the progressivity of taxes; increase social spending; broaden the base of tax revenues; strengthen progressive non-income taxation; introduce green taxation; increase payout of dividends of SOEs; address the mismatch in revenue and expenditures at the local government level.

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UDC 331.5

# APPLIED ASPECTS OF INFORMATION TECHNOLOGY DEVELOPMENT AS A FACTOR IN IMPROVING THE QUALITY OF LIFE

# ПРИКЛАДНЫЕ АСПЕКТЫ РАЗВИТИЯ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ КАК ФАКТОР ПОВЫШЕНИЯ КАЧЕСТВА ЖИЗНИ

***Ogorodnikova E.*, Selezneva M.**, Kocherian M.****
*Ural State University of Economics, Russia*
*e-mail: cmb_8@mail.ru*, mvselezneva@yandex.ru**, post-1816@yandex.ru****
***Огородникова Е.С.*, Селезнева М.В.**, Кочерьян М.А.****
*Уральский государственный экономический университет, Российская Федерация*

*Keywords: information technologies, quality of life, labor relations, requirements for employee competencies, "over-professional" competencies.*

*Ключевые слова: информационные технологии, качество жизни, трудовые отношения, требования к компетенциям работника, «надпрофессиональные» компетенции.*

*Abstract. The increasing use of information technologies actively contributes to solving a number of problems of improving the quality of life of the population, stimulates the creation of highly efficient jobs, and is also aimed at improving conditions for increasing social mobility, labor quality, wage growth, and employment support. The aim of the research is to study the applied aspects of the development of information technologies from the standpoint of the impact on the quality of life of the population. The results showed that the majority of respondents positively assess the impact of information technology on the quality of life. The main consequences of the introduction of information technologies include the transition from long-term labor relations to short-term performance of tasks on crowdworking Internet sites, the disappearance of a number of traditional professions, the emergence of new ones and the increase in requirements for employee competencies.*

*Аннотация. Все большее применение информационных технологий активно способствует решению ряда проблем повышения качества жизни населения, стимулирует создание высокоэффективных рабочих мест, а также направлено на улучшение условий для повышения социальной мобильности, качества труда, роста оплаты труда, поддержки занятости. Цель исследования направлена на изучение прикладных аспектов развития информационных технологий с позиции влияния на качество жизни населения. Результаты показали, что большинство респондентов положительно оценивают влияние информационных технологий на качество жизни. К основным последствиям внедрения информационных технологий можно отнести переход от долгосрочных трудовых отношений к краткосрочному выполнению заданий на краудворкинговых интернет-*

*площадках, исчезновение ряда традиционных профессий, появление новых и повышение требований к компетенциям сотрудников.*

The quality of labor life is understood as a complex indicator that reflects the development level of the backbone parameters of the labor process in an organization, determined on the basis of expert assessments, as well as the degree of employee satisfaction with their work activity [1]. Integrating various approaches of researchers [2, 3], the indicators of the quality of labor life include: working conditions at the workplace; salary level; creation by the employer of conditions for the development of the personality of the employee; motivation to work and satisfaction of employees.

The purpose of the article is to determine the nature of the information technology impact on the quality of labor life in modern Russia.

Researchers ambiguously assess the information technology impact on the quality of the labor life of Russians. Information technologies lead to the disappearance of the line between working time and rest time, the employee is constantly in touch and cannot "disconnect" from solving work issues even on vacation [4]. The use of a personal computer, mobile phone and other devices and means of communication in the course of work raises the problem of the inviolability of information and documents of a private nature.

On the one hand, by using means of audiovisual monitoring of the employee's behavior in the workplace, the employer invades the employee's personal space. This is especially important when working remotely from home. When exercising control over the activities of a remote worker, there are high risks of the private life of the worker and their family members getting into the employer's field of view.

But, on the other hand, as experts from the international labor organization note, technological tools and digital surveillance systems are actively used to manage the labor force in modern workplaces (for example, a GPS system tracks the location and speed of drivers of both trucks and cars; special programs to control computer screens, analyze keyboard activity in order to monitor the activities of employees). These methods are aimed at increasing labor productivity, the level of safety, preventing accidents, illegal behavior, monitoring the health of an employee, etc. [5, 6].

Information technologies play a positive role in the formation of employees' income. Modern information technologies allow earning not only at main place of work, but also in free time by working on Internet platforms and receiving additional income. In addition, working from home with the help of Internet technologies provides an opportunity to earn money for such low-mobility categories of citizens as people with disabilities; elderly people; parents with young children or children with disabilities; caregivers of relatives in need of assistance. Also, information technology can improve the welfare of low-income categories of citizens, for example, students who earn extra money in their free time.

The creation by the employer of conditions for the development of the personality of the employee is connected, first of all, with the implementation of the idea of lifelong learning. In conditions when there is a lot of information and it quickly becomes

outdated, the knowledge gained at the university is not enough for successful work. At the same time, learning is associated not only with obtaining new information, but also with the development of the necessary skills. For example, due to constant changes in the economy, the number of jobs where you can do one thing is decreasing (for example, the work of an accountant or a salesperson), there are more and more places where work is organized as a set of various projects [7, 8].

Therefore, in order to increase competitiveness in the labor market, it is already important for an employee to have a certain set of so-called "over-professional" competencies, among which the Atlas of new professions lists: process and project management, multilingualism and multiculturalism, customer focus, systemic thinking, the ability to work with teams, groups and individual people; work in the mode of high uncertainty and fast change of tasks and others. In this regard, the system of training and additional professional education of employees should be transformed into a system of professional development [9].

According to the results of the survey, the majority of respondents positively assessed the information technology impact on the quality of their life. Information technologies have an increasing impact on the quality of life of the Russians, so there is a problem of ensuring digital literacy of the population. The lack of competencies in the use of information technologies will lead to an increase in social inequality, when people who do not have digital skills will not be able to receive education, find a job, and communicate.

According to the annual survey of the Federal State Statistics Service of Russia in the form No. 1-IT "Questionnaire for a sample survey of the population on the use of information and communication networks" and a labor force survey in the form 1–3 "Questionnaire for a sample survey of the labor force", the digital skills of those employed in economy and students in secondary and higher education programs are formed at the next level.

The maturity level of information skills is quite high, but in some areas it does not exceed 50% of the number of respondents. It seems promising to spread the idea of professional development to the sphere of labor relations. Accordingly, the institution of training and additional professional education can be transformed into the institution of training and professional development of employees.

Modern technological advances – artificial intelligence, automation and robotics – lead, on the one hand, to the reduction, and on the other hand, to the creation of new jobs, but new high-tech jobs will require the released workers to quickly change their professional skills. Therefore, it is objectively necessary to increase investment in the development of human abilities, which, first of all, should be associated with the possibility of realizing the right to lifelong learning.

Speaking about the impact of digitalization on the labor life quality, it should be noted that it occurs unevenly in space and time. Despite the impressive spread of information technology, not all subjects of labor relations receive "digital dividends" from this. In addition to the benefits, there are also significant risks. A new way of organizing jobs based on the use of information technology allows to set flexible

working hours, combine work and home duties, expands access to jobs for people with reduced mobility. At the same time, there are such consequences as the transition from long-term labor relations to short-term one-time performance of tasks on crowdworking Internet platforms, the reduction of unskilled jobs, the disappearance of a number of traditional professions, the emergence of new ones, and high requirements for the competence of employees.

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# DEVELOPMENT OF DIGITAL AGRICULTURE
# РАЗВИТИЕ ЦИФРОВОГО СЕЛЬСКОГО ХОЗЯЙСТВА

***Petrova A.***
*Vitebsk State Technological University, Belarus*
***Петрова А.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: digital economy, agriculture, digital transformation, digitalization of the agro-industrial sector, innovative development.*
*Ключевые слова: цифровая экономика, сельское хозяйство, цифровая трансформация, цифровизация агропромышленного сектора, инновационное развитие.*

*Agriculture is a priority sector of the economy of the Republic of Belarus. The problems and guidelines of digital transformation of the subjects of the agro-industrial sector for the purpose of sustainable socio-economic development of the regions are considered. The features of investing in agriculture during the period of its digitalization are analyzed. The directions of improvement of innovative activity in the agricultural sector, which include the modernization of the organizational and legal structure and the increase in investment attractiveness, are identified.*
*Аннотация. Сельское хозяйство является приоритетной отраслью экономики Республики Беларусь. Рассмотрены проблемы и ориентиры цифровой трансформации субъектов агропромышленного сектора с целью устойчивого социально-экономического развития регионов. Проанализированы особенности инвестирования в сельское хозяйство в период его цифровизации. Определены направления совершенствования инновационной деятельности в аграрной сфере, к которым относятся модернизация организационно-правовой структуры и увеличение инвестиционной привлекательности.*

During the period of integration economic conditions, all organizations striving for effective functioning need to go through the process of digital transformation, as the new socio-economic system today is formed by such concepts as «technological society», «digital economy», «knowledge economy», which determined the relevance and choice of the research topic. The agro-industrial complex of the Republic of Belarus is a key sector of the country's economy, where the basis of the processes of integration of conglomerates and megaclusters is the transformation of the industry, contributing to the development of specialization and concentration of production, as one of the most important prerequisites for the connection of agriculture and industry.

Agriculture is increasingly acquiring the properties of a knowledge-intensive branch of the national economy. Currently, the use of the necessary information received on time and processed efficiently using the latest technologies can significantly increase labor productivity, which in turn reduces costs and makes the agro-industrial complex

an interesting object for investment. In most developed countries, investment in agriculture is encouraged and supported by the state. The main directions of investment policy in this sector of the economy are aimed at increasing production, actively using the latest technical, technological and managerial achievements. The need for digitalization of the agro-industrial complex is obvious – implementation of digital economy principles will create an institutional environment that meets modern realities and allows to generally improve production efficiency.

Agriculture is a priority industry in the Republic of Belarus. It is essential for ensuring the country's food security and for providing raw materials to other industries. Agriculture is also one of the most important activities in the republic for it employs more than 20 % of the workforce. In 2021 agricultural production amounted to 95.8 % of the level of 2020 [4]. The most important link of the new model of the national economy in the Concept of the National Strategy of Innovative Development of the Republic of Belarus for the period up to 2035 is defined as digital transformation based on high-tech business projects. Technological innovations should become the center of the Belarusian economy, and the digital integration of new generation information models into all areas of life should be the tool [3]. At the same time, emphasis is placed on the development of Industry 4.0 technologies, precision agriculture, smart farms and digital greenhouses. Thus, one of the key benchmarks of development agribusiness is a digital transformation, which includes changes and problems associated with the use of innovative technologies and their integration into all areas of the studied sector.

The Belarusian agricultural sector is now at the turning-point stage. The country managed to overcome the recession of production, to bring the number of loss-making agricultural companies to the minimum, to restore the balance at the foodstuffs market by raising the share of home-made products; to extend exports and domestic sales of foodstuffs. Due to the state support, especially due to investments in modernization and retooling, the agricultural output has increased greatly. The Belarusian agrarian business is represented by large agricultural enterprises. Most of the farms have mixed crop and livestock farming. A powerful cattle breeding has been created in Belarus to manufacture milk and meat products.

The republic is one of the main producers of flax in the world and the second producer of potatoes in Europe. The fact that potatoes are Belarusian «second bread» is known far beyond the republic. No wonder: Belarus is the second producer of potatoes in Europe. The increase in cattle breeding production and the demand for new products required a modernization of dairy and meat-processing companies. Belarus is considered to have low prices for foodstuffs among other countries in transition. Retail prices for foodstuffs in Belarus are much lower than those in Russia and other CIS countries. Belarusian agriculture does not only produce farm products to meet domestic needs. The republic is a traditional exporter of agricultural products. Among them are pork, beef, chicken, animal oil, cheese, eggs, flax, vegetables. The Belarusian agro-industrial complex has recently turned into a big exporter. Price – reasonable, quality – excellent. This is the goal of Belarusian agrarians.

Thus, we can conclude that the main activities of States related to increasing the investment attractiveness of agriculture are aimed at obtaining new scientific knowledge, introducing innovative technologies and developing the digital economy. Taking into account the need for large investments in the agro-industrial sector of the economy in developed countries, there are whole sets of measures aimed at encouraging and supporting agricultural investors.

To implement the digital economy in agriculture, the Ministry of agriculture of the Russian Federation adopted the departmental project «Digital agriculture» in 2020. According to this document, digital agriculture refers to agriculture based on innovative ways of producing agricultural products using digital technologies, including robotics, e-Commerce, analysis of large databases, the Internet of things, which contribute to increasing labor productivity and reducing costs. Agriculture includes several areas, the main of which are crop production and animal husbandry [2].

According to scientists, the introduction of e-agriculture will help agricultural enterprises successfully solve many problems: increase production by optimizing operations including proper planting, watering, pesticide treatment, and harvesting; improvement of product quality due to the implementation of product quality analysis; improvement of animal husbandry through the use of modern electronic sensors that can track the condition of animals, as well as their location [1, p. 351].

The beginning digitalization of the agro-industrial complex can level out many investment risks and make the industry more attractive to potential investors. Thus, we can state that agriculture is interesting area of investment from the point of view of studying. This industry is the most important sector of the economy for any state.

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UDC 334.7

# MANAGEMENT OF INTER-SUBJECT INTERACTION OF INDUSTRIAL ECOSYSTEM PARTICIPANTS

# УПРАВЛЕНИЕ МЕЖСУБЪЕКТНЫМ ВЗАИМОДЕЙСТВИЕМ УЧАСТНИКОВ ПРОМЫШЛЕННОЙ ЭКОСИСТЕМЫ

***Plakhin A.**, Blinkov I.**, Rostovtsev K.******
*Ural State University of Economics, Russia*
*e-mail: apla@usue.ru*, blinkov_io@nlmk.com**, rostovtsev@isnet.ru****
***Плахин А.Е.*, Блинков И.О.**, Ростовцев К.М.******
*Уральский государственный экономический университет, Российская Федерация*

*Keywords: inter-subject interaction, industrial ecosystem, management, specific organizational forms, ecosystem effects.*

*Ключевые слова: межсубъектное взаимодействие, промышленная экосистема, управление, специфические организационные формы, экосистемные эффекты.*

*Abstract. The relevance of the study is due to the fact that in the field of industrial production, the implementation of integration processes for the design and deployment of scientific and technological chains that produce finished competitive products is often carried out within the framework of ecosystems representing specific organizational forms, the task of which is to streamline the interaction of independent entities in order to obtain positive synergistic effects. The subject of the study was the organizational and economic relations that arise in the process of forming an organizational mechanism for managing the inter-subject interaction of ecosystem participants.*

*Аннотация. Актуальность исследования обусловлена тем, что в сфере промышленного производства реализация интеграционных процессов проектирования и развертывания научно-технологических цепочек, производящих готовую конкурентоспособную продукцию, зачастую осуществляется в рамках экосистем, представляющих конкретные организационные формы, задачей которых является упорядочение взаимодействия независимых субъектов с целью получения положительных синергетических эффектов. Предметом исследования стали организационно-экономические отношения, возникающие в процессе формирования организационного механизма управления межсубъектным взаимодействием участников экосистемы.*

An ecosystem could be clarified as an organizational form of coordination of complementary resources and competencies of legally independent economic entities in order to ensure positive synergy from their interaction. The development of ecosystem is possible due to the motive for increasing the profits of participants, but at

the same time it is limited by the possibilities of obtaining this profit due to the effects generated by a new form of interaction.

Based on this approach, we can distinguish three types of coordination related to the use of the resources of the participants in the industrial ecosystem [1]:

- Firstly, coordination of relations concerning the use of non-specific resources. The absence of the resource rarity property makes it possible to use the market exchange mechanism;
- Secondly, coordination of relations associated with the use of specific resources is based on the principles of hierarchy;
- Thirdly, the use of the hybrid coordination mechanism, which involves the formation of stable network relationships.

The essential characteristics of an ecosystem as a special organizational superstructure should include not only mechanisms for coordinating economic entities, but also iterative procedures for selecting these coordination mechanisms. At the same time, the criterion for the selecting one or another coordination mechanism within the ecosystem is the possibility of achieving positive synergy and the cumulative economic effectiveness of the interaction of ecosystem participants.

Within the framework of the research goals, we have developed a methodology for assessing the partnerships of ecosystem participants, which allows to obtain a comprehensive understanding of the specificity of the connectedness of partners, the forms of coordination of interaction and the formation of additional synergistic effects of the ecosystem.

The methodology we propose allows to determine the specificity of relations between ecosystem participants, which determines their interdependence, taking into account the resource potential of each partner.

The structural elements of the model are of a qualitative nature, therefore, to ensure their comparability when calculating integrated indicators, it is necessary to use the method of expert assessments, which is used to reduce uncertainty and is able to ensure the objectivity, complexity and reliability of management decisions.

Based on the data obtained, characterizing the existing ways of organizing interaction between ecosystem participants, such possible forms of coordination are determined as: market exchange; hybrid form; hierarchy.

In hierarchical structures, a fundamentally different control mechanism is used, based on a vertical power pyramid built on the principle of subordination. The main tool that binds this structure and makes it sustainable is the ownership of assets. Mixed coordination mechanisms are based on a symbiosis to varying degrees of market and hierarchical mechanisms. Organizations using a mixed mechanism of coordination are the result of the transformation of two extreme types of organization of interaction, arising in two diametrically opposite directions [2].

In the works of most authors, the ecosystem, as a specific form of network interaction, occupies an intermediate position between market and hierarchical coordination [3]. In addition, Walter A., Ritter T., Gumeden H. consider partnerships

as an effective mechanism for coordinating work and adapting the economic system to constant changes [4].

Further, the forms of coordination must be analyzed from the standpoint of the formation of additional synergistic effects by calculating the relevant indicators before and after the interaction.

The main indicators of ecosystem effects achieved include: increase in the output of quality products; increase in profits of ecosystem participants; increasing the quality of products; reducing the labor intensity of products; reducing of risks in the implementation of joint activities; growth of qualification of employees with high qualification and some others.

When developing indicators for assessing additional effects, not only infrastructural effects and economies of scale are taken into account through the indicators of output and profits of ecosystem entities, but also the growth of innovation, qualifications, competitiveness, investment attractiveness and risk reduction is assessed [5].

At the next stage of the proposed model, the correspondence between the form of coordination of interaction between ecosystem participants and the interdependence is determined. When the results obtained for all participants of the ecosystem are combined, a complete picture of intersubjective interaction is formed and it becomes possible to manage such a complex object of management as an ecosystem that has a polysubjective structure.

In accordance with the developed methodology, an assessment was made of the interdependence between the participants in the studied industrial ecosystem of NLMK Ural. Most of the relationships that have developed within the NLMK Ural ecosystem are characterized as relationships of a specific nature. Critical relationships, which are characterized by a high level of interdependence between ecosystem participants, are observed only for three partners.

In order to assess ecosystem effects, the indicators of the studied ecosystem proposed within the framework of the author's methodology were calculated for the period from 2010 to 2021, with the allocation of 4 main stages of ecosystem development in accordance with the year the partnership was established.

The results of the study confirm that the NLMK Ural ecosystem needs to modify the ecosystem coordination system in the following areas:

− attraction of partners, the establishment of stable relations with which would allow solving the issues of increasing competitiveness, qualification, innovative activity, risk reduction;

− changing the form of coordination of ecosystem participants from hybrid tools to hierarchical tools related to the value chain and generating significant additional synergistic effects;

− changing the form of coordination of ecosystem participants related to infrastructure service organizations from hybrid instruments to market instruments.

It is important to emphasize that the organization of the ecosystem involves a partial reorganization of the management systems of business partners. Often this problem is

solved empirically, that is, through trial and error, which may lead to the premature termination of cooperation. We propose to solve this problem by creating a coordinating council for managing inter-firm interaction between ecosystem participants, consisting of representatives of partner enterprises. Its main functions should be: development and coordination of goals, objectives and projects of intercompany interaction; organization and control over the implementation of science-intensive projects; assessment with a group of experts of inter-subject relations of ecosystem participants, acting as an initiator, as well as its business partners; development of recommendations for improving the adaptive system of partnerships.

Thus, the recommendations presented above make it possible not only to assess the effectiveness of the organizational mechanism for managing inter-subject interaction of ecosystem participants, but also serve as a tool for timely adjustment, building and maintaining inter-subject relations of ecosystem participants, strengthening the protection of the competitive position of the initiating enterprise.

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# STUDY OF THE POTENTIAL OF THE REPUBLIC OF BELARUS FOR THE IMPLEMENTATION OF THE "SMART SPECIALIZATION" STRATEGY

***Sherstneva O.***
*Vitebsk State Technological University, Belarus*
*e-mail: olga_sherstneva@mail.ru*
***Шерстнева О.М.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: innovations, research and entrepreneurship, regional development, smart specialization strategy.*
*Ключевые слова: инновации, исследовательская и предпринимательская деятельность, региональное развитие, стратегия «умной специализации».*

*Abstract. The article defines the main indicators characterizing the possibility of applying the "smart specialization" strategy, including the scientific and innovative environment of the regions, as well as the business sector. A study of innovative, scientific and entrepreneurial activities of the Republic of Belarus in the context of regions was carried out. As a result of the study, both positive and negative trends. The main directions of activation of innovative, scientific and business development of enterprises of the Republic of Belarus are proposed in order to create the possibility of applying the strategy of "smart specialization".*
*Аннотация. В статье определены основные показатели, характеризующие возможность применения стратегии «умной специализации», включающие научную и инновационную среду регионов, а также предпринимательский сектор. Проведено исследование инновационной, научной и предпринимательской деятельности Республики Беларусь в разрезе регионов. В результате проведенного исследования были определены как положительные, так и отрицательные тенденции. Предложены основные направления активизации инновационного, научного и бизнес развития предприятий Республики Беларусь с целью создания возможности применения стратегии «умной специализации».*

A key aspect of "smart specialization" both at the regional and international level is the promotion of technology, science and business, as well as the creation of competitive advantages that would allow these territories to stimulate their economic and social development on the principles of sustainable development. A key element of the smart specialization strategy for regional innovation and innovation development is the promotion of technology in the business of enterprises and economic and social institutions [1, 2]. The Smart Specialization Strategy is, in fact, a part of the European Commission's Smart Growth Strategy, which aims at leading Europe towards smarter, more inclusive and more sustainable growth.

Thus, "smart specialization" is a concept for the development of the region based on the identification of competitive areas/activities and the promotion of smart business systems and smart cooperation [3].

The effectiveness of research activities is largely determined by the number of organizations that carry out research and development; intellectual potential, which is formed by scientific personnel; as well as the volume of research and development performed, scientific and technical services provided by organizations. The Republic of Belarus is traditionally considered a state with a significant scientific and intellectual potential; scientific schools recognized in the world; and a developed system of personnel training.

In terms of the number of organizations performing research and development, there is a noticeable decrease in their number: by 9 organizations in the Republic. However, the growth of the organizations under study is visible in the Vitebsk and Gomel regions; the leading position over the past five years has been occupied by the city of Minsk. The lagging regions for this indicator are the Mogilev and Grodno regions [4, p. 755]. In terms of the number of personnel involved in research and development, it can be noted that the largest number of people corresponds to the city of Minsk and the Minsk region, however, in 2020 there is a noticeable increase in the number in the Vitebsk region (+198). But also in 2020, compared to 2019, in the Republic as a whole, there is a decrease in the number of personnel engaged in research and development by 2113 people [5].

A number of researchers point at a negative trend of -3.8 % (-130 people) [4, p. 754]. At the same time, despite the decrease in the number of organizations using innovations, the volume of research and development carried out is growing [4, p. 756]. As evidenced by the given data, in the analyzed period there is an increase in the volume of research and development performed, scientific and technical services provided by organizations.

The innovative activity of enterprises is not only a characteristic indicator of innovative activity in the country, but also one of the main indicators of the knowledge economy. According to the data of the National Statistical Committee of the Republic of Belarus, during the study period, there has been an increase in the number of Belarusian enterprises engaged in innovative activities in all regions of the country, with the exception of the Minsk region [6]. In the analyzed period, the growth rate of shipped innovative products was positive in all regions, with the exception of Minsk. In addition, there was a decrease in the share of shipped innovative products in the total volume of shipped products in 2019 from 18.6 % to 16.6 %. However, at the end of the analyzed period, there was a positive trend. Thus, in 2020, compared to 2019, the share of shipped innovative products in the total volume of shipped products increased from 16.6 % to 17.9 %. This circumstance testifies to the increased susceptibility of national enterprises to innovations as a means of increasing their competitiveness [7]. It should also be noted that at the end of 2021, 88 organizations participate in joint projects for the implementation of innovative activities, which is about 20 % of all organizations performing research and development in 2021. The largest number of organizations

participating in joint projects for the implementation of innovative activities in 2021 is noted in Minsk, in the Brest, Vitebsk and Minsk regions. In terms of the number of joint projects for the implementation of innovative activities, the city of Minsk and the Brest region are in the lead [8].

One of the important components of the implementation of the "smart specialization" strategy is the entrepreneurial activity of the regions and the country as a whole. For the period 2016–2020 there is an increase in the share of small and medium enterprises participating in joint innovation projects. The share of staff employment in knowledge-intensive activities has been on the rise over the past five years. Also, the share of innovations new to the market and new to the company in the total turnover in the Republic of Belarus as a whole in 2020 increased by 0.39 % compared to 2019 [9]. The growth of these indicators is associated with an increase in the share of investments in fixed assets of SMEs. Minsk, and Minsk, Mogilev, and Vitebsk regions occupy the leading position in terms of the share of investment in fixed capital of SMEs. In the Grodno and Brest regions, there is a noticeable decrease in the share of investment in fixed capital of SME organizations in 2020 compared to 2019 [10].

The study made it possible to determine that the development of innovative, scientific and entrepreneurial activities of enterprises in the Republic of Belarus is characterized by both positive and negative trends. Thus, in the main areas characterizing the possibility of applying the "smart specialization" strategy, the following conclusions can be drawn:

To activate the innovative, scientific and business development of enterprises of the Republic of Belarus in order to create the possibility of applying the "smart specialization" strategy, it is necessary: development of new and improvement of basic industrial technologies to improve the quality of products, reduce the cost of its production; development of innovative products with high added value, involving modifications of the product and modernization of the technological process; development of sectoral and university science, creation on their basis of sectoral scientific and testing laboratories for the needs of all sub-sectors of industry; provision by the state of the principles of sustainable financing of research and development using various sources (the republican budget, innovation funds, venture funds, grants, own funds of enterprises); development of various forms of scientific and technical partnership, expansion of the geography of the search for business partners in the innovation sphere between regions and abroad.

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# MODELING AS A TOOL FOR ORGANIZING ACTIVITIES IN THE BUSINESS SPHERE

# МОДЕЛИРОВАНИЕ КАК ИНСТРУМЕНТ ПРИ ОРГАНИЗАЦИИ ДЕЯТЕЛЬНОСТИ В БИЗНЕС-СФЕРЕ

***Shikshnyan E.K., Stasenia T.P., Mandrik O.G.****
*Vitebsk State Technological University, Belarus*
*e-mail: mandrik_miit@rambler.ru**
***Шикшнян Е.К., Стасеня Т.П., Мандрик О.Г.****
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: modeling, business-model, business process.*
*Ключевые слова: моделирование, бизнес-модель, бизнес-процесс.*

*Abstract. In the world of modern technologies, constant digitalization of society, it is difficult to imagine the life and activities of a person, organizations, firms, states and other economic entities without visual, understandable and symbolic images that help determine the development and activities in the future. One of these assistants is business process modeling.*

*Аннотация. В мире современных технологий, постоянной цифровизации общества сложно представить жизнь и деятельность человека, организаций, фирм, государств и других субъектов экономики без наглядных понятных и символьных образов, которые помогают определить развитие и деятельность в будущем. Одним из таких помощников является моделирование бизнес-процессов.*

Business (activity, occupation, enterprise) is an activity aimed at systematic profit-making. In English, the term «business» is used for all shades of the meaning of the concept of «business».

A model (French modele from Latin modulus «measure, analogue, sample») is a system which research serves as a means for obtaining and analyzing information about real processes, devices, concepts or systems [1]. Also, a model is an abstract representation of reality in some form, designed to represent certain aspects of this reality and to provide answers to the questions being studied [2].

Modeling is performed in order to reduce the uncertainty of various characteristics. When transferring all knowledge about an object, several types of models (schemes) are developed that reflect the object from different points of view, for example: structural; functional; behavioral; temporal, etc.

A business-model is a representation of how an organization makes (or intends to make) money. The business model describes the value that an organization offers to various customers, reflects the organization's abilities, the list of partners required to create, promote and deliver this value to customers, the capital ratios necessary to obtain sustainable income streams [3].

A business-process is a set of sequential «steps», the implementation of which leads to the creation of a product or the expected result of an event that fully meets the initial requirements. At certain steps, it is necessary, based on the available data, to choose one of the possible branches of movement, which significantly affects the final result. A thorough analysis of the initial data and choice options leads to an optimal solution that cannot be obtained without the use of modeling.

The purpose of the article is to explore approaches and types of building business-processes, to build a business-process.

The business-process model can be presented in the form of a graphical, tabular, textual and symbolic description that reflects the actual or intended activity of the subject.

Modeling must begin with the definition and description of the functionality of the business-process as a whole.

Let's model a business-process that describes the stages of admission to a higher educational institution in the form of a flowchart (Figure 1).

The algorithm of the business-process «Admission to the university» consists of the following processes:

1. The first stage assumes that the future applicant, with the help of career guidance tests, his inclinations and hobbies, advice from relatives and teachers, makes a choice of who he wants to become.
2. The choice of specialty is made, then you need to find out which universities have the chosen specialty, for this you need to explore various educational sites, directories, university websites.
3. At the next stage, the applicant is determined with the city and university for admission. The main driving force at this stage is transport communication, the prestige of the university, the cost of education.
4. Then preparation for the CT begins, which includes self-study, attending extracurricular classes or tutors.
5. The next function involves testing knowledge on the RT, where the applicant checks his strength and makes a forecast for admission.
6. Next, the final school exams take place, at the entrance of this stage the applicant receives a document on general secondary education, which is necessary for further admission.
7. Delivery of the DT takes place within the time limits established by the Ministry of Education and in accordance with all requirements.
8. Next, the applicant undergoes a medical examination and at the exit receives a certificate of eligibility for training in the chosen specialty.
9. Then the applicant receives the CT certificates necessary for submitting documents in accordance with the rules for admission to universities.
10. At the stage of monitoring the introductory company, a branching occurs when the applicant sees that he knows enough or not enough points.

11. In the first situation, the applicant submits to the selection committee all the necessary documents for admission specified in the rules for admission to universities and waits for lists of enrolled.

12. When adding the second option, a branching occurs again, which assumes that the applicant chooses a similar specialty or another university, or decides to enter another educational institution (college).

13. At the output of the business-process, the applicant receives a positive result – enrolled or unsatisfactory – not enrolled.

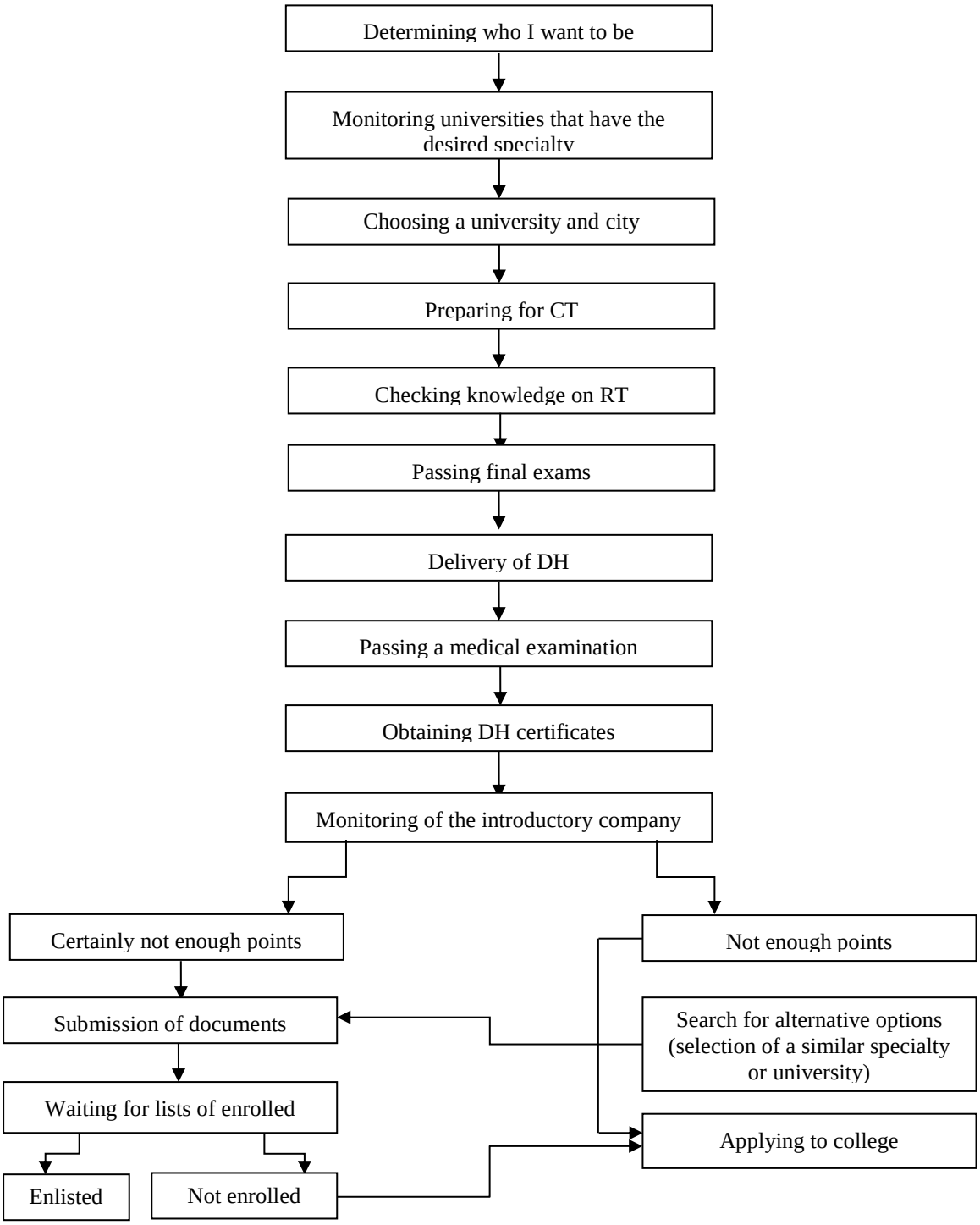


Figure 1 – An example of a business-process description

As a result of the work carried out, the following conclusions can be drawn:

Firstly, the visualization of the business-process allows you to visually see all the «steps» of the simulated situation.

Secondly, an adequately designed model allows you to identify the shortcomings that exist in this model, redirect and improve business-processes and conduct the necessary analyzes.

Thirdly, the use of any modeling method suggests that the main concept is the connections that serve to describe the interactions of objects.

Fourthly, business-processes are used for various purposes, therefore, it is necessary to determine in advance the purpose and structure of the model being developed based on the available data.

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## ASSESSMENT OF INVESTMENT AND INNOVATION DEVELOPMENT OF THE REPUBLIC OF BELARUS

## ОЦЕНКА ИНВЕСТИЦИОННО-ИННОВАЦИОННОГО РАЗВИТИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

***Sovetnikova O.***
*Vitebsk State Technological University, Belarus*
*e-mail: sovetnikova@bk.ru*
***Советникова О.П.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: investments, innovative development, economic growth, the Republic of Belarus, competitive advantages.*

*Ключевые слова: инвестиции, инновационное развитие, экономический рост, Республика Беларусь, конкурентные преимущества.*

*Abstract. The article considers the main directions of the State Program of Innovative Development of the Republic of Belarus; the competitive advantages of the country are revealed. The results of the Global Innovation Index are presented. An*

*assessment of the innovative development of the Republic of Belarus and the EAEU member countries was carried out. The problems of commercialization of innovations in the Republic of Belarus and in the world are revealed.*

*Аннотация. В статье рассмотрены основные направления Государственной программы инновационного развития Республики Беларусь; выявлены конкурентные преимущества страны. Представлены результаты Глобального инновационного индекса. Проведена оценка инновационного развития Республики Беларусь и стран – членов ЕАЭС. Выявлены проблемы коммерциализации инноваций в Республике Беларусь и в мире.*

One of the main directions of economic policy in the Republic of Belarus is to create conditions for attracting investments, including foreign ones. The Republic of Belarus is in many respects inferior to the most technologically advanced countries in terms of the level of innovative development, while innovation is the main source of economic growth, as well as a factor of competitiveness of both the organization and the national economy.

Currently, the innovation policy in Belarus is based on the State Program of Innovative Development. The main directions of this program are: organization of the development and implementation of innovative projects of national importance; innovative development of the regions; development of innovative entrepreneurship; development of innovative infrastructure; formation of an institutional environment that encourages innovation; development of international cooperation in the field of innovation; personnel support for the innovative development of the national economy.

To implement these directions, you should: improve the regulatory framework governing innovation activities; increase the prestige of the academic profession; attract young people to science; promote the creation of technology parks, business incubators, etc.

Investors negatively assess the prospects for economic growth of the Republic of Belarus, so they are not ready to invest in fixed assets and prefer to limit investment activity.

However, the Republic of Belarus has a number of competitive advantages not only in Europe, but also on a global scale: favorable geographical location in the center of Europe; competitive investment and tax climate; developed transport and logistics infrastructure; highly qualified workforce. Among the main objectives of the strategy is to determine the directions for attracting foreign direct investment in the economy, to orient foreign capital investments in the creation of high-tech industries and other types of economic activities encouraged by the state. It provides for assistance in attracting funds for the implementation of projects using advanced foreign technologies and management, stimulating the inflow of capital of multinational corporations in the implementation of projects that ensure the accelerated development of exports to countries with high effective demand and import substitution. It is also planned to improve the structure of foreign direct investment, which provides for an increase in the share of investments in the active part of fixed assets [1, p. 194].

One example of attracting investment to the country is the construction of the Great Stone Industrial Park. It is a special economic zone, which is characterized by a special legal status and special tax benefits. In 2020, the Republic of Belarus took 64th place in the Global Innovation Index (GII), which is 8 positions higher compared to 2019. Thus, the positive trend to improve the position of Belarus in the GII continued (2018 – 86th place, 2019 – 72nd place) (Figure 1).

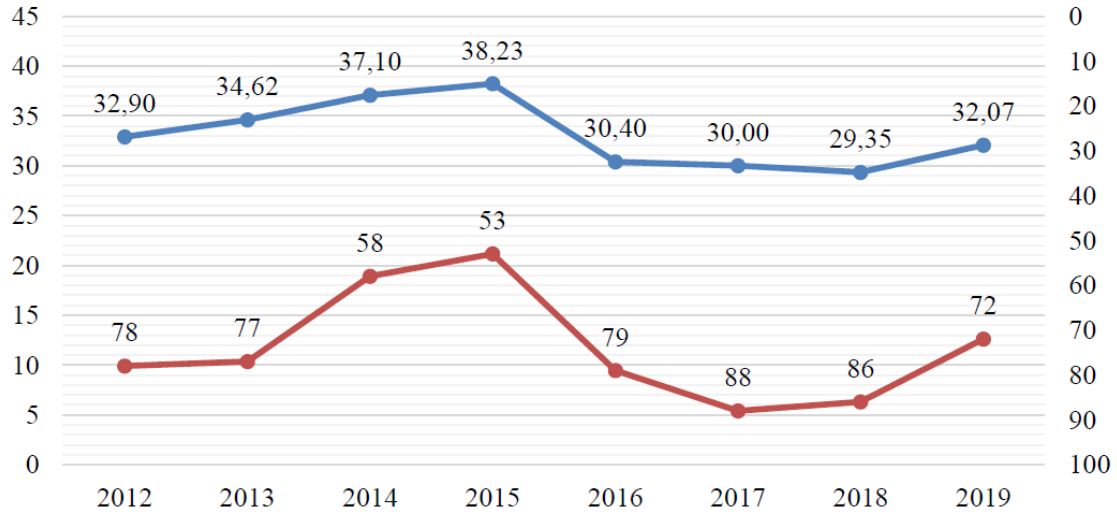


Figure 1 – Belarus in the GII 2012–2019

Source: compiled by the author according to [2].

The GII report is one of the main sources of information assessing the country's innovation performance.

Eighty indicators used for the analysis make it possible to get a general idea of innovation activity, including from the point of view of the political situation, the development of education, infrastructure and business. GII reports are developed and published by the European Institute of Business Administration (INSEAD), International Business School (France), Cornell University (USA) and the World Intellectual Property Organization (WIPO). The economies covered by the study represent 93.5 % of the world population and 97.4 % of world GDP. The key positive indicators of the GII that influenced the position of the Republic of Belarus in the ranking were: "Creation of mobile applications" (1st place); "ISO 9001 quality certificates" (5th place); "Public expenditures for 1 student of secondary education" (8th place); "Graduates in exact and engineering sciences" (11th place); "Export of ICT services" (15th place), "Applications for patents for utility models by origin" (16th place). The improvement in the ranking of Belarus in the GII-2020 is the result of work carried out with the participation of the State Committee for Science and Technology and the National Center for Intellectual Property to develop the infrastructure of an innovative economy, including modern information technologies, improve the business and institutional environment, and improve the quality of education. The

values of the innovative development index of the Republic of Belarus and the EAEU member countries at the end of 2016–2020 are presented in Table 1.

Table 1 – Positions of the Republic of Belarus and the EAEU member countries in the Global Innovation Index at the end of 2016–2020

| Country | Index | 2016 г. | 2017 г. | 2018 г. | 2019 г. | 2020 г. |
|---|---|---|---|---|---|---|
| Armenia | place in the rating | 60 | 59 | 68 | 64 | 61 |
| | index value | 35.14 | 35.65 | 32.81 | 33.98 | 32.64 |
| Belarus | place in the rating | 79 | 88 | 86 | 72 | 64 |
| | index value | 30.39 | 29.98 | 29.35 | 32.07 | 31.27 |
| Kazakhstan | place in the rating | 75 | 78 | 74 | 79 | 77 |
| | index value | 31.51 | 31.50 | 31.42 | 31.03 | 28.56 |
| Kyrgyzstan | place in the rating | 103 | 95 | 94 | 90 | 94 |
| | index value | 26.62 | 28.01 | 27.56 | 28.38 | 24.51 |
| Russia | place in the rating | 43 | 45 | 46 | 46 | 47 |
| | index value | 38.50 | 38.76 | 37.90 | 37.62 | 35.63 |

Source: compiled by the author.

Thus, the analysis and the results make it possible to identify a number of problems of the commercialization of innovations in the Republic of Belarus and in the world:

− underdevelopment and low level of use of the potential opportunities of the national innovation market. When conducting a qualitative assessment of innovations, it is possible to ensure a high margin as a result of the introduction of innovations into production, to avoid inefficient use of material and time resources of enterprises and companies;

− lack of a scientifically grounded theoretical and methodological base for assessing commercialization projects;

− the lack of an appropriate infrastructure that allows for the effective commercialization of innovations and ensures the implementation of innovation policy in accordance with the requests of the NIS, society and the state;

− low cost of innovative products, which leads to the use of such methods of commercialization as the assignment of a part of the rights to innovation and the full transfer of rights. This means a lower level of profitability as a result of the lack of opportunities for self-introduction of innovations into the markets;

− bureaucracy in the registration of patent rights for innovations and the duration of the patenting process;

− lack of young scientific personnel.

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# THE EFFECT OF FINANCIAL LEVERAGE IN ASSESSING SOURCES OF INVESTMENT FINANCING

# ЭФФЕКТ ФИНАНСОВОГО РЫЧАГА В ОЦЕНКЕ ИСТОЧНИКОВ ФИНАНСИРОВАНИЯ ИНВЕСТИЦИЙ

***Svanidze N.N.[1], Kasaeva T.V.[2*], Chebotareva O.G.[2]***
*[1]JSC "Vityaz", Belarus*
*[2]Vitebsk State Technological University, Belarus*
*e-mail: kasaevatv@mail.ru[2*]*
***Сванидзе Н.Н.[1], Касаева Т.В.[2*], Чеботарёва О.Г.[2]***
*[1]ОАО «Витязь», Республика Беларусь*
*[2]Витебский государственный технологический университет, Республика Беларусь*

*Keywords: equity, debt capital, profit, return on assets, leverage.*
*Ключевые слова: собственный капитал, заемный капитал, прибыль, рентабельность активов, плечо финансового рычага.*

*Abstract. Attracting debt capital of financing for investment activities of industrial organizations requires an assessment of the level of their use to generate additional income. According to the authors, a factor model of the financial leverage effect can be used for these purposes, which allows assessing how efficiently and rationally an organization borrows funds to increase profits. The research in one of the largest industrial companies in the country allows us to conclude that high interest rates on loans are not covered by the level of profitability of investment projects implemented. For sustainable business development, management needs to ensure the search for new management solutions and tools in financing the investment activities of the organization.*

*Аннотация. Привлечение заемных источников финансирования инвестиционной деятельности промышленных организаций требует оценки уровня их использования для получения дополнительных доходов. По мнению авторов, для этих целей может быть использована факторная модель эффекта финансового рычага, позволяющая оценить, насколько эффективно и рационально организация заимствует средства для увеличения прибыли. Проведенные исследования в одной из крупных промышленных компаний страны позволяют сделать вывод о том, что высокие процентные ставки по кредитам*

*не перекрываются уровнем доходности реализуемых инвестиционных проектов. Для устойчивого развития бизнеса менеджменту необходимо обеспечить поиск новых управленческих решений и инструментов в финансировании инвестиционной деятельности организации.*

The object of research JSC «Vityaz», a large multidisciplinary organization that currently specializes in the development and manufacture of electric charging stations, color LCD televisions, household appliances, medical equipment, special technological equipment and devices, construction products, thermal energy generation. The products manufactured by the company, the services rendered, the work performed are represented in almost all types of economic activity.

The main areas of investment activity of JSC «Vityaz» are repair, replacement, maintenance, reconstruction and modernization of worn-out production facilities, purchase of new equipment, tools, transport and investments in intangible assets. There are investments in long-term financial investments, the structure of which is represented by investments in the authorized funds of its own subsidiaries and securities of two banks.

In order to assess how efficiently and rationally the company borrows funds to make a profit, the effect of financial leverage was calculated, which is one of the indicators for evaluating the effectiveness of the company's investment activities.

This indicator reflects the level of additional return on equity with a different proportion of the use of debt capital. The effect of financial leverage (DFL) is determined by the formula:

$$DFL = (1-t)*(ROA-r)*(D/E)$$

where the t – the income tax rate, the coefficient; ROA – return on assets, %; r – average calculated interest rate for a loan,%; D – the average amount of debt capital for the period; E – the average amount of equity for the period; (1-t) – tax corrector, based on this coefficient, the level of return on capital decreases, taking into account taxation; (ROA-r) – differentiation of financial leverage, that is, a decrease in return on capital as a result of paying interest on a loan; (D / E) – the leverage of the financial lever, that is, the ratio of debt to equity.

Data for calculating the effect of financial leverage are obtained from the company's financial statements. Some indicators, such as the average annual amount of equity and debt capital, as well as the average annual amount of assets are calculated based on their average balances at the beginning and end of the reporting period. The data is presented in the table 1.

The calculations show that the effect of financial leverage has a negative value, which is caused by the fact that the (ROA) return on assets is lower than the average calculated interest rate for the loan, that is, the company cannot provide such efficiency to compensate for the use of the loan. This fact took place both in 2019 and 2020. The negative value of the DFL indicates that payments for the use of loans are made at the expense of equity, that is, debt capital is used inefficiently. However, a decrease in the

negative value of the coefficient in 2020 by 6.27 % is a positive factor and leads to a decrease in the fall in return on equity. Thus, in 2019, a decrease in equity due to credit funds occurred by 15.26 % or by 4,209 thousand rubles (27 583*(-15.26 %)), and in 2020 by 8.99 % or by 2,921 thousand rubles. (32 494*(-8.99 %)).

Table 1 – Calculation of the effect of financial leverage

| Indicators | Symbol | 2019 | 2020 | Deviation |
|---|---|---|---|---|
| The average annual amount of equity, thousand rubles | E | 27 583 | 32 494 | 4 911 |
| The average annual amount of debt capital, thousand rubles | D | 28 474 | 27 506 | -968 |
| Average annual amount of assets, thousand rubles | A | 80 092 | 86 283 | 6 191 |
| Financial leverage, coef. | D/A | 1.032 | 0.846 | -0.186 |
| Profit before taxes, thousand rubles | P | 2 457 | 6 332 | 3 875 |
| Taxes on their profits, thousand rubles | T | 379 | 10 | -369 |
| The level of taxation, coef. | t | 0.18 | 0.18 | - |
| Return on assets, % | ROA | 3.07 | 7.34 | 4.27 |
| Interest payable, thousand rubles | IP | 5 060 | 4 368 | -692 |
| Average calculated interest rate for the loan,% | r | 21.10 | 20.3 | -0.8 |
| The effect of the financial leverage | DFL | -15.26 | -8.99 | 6.27 |

Compiled by the authors.

All this points to the inefficient use of debt capital, which means that the company's management should make such management decisions that would help attract the most profitable investments for them, as well as investing in effective investment projects.

To determine how the DFL has changed due to each component, you can use the method of chain substitution and calculate the conditional indicators of the DFL:

DFL con 1 = 0.82*(3.07-21.10)*1.032 = -15.26 %;
DFL con 2 = 0.82*(7.34-21.10)*1.032 = -11.64 %;
DFL con 3 = 0.82*(7.34-20.30)*1.032 = -10.97 %;
DFL con 4 = 0.82*(7.34-20.30)*(27506/27583) = -10.60 %;
DFL con 5 = 0.82*(7.34-20.3)*0.846 = -8.99 %.

The total change in the DFL due to all factors is 6.27%, including due to:
the level of taxation: -15.26-(-15.26) = 0 %;
the level of return on assets: -11.64-(-15.26) = 3.62 %;
loan interest rate: - 10.97-(-11.64) = 0.67 %;
the level of debt capital: -10.60-(-10.97) = 0.37 %
the level of equity: -8.99-(-10.6) = 1.61 %.
Δ DFL = 0+3.62+0.67+0.37+1.61 = 6.27 %.

As it can be seen from the calculations, the level of taxation in 2019 and 2020 has not changed. The income tax rate remained at 18 %, so this factor had no effect on financial leverage. The company itself cannot influence this indicator, since the rate is set by the state.

As for the financial leverage differential, that is, the difference between the return on assets and the payment for debt capital, the higher the value of this indicator, the more pronounced the positive effect of the financial leverage. It was the increase in return on assets in 2020 compared to 2019 by 4.27 % that gave some positive effect in reducing the negative value of the DFL, which led to its change by 3.62 %. And the reduction of the loan interest rate in 2020 compared to 2019, due to the reduction of the refinancing rate by the National Bank of the Republic of Belarus, by 0.8 %, led to a change in the DFL by 0.67 % for the better.

The leverage of the financial lever shows how the leverage is affected by the share of debt capital. The value of the leverage in 2019 and 2020 was 1.032 and 0.846, respectively. Both values are higher than the recommended value of 0.7, which means that the company risks losing its financial stability. In 2020, this value approached the recommended one, since the ratio of debt capital and equity shifted towards a slight increase in equity, although there was still an excess, which means that the risk of financial stability remains. As a result, due to a decrease in the level of debt capital, the financial leverage increased by 0.37 %, and due to an increase in the level of equity, the financial leverage increased by 1.61 %. The fact that equity capital in 2020 began to occupy a greater share compared to financial obligations, on the one hand, indicates the beginning of stabilization in the company, and on the other hand, that the company no longer uses new financial instruments, and, perhaps, does not fully reveal its development potential.

JSC «Vityaz», being an open joint stock company, the authorized capital of which is divided into shares, has the opportunity to change the structure of its capital. Competent management of its stake, access to Russian or international capital markets, by targeted sale or through IPO, the use of various sources of financing, all this will help the company not only to get cheap money for its development, financing of real investments, but also to attract foreign investment in its business. Also, in order to attract cheap money, the company needs to continue to actively participate in various government programs and projects funded from the budget.

Factor analysis of the effect of financial leverage also revealed a number of problems, but also showed directions for improving the efficiency of the company's investment activities. In order for the effect of financial leverage to be positive, the company needs to increase the return on assets (ROA) so that it is higher than the interest rate on loans and borrowings. To this end, JSC «Vityaz», in addition to negotiating with banks to reduce key rates, must:

- increase profits (by increasing prices and /or reducing costs, increasing the share of products with higher profitability in the assortment, ensuring a rational ratio between income and expense growth (the former should always overtake the latter), etc.);
- ensure a relative decrease in the value of all assets (in relation to revenue);

- increase the profitability of sales;
- increase the level of capital return;
- increase asset turnover;
- increase the share of the active part of fixed assets.

If the positive effect of a financial lever determines its differential, then it is possible to strengthen this effect by properly managing the leverage of the financial lever, by planning and achieving an optimal ratio of debt and equity.

UDC 334(476)

# DEVELOPMENT OF ENTREPRENEURSHIP IN THE REPUBLIC OF BELARUS

# РАЗВИТИЕ ПРЕДПРИНИМАТЕЛЬСТВА В РЕСПУБЛИКЕ БЕЛАРУСЬ

***Vankevich A., Mironchik V.****
*Vitebsk State Technological University, Belarus*
*e-mail: vlad.mironchik.00@mail.ru**
***Ванкевич Е.В., Мирончик В.В.****
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: entrepreneurship, small and medium enterprises, development analysis, statistical data.*

*Ключевые слова: предпринимательство, малый и средний бизнес, анализ развития, статистические данные.*

*Abstract. Entrepreneurship plays a significant role in the country's economy. The number of jobs grows, the contribution to the country's GDP and to the Social Protection Fund increases, and the monopoly decreases. The selection of goods and services increases. The more competitive enterprises, producing the same products are, the higher the level of competitiveness and quality of goods become. This article presents statistics on the dynamics of the development of small and medium enterprises in the Republic of Belarus, describes the main directions and advantages of entrepreneurship over large business.*

*Аннотация. Предпринимательство играет важную роль в экономике страны: увеличивается количество рабочих мест, вклад в ВВП страны, взносы в ФСЗН, уменьшается монополия. Для потребителей увеличивается выбор товаров и услуг. Чем больше конкурентоспособных предприятий, производящих одну и ту же продукцию, тем выше уровень конкурентоспособности и качество. В данной статье представлена статистика динамики развития малого и среднего предпринимательства в Республике Беларусь, описаны основные направления и преимущества предпринимательства над крупным бизнесом.*

It is legitimate to analyze the dynamics of entrepreneurship development in the Republic of Belarus using official data of the National Statistical Committee of the Republic of Belarus.

According to statistical data in the Republic of Belarus on January 1, 2022, the share of small and medium enterprises in the gross domestic product was 26.6 %, and the share in gross value added was 30.5 %, which turned out to be 1 percentage point higher compared to 2020. In the context of the regions of the republic, the maximum gross value added is observed in Minsk and the Minsk region – 44.7 % and 33.6 %, respectively. This macroeconomic indicator for small and medium enterprises in other regions makes in Brest – 24.9 %, Mogilev – 23.8 %, Grodno – 20.1 %, Vitebsk – 17.5 % and Gomel – 15.3 %.

There are 7 main types of economic activity in the Republic of Belarus: industry; wholesale and retail, car and motorcycle repair service; agriculture, forestry and fisheries; construction; transport, postal and courier activities, warehousing; information and communication; professional, scientific and technical activities [1].

A strong tendency towards active development of small and medium enterprises in the Republic of Belarus has been observed not only over the past year.

The analysis of the activities of small and medium enterprises in the Republic of Belarus for 2011–2021 allowed us to identify the following trends, presented in Table 1.

Analyzing the data in Table 1, it can be noted that in 2011–2021 entrepreneurship in the Republic of Belarus was actively developing. The decrease in small and medium enterprises in terms of the number of employed is evidenced by an increase in the number of legal entities by 18.4 % and individual entrepreneurs by 19.7 % in 2021 compared to 2011. The average number of employees of small and medium enterprises has decreased, and wages have increased, this can be explained by the growing demand for specialists capable of automating processes in order to replace physical labour and increase productivity. There is also a positive change of such indicators as revenue from sales of products, goods, works, services; net profit; volume of production; industrial production; investments in fixed assets; retail turnover of trade organizations; turnover of public catering.

A decrease in exports and an increase in imports of small and medium enterprises with an increase in turnover for 2011–2021 can be characterized as the ability to adapt business processes to the requirements of domestic consumers and an increase in the degree of trust in Belarusian brands. Small and medium enterprises are more focused on domestic markets.

As evidenced by foreign experience, entrepreneurs are an important criterion for the presence of a real market economy in the country and a factor of economic growth in most industries. Small and medium entrepreneurship as a form of doing business has a number of advantages over large organizations. Entrepreneurs, unlike large enterprises and large businesses, easily adapt to external changes and can more easily reorganize their business processes. Due to the increased mobility of entrepreneurs, it takes less time to establish business processes. Thus, the development of small and medium

enterprises is an important strategic guideline for the Republic of Belarus, ensuring its sustainable growth, saturation of the domestic market and employment of the population.

Table 1 – Key economic indicators of the activity of small and medium enterprises in the Republic of Belarus from 2011 to 2021

| Key economic indicators | 2011 | 2021 | Growth rate |
|---|---|---|---|
| Microbusinesses, small and medium enterprises | | | |
| Number of micro, small and medium enterprises – legal entities at the end of the year, units | 91 277 | 111 908 | 122.6% |
| Average number of employees of organizations, people | 1 223 584 | 1 121 759 | 91.6% |
| Nominal accrued average monthly salary, rubles (2011 – thousand rubles) | 1 760.1 | 1 479.4 | 84.1% |
| Revenue from sales of products, goods, works, services, million rubles (2011 – billion rubles) | 358 956.1 | 175 063.6 | 487.7% |
| Net profit, loss (-), million rubles (2011 – billion rubles) | 16 698.2 | 9 133.8*) | 546.9% |
| Return on sales, % | 9.3 | 8.4*) | -0.9 p |
| Share of unprofitable organizations, % | 19.8 | 19.1*) | -0.7 p |
| Volume of production (works, services), million rubles (2011 – billion rubles) | 149 544.0 | 85 617.8 | +572.5% |
| Industrial production, including the cost of tolling (not paid by the manufacturer) raw materials, million rubles (2011 – billion rubles) | 60 786.8 | 29 642.9 | 487.6% |
| Investments in fixed assets, million rubles (2011 – billion rubles) | 35 534.0 | 11 051.1 | 311% |
| Retail turnover of trade organizations, million rubles (2011 – billion rubles) | 32 728.1 | 16 301.2 | 498.1% |
| Turnover of public catering, million rubles (2011 – billion rubles) | 2 004.7 | 1 622.9 | 809.5% |
| Export of goods, million US dollars | 18 618.7 | 17 039.9 | 91.5% |
| Import of goods, million US dollars | 14 213.0 | 17 825.3 | 125.4% |
| Balance of foreign trade in goods, million US dollars | 4 405.7 | -785.4 | -117.8% |
| Individual entrepreneurs | | | |
| Number of individual entrepreneurs at the end of the year, people | 219 285 | 273 120 | 124.6% |
| Number of individuals engaged by individual entrepreneurs under labour or civil law contracts, people | 16 802 | 74 563 | 443.8% |
| Revenue from sales of products, goods, works, services, million rubles (2011 – billion rubles) | 13 808.2 | 14 817.4 | 1073.1% |
| Export of goods, million US dollars | 100.5 | 220.8 | 219.7% |
| Import of goods, million US dollars | 487.4 | 359.2 | 73.7% |
| Balance of foreign trade in goods, million US dollars | -386.9 | -138.4 | -64.2% |
| Number of individual entrepreneurs at the end of the year, people | 219 285 | 273 120 | 124.6% |

*) – without taking into consideration microbusinesses not included into the sample of respondents.

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# REGIONAL SUPPLY CHAIN MANAGEMENT MECHANISM WITH GREEN LOGISTICS PRINCIPLES

# МЕХАНИЗМ УПРАВЛЕНИЯ РЕГИОНАЛЬНЫМИ ЦЕПЯМИ ПОСТАВОК С УЧЕТОМ ПРИНЦИПОВ ЗЕЛЕНОЙ ЛОГИСТИКИ

***Veretennikova E.***
*Euphrosyne Polotskaya State University of Polotsk, Belarus*
*e-mail: e.veretennikova@psu.by*
***Веретенникова Е.С.***
*Полоцкий государственный университет имени Евфросинии Полоцкой, Республика Беларусь*

*Keywords: supply chain management, region, green logistics.*
*Ключевые слова: управление цепями поставок, регион, зеленая логистика.*

*Abstract. The components of logistics activities that affect the environment and the ecological situation of the regions are identified. An author's mechanism for managing regional supply chains has been developed, taking into account the principles of green logistics, which contributes to the sustainable logistics development of the regions and helps to improve the quality of life of the population.*

*Аннотация. Выявлены компоненты логистической деятельности, влияющие на окружающую среду и экологическую ситуацию регионов. Разработан авторский механизм управления региональными цепями поставок с учетом принципов зеленой логистики, который способствует устойчивому логистическому развитию регионов и содействует повышению качества жизни населения.*

The progressive development of logistics and supply chain management in the region is inextricably linked to technological progress and the negative impact that it has on the environment. Every day, the amount of non-renewable resources is being used more and more, the results of the supply chains affect the ecological situation of entire regions and countries. At the same time, the level of awareness of the environmental responsibility of people is growing, which is expressed in the creation and widespread use of technologies aimed at preserving the environment and reducing

the negative impact on it. In this regard, the problem of using green technologies and the principles of green logistics at all stages of supply chain management is being updated: from the purchase of raw materials to the sale of finished products.

The Republic of Belarus considers green logistics as one of the tools for ensuring sustainable development and as a factor in increasing the competitiveness of regions and the country as a whole. This is evidenced by the program documents developed in Belarus: the Program for the Social and Economic Development of the Republic of Belarus for 2021–2025; National Strategy for Sustainable Socio-Economic Development of the Republic of Belarus for the period up to 2030; National Action Plan for the Development of the Green Economy in the Republic of Belarus for 2021–2025; Concept for the development of the logistics system of the Republic of Belarus for the period up to 2030; State Program "Environmental Protection and Sustainable Use of Natural Resources" for 2021–2025; State program "Transport complex" for 2021–2025.

Research by V.D. Gerami, A.V. Kolika [1, p.33], S.A. Bugayan, K.D. Ignatova, N.D. Ivanov [2], M.Yu. Grigorak, Yu.V. Varenko [3], T.E. Evtodieva [4], M.N. Grigorieva, S.A. Uvarov [5, p. 647], Yu. Yu. Loginov, V. F Lukin [6, p. 677], L.M. Zaretskaya [7], I.I. Mukhina, A.V. Smirnova [8], A.N. Voronkov [9, p. 215], I.I. Koblyanskaya [10], N.Yu. Anashkina [11], I.O. Abramova, M.Sh. Murtazina [12], V.G. Khalyn [13], V.D. Sekerina, M.N. Dudina, N.V. Lyasnikova [14], V.G. Logunova [15] and others are devoted to the study of green logistics.

As a result of the study, we have identified the components of logistics activities that affect the environment and the ecological situation of the regions (Figure 1).

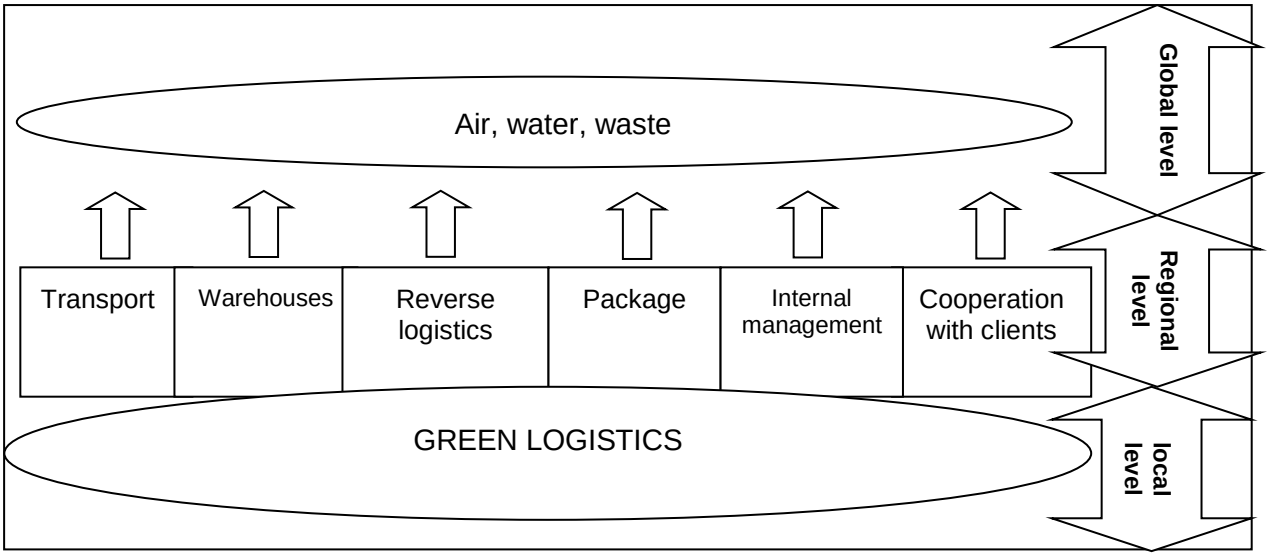


Figure 1 – The impact of logistics activities on the environment

Source: compiled by the author.

Taking into account the above identified components, we have developed a mechanism for managing regional supply chains (Figure 2), which will minimize

environmental and economic damage, increase the consumer value of products, and also increase the competitiveness of the region in terms of sustainable development.

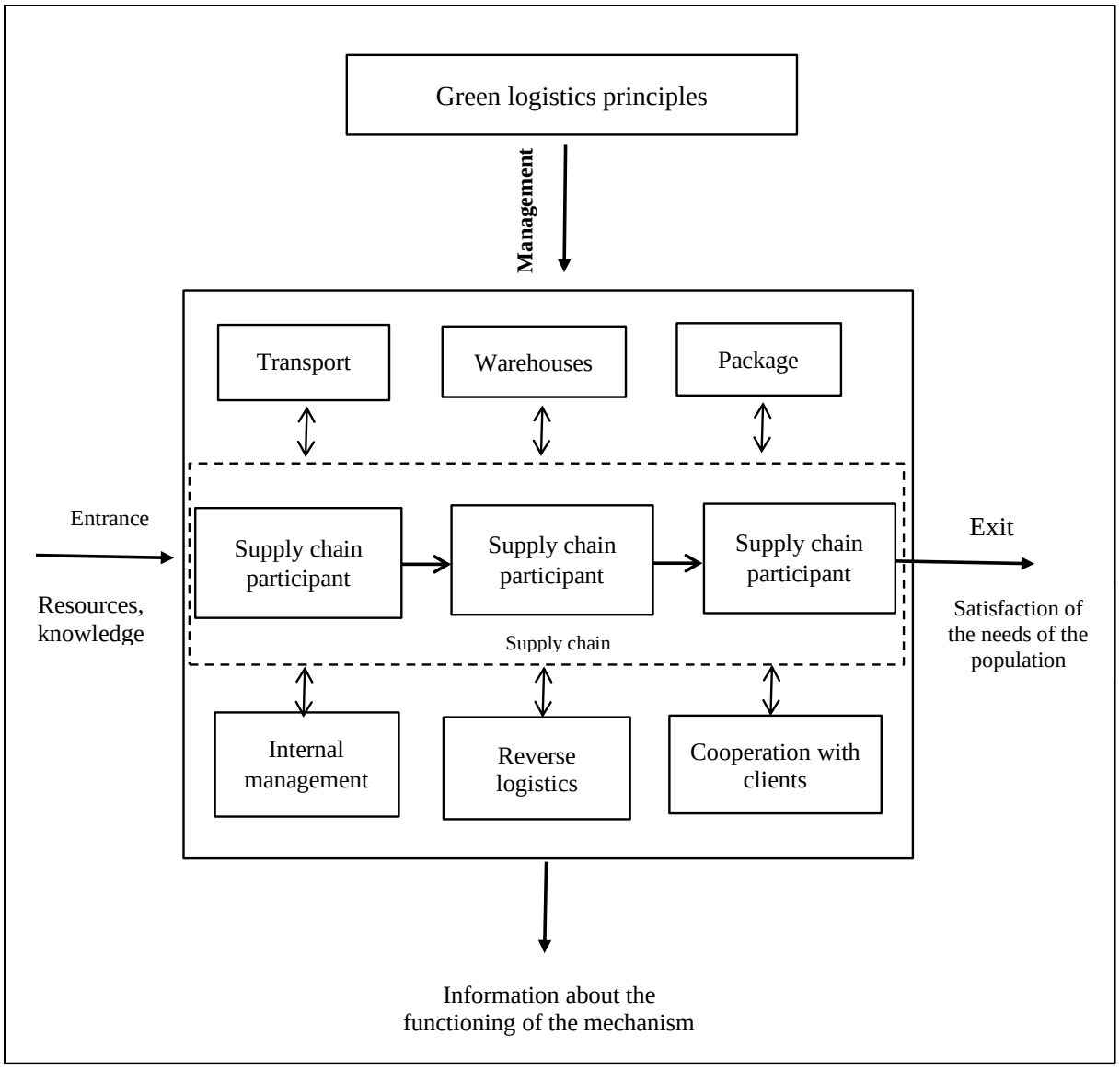


Figure 2 – The mechanism for managing regional supply chains
Source: compiled by the author.

Unlike the existing ones, in the proposed mechanism, the management of regional supply chains is carried out taking into account the principles of green logistics; the mechanism takes into account not only the own economic interests of supply chain participants, but also the main goals of sustainable development of the region, based on the principles of preserving and increasing natural potential in order to create the most favorable environment for the comprehensive development of the individual.

For participants in supply chains today, the main goal is to obtain the maximum possible profit, the implementation of "green" principles is considered an economically unprofitable activity, because. these activities contribute to an increase in logistics

costs and, as a result, lead to an increase in the final cost of products or services. Therefore, the state should provide subsidies, introduce a system of preferential lending and taxation for enterprises that operate in accordance with the principles of green logistics, as well as reduce prices for environmentally friendly materials and fuels in order to promote them and increase their accessibility.

Thus, the management of regional supply chains, taking into account the principles of green logistics, helps to minimize the damage caused to the environment, ensures efficient management of logistics flows, and also improves the competitiveness, image and reputation of both supply chain participants and regions as a whole; supply chain management, taking into account the principles of green logistics, contributes to the sustainable logistics development of the regions and contributes to improving the quality of life of the population.

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# NEOCLUSTERIZATION ON THE INDUSTRY 4.0 PLATFORM AS A DRIVER OF STABILIZATION OF THE ECONOMY OF THE REPUBLIC OF BELARUS: THEORETICAL AND PRACTICAL ASPECTS

# НЕОКЛАСТЕРИЗАЦИЯ НА ПЛАТФОРМЕ ИНДУСТРИИ 4.0 КАК ДРАЙВЕР СТАБИЛИЗАЦИИ ЭКОНОМИКИ РЕСПУБЛИКИ БЕЛАРУСЬ: ТЕОРЕТИЧЕСКИЕ И ПРАКТИЧЕСКИЕ АСПЕКТЫ

***Yashava G.A.*, Kondrateva V.D.***
*Vitebsk State Technological University, Belarus*
*e-mail: gala-ya@list.ru**
***Яшева Г.А.*, Кондратьева В.Д.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: cooperation, stakeholder, blockchain technologies, digital economy, cluster, smart cooperation, smart industry.*
*Ключевые слова: сотрудничество, стейкхолдер, блокчейн-технологии, цифровая экономика, кластер, smart-кооперация, smart-индустрия.*

*Abstract. The article discusses the theoretical and methodological foundations of network cooperation in clusters, including: forms of cooperation and their advantages for stakeholders; the composition of cluster-type network structures; the concept of "cluster", "network cooperation"; types of network connections. The analysis of the degree of development of network cooperation in Belarus was carried out on the basis of a survey of 421 business entities, which revealed the following problems: lack of information about potential partners; low level of trust between entrepreneurs; lack of infrastructure and services for organizing cooperation and business cooperation.*

*Taking into account the digitalization of the Belarusian economy, the directions of enhancing network cooperation in clusters have been developed, including: subcontracting service, blockchain technologies, smart contract, the use of which will contribute to improving the efficiency of both cluster entities and the economy as a whole.*

*Аннотация. В статье рассмотрены теоретико-методологические основы сетевого сотрудничества в кластерах, включая: формы сотрудничества и их преимущество для стейкхолдеров, состав сетевых структур кластерного типа, понятие «кластер», «сетевое сотрудничество», виды сетевых связей. Проведен анализ степени развития сетевого сотрудничества в Беларуси на основе анкетирования 421 субъекта хозяйствования, который позволил выявить проблемы: отсутствие информации о потенциальных партнерах, низкий уровень доверия между предпринимателями, отсутствие инфраструктуры и услуг по организации сотрудничества и кооперации бизнеса.*

*С учетом цифровизации экономики Беларуси, разработаны направления активизации сетевого сотрудничества в кластерах, включая: сервис субконтрактации, блокчейн-технологии, смарт-контракт, применение которых будет способствовать повышению эффективности как субъектов кластера, так и экономики в целом.*

In the Republic of Belarus, cluster policy is becoming an important tool for stimulating the innovative development of the economy. At the same time, clustering processes are not active enough in comparison with foreign countries. Clusters of foreign countries employ about a third of the total number of employees, and labor productivity is 40 % higher [1]. Currently, only 8 active clusters, 6 emerging and 18 cluster initiatives have been created in the Republic of Belarus [3].

Innovation is a crucial factor in productivity growth and value creation. The importance of innovation is especially increasing in the era of the Fourth Industrial Revolution (Industry 4.0). The cluster concept is influenced by the external environment – namely, the development of ICT, the Internet, the concept of "Society 5.0", informatization of production, etc. [2].

The aim of the work is to develop the theoretical foundations of neoclusters and develop practical directions for their creation in order to innovatively develop the economy of the Republic of Belarus.


Figure 1 – Map of clusters of the Republic of Belarus

Source: [3].

A new concept is proposed, which is a neocluster. It is based on the transformation of a cluster into a neocluster. We believe that the neocluster is a network structure of entities localized in the region, interconnected in the value chain, interacting with each other on the basis of ICT and/or basing their business processes on elements of

Industry 4.0. The paper proposes a neocluster structure, which, unlike the cluster structure, contains elements of Industry 4.0.

The same processes as in clusters are observed in neoclusters, in particular active cooperation of participants, exchange of advanced developments, iterative modernization, integration of production processes, optimization of operational activities, diversification of work with suppliers. Similarly, specialized cluster enterprises cooperate and compete with each other in the value chain, outsourcing certain functions if necessary [4, 5].

In the context of Industry 4.0, the ability to flexibly integrate into existing enterprise networks provides great advantages. The high level of communication technologies allows us to quickly exchange information and set a strict sequence of operations in the production chain. The density of cooperative networks is growing, creating prerequisites for the formation of cyber-physical systems [3].

In order to develop the cluster theory, the following neocluster features are formulated: strategic orientation to innovation; use of cyber-physical systems; use of artificial intelligence technology; accelerated integration of computing resources into industrial processes; blurring the boundaries between physical, digital and biological technologies within the neocluster manufacturing industry; robotization and informatization of production; active use of cloud technologies; use of ERP, CRM software for automating customer interaction strategies; BPM for managing the business processes of the system.

Following are the advantages of neoclusters compared to conventional clusters: higher competitiveness compared to clusters; lower transaction costs compared to clusters; the use of simulation modeling and the creation of digital twins.

The analysis of the external environment, conducted on the basis of a review of various studies, revealed the following prerequisites that influence the formation of neoclusters: the development of ICT and the digitalization of society; the development of network forms of relationships between subjects. Network forms include: clusters, technology platforms, strategic alliances; the "democratization" of knowledge through the Internet.

The following directions of development of neocluster structures are proposed.

Digitalization of communications between cluster entities:

− Creation of: databases on cluster entities within the framework of the regional statistical office; business platforms (technological, procurement, digital, etc.); development of the architecture of "live laboratories" for the "smart cooperation" of stakeholders in the production of innovative products;

− Creation of Internet portals: Internet platforms for training, networking and cooperation; creation of a virtual Subcontracting Center; virtual business incubators; social business network "Cluster";

Digitalization of training of cluster participants:

− creation of Knowledge Centers in the form of virtual organizations based on industry research and/or educational organizations of the cluster;

− opening of a business school of distance learning for cluster entities at the entrepreneurs support center;

Digitalization of production in the subjects of the cluster:

− development of the smart industry based on the principles of "smart cooperation";

− introduction of artificial intelligence technology;

− introduction of blockchain technologies; cloud technologies.

Implementation of: ERP, CRM software for automating strategies of interaction with customers; BPM (business process management) for managing the business processes of the system.

Thus, neoclusters are clusters of the future. Combining all the components of Industry 4.0 will make neocluster as automated and competitive as possible, and, consequently, a leader in the global market. The use of digital information and communication technologies in the organization and operation of clusters, i.e. neoclusterization, will contribute to the sustainable development and increase the competitiveness of the Belarusian economy.

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# THE USE OF ARTIFICIAL INTELLIGENCE IN ECONOMICS AND MARKETING

# ПРИМЕНЕНИЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В ЭКОНОМИКЕ И В МАРКЕТИНГЕ

***Yashava G.A.**, *Panchenko E.V.***
*Vitebsk State Technological University, Belarus*
*e-mail: gala-ya@list.ru**
***Яшева Г.А.**, *Панченко Е.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: artificial intelligence, chat-bot, marketing, efficiency, advertising.*
*Ключевые слова: искусственный интеллект, чат-бот, маркетинг, эффективность, реклама.*

*Abstract. The article describes the concept and use of artificial intelligence in the modern world. It explains how artificial intelligence helps to increase the effectiveness of campaigns, collecting and analyzing the information received. The scope of application is described: personalization of services; predictive analytics; communications; content generation. The study of the experience of using artificial intelligence made it possible to determine the marketing tasks that can be solved with the help of artificial intelligence, as well as the main steps for the implementation of artificial intelligence.*

*Аннотация. В статье изложено понятие и использование искусственного интеллекта в современном мире. Объясняется, как искусственный интеллект помогает увеличить эффективность кампаний, сбора и анализа полученной информации. Описана сфера применения: персонализация услуг, предиктивная аналитика, коммуникации, генерация контента. Изучение опыта применения искусственного интеллекта позволило определить маркетинговые задачи, решаемые с помощью искусственного интеллекта, а также основные шаги по внедрению искусственного интеллекта.*

Introduction of elements of Industry 4.0. and the concept of Society 5.0 in the real sector of the economy significantly change business processes, including marketing. Marketing research, the purpose of which is to refine products to the desired level or to remove a product from the product range, in Belarusian organizations is currently carried out on the basis of statistical observations using a survey (self-registration, correspondence). This method entails a representativeness error and requires a lot of

time and money. To increase the efficiency of collecting and analyzing information received from the consumer, it is possible to suggest the use of artificial intelligence in the field of digital marketing.

At the present stage of development, the ultimate goal of the strategies of any transnational corporations (TNCs) in the world market is the growth of business efficiency, which is largely ensured by the development and implementation of modern technologies. Artificial intelligence (AI) for the subjects of international economic relations is a set of tools that ensure the digital transformation of business. The development of artificial intelligence can not only change the business, but also modify the format of competition in the world market, contribute to further differentiation of the countries of the world according to the levels of economic and technological development [6].

With a growing amount of data, with high consumer requirements for the quality of real-time interactions, machine learning will become indispensable. AI will help companies link together disparate data and develop algorithms that predict people's behavior and/or recommend certain actions in real time.

Already, the use of AI is strongly correlated with higher business performance and higher revenue. AI is guaranteed to help improve economic performance and offload employees, launch more effective campaigns and better analyze them. AI can help copywriters, editors, production teams, and analytics departments, but it cannot completely replace them.

Applications of AI:

1. Personalization of services. This is one of the more undeniable and early applications of AI. It is easy to analyze purchase statistics for the system, data from statistics counters and databases are often well structured. With the support of AI, Eldorado, 220 Volt and almost all retailers in the Russian Federation are personalizing their own product offerings.

2. Predictive analytics. Performs tasks: predicting customer behavior to increase conversion and reduce risks; forecasting company budgets, marketing costs; customer segmentation based on various variables, etc.

3. Communications. For retail, smart chatbots that understand the meaning of questions well and can give clear answers are of great importance than voice control.

4. Content generation. Creation of realistic portraits of people or animals, personalized videos, texts in different languages.

The study of the experience of using AI [1, 2, 3, 4, 5, 6] made it possible to determine the marketing tasks that can be solved with the help of AI:

1. Text generation

The neural network generates original words based on content analysis in the digital space. Word formats range from marketing slogans to messages, from blog posts to sales posts. Such tools are in great demand, as the entire process is delegated to AI.

2. Creation of advertising creatives

In order not to spend a lot of time and money on collecting data, the results of past campaigns, the effectiveness of competitors' advertising and providing analytics, AI

solutions can help. They process a lot of relevant creatives in a niche, find out what exactly they attracted the audience - from the visual components to the wording on the poster, and then generate a personal original creation.

3. Launching advertising campaigns

AI can help increase performance in all three stages of an effective advertising campaign (hyper-targeted audience, powerful creatives, maximum automation of assembly, launch and scaling). To begin with, select a micro-segmented audience in social networks, observing compliance. Next, research competitors' ads and create high-converting creatives. And, in the end, complete and launch campaigns in one window and in a certain number of clicks.

4. Creation of deepfakes for marketing activities

Deepfake is a replacement for photo, audio and video materials close to reality, developed with the support of neural networks. Despite the fact that almost everyone is skeptical about the use of deepfakes, this development has the ability to deliver important bonuses to firms. This is a promising marketing tool if you respect copyright and do not abuse technology.

5. Creation and launch of outreach and email newsletters

To create a catchy headline and the beginning of the email, match the subject and offer without obsessive words - the ability to communicate with current customers. Artificial intelligence can also be trained in this, which can analyze user behavior and personalize its mailings.

6. Chatbot training

It takes time, a good command, and a large dataset to train a machine to recognize keywords and ignore typos and spelling errors. A little perseverance, and the bot will clearly recognize the request and respond to the user in a "natural" language. As a result, positively influencing marketing and sales.

7. Processing and analysis of small & wide data: for everything

Companies are gradually switching to small & wide data. Processing and analyzing big data is too costly and time consuming for SMB, and they have nowhere to collect such an amount of data. But even working with small & wide data is easily automated: AI can analyze the data and visualize the findings, brightly highlighting insights on which companies can base their decisions.

Stages of AI implementation:

1. Collection and analysis of information;
2. Entering the received information into the data processing program;
3. Writing an algorithm from scratch or improving based on a framework;
4. Training and self-learning of the algorithm;
5. Create a new marketing strategy for the organization using modern AI capabilities.

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UDC 334

## ANALYSIS OF THE COMPETITIVENESS OF PRODUCTS BY MEANS OF INFORMATION TECHNOLOGY

## АНАЛИЗ КОНКУРЕНТОСПОСОБНОСТИ ПРОДУКЦИИ СРЕДСТВАМИ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ

***Yashava G.A.*[*], *Vardomatskaya E.U.*[**], *Grigoruk A.M.***
*Vitebsk State Technological University, Belarus*
*e-mail: gala-ya@list.ru*[*], *elena101.vard@gmail.com*[**]
***Яшева Г.А.*[*], *Вардомацкая Е.Ю.*[**], *Григорук А.М.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: textile industry, competitiveness, market profile, competitiveness polygons, competitiveness ratio, digitalization.*

*Ключевые слова: текстильная отрасль, конкурентоспособность, рыночный профиль, многоугольники конкурентоспособности, коэффициент конкурентоспособности, диджитализация.*

*Abstract. The article considers methods for analyzing the competitiveness of children's goods produced by Belarusian knitwear enterprises, a comparative analysis of the competitiveness of real products and an ideal product is carried out.*

*Аннотация. В статье рассмотрены методы анализа конкурентоспособности товаров детского ассортимента производства белорусских трикотажных предприятий, проведен сравнительный анализ конкурентоспособности реальной продукции и идеального продукта.*

Light industry is one of the most important components of the industrial complex of the Republic of Belarus. In the light industry of Belarus, the largest in terms of output and the number of employed workers is the textile industry, which combines the production of all types of fabrics, knitwear, felting and other products based on fibrous raw materials. In modern conditions of global challenges, the issue of product competitiveness is of particular relevance [1]. During the fourth industrial revolution, the purpose of which is to optimize business processes based on the digitalization of the economy, the Bellegprom concern has developed a concept for increasing the competitiveness of textile products, including the technical re-equipment of enterprises, updating and expanding the range of products, taking into account local raw materials and customer demand, enhancing search for markets. It is also planned to master and introduce progressive technologies in the production of yarn, fabrics, knitted fabrics, etc. [2].

The purpose of the study is to develop methods and tools for modeling and evaluating the competitiveness of products in the MS Excel environment.

Tasks:

- to develop a methodology for assessing competitiveness in the MS Excel environment and to test it;
- develop a computer model for assessing the competitiveness of textile industry products in MS Excel environment.
- develop recommendations for using the results of competitiveness assessment in making business decisions.

Object of study: cotton knitwear produced by knitting factories of the Republic of Belarus: JSC "Svitanak", Zhodino; JSC "PTF 8 March", Gomel; JSC "Kupalinka", Soligorsk.

The assessment of the competitiveness of the products of the above-mentioned enterprises was carried out on the basis of children's products, which, according to experts - specialists of the marketing department, have the greatest demand among buyers. A survey of buyers of products - commercial organizations was conducted in Zhodino and Minsk, and made it possible to identify the most significant indicators that affect the competitiveness of this group of goods: price (46 %); end-user demand (31 %); product design (14 %); delivery time (9 %) [3]. Therefore, the analysis of the level of competitiveness of the children's assortment was carried out according to the following indicators: comfort, external design of the product, materials used, fit of the

model, tailoring quality, colors, prestige, packaging, brand, product cost, distribution channels.

The results of the survey in comparison with the characteristics of the ideal product and the relative deviations from the standard of indicators for assessing the competitiveness of the enterprises: JSC "Svitanak", Zhodino; OJSC "PTF 8 March", Gomel; OJSC "Kupalinka", Soligorsk are presented in Table 1.

Table 1 – Indicators of competitiveness of products of knitwear enterprises.

| Options | The weight | Characteristic perfect product | Analyzed p/p "Svitanak" | Competitor 1 Kupalinka | Competitor 2 March 8 | Analyzed p/p "Svitanak" | Competitor 1 Kupalinka | Competitor 2 March 8 |
|---|---|---|---|---|---|---|---|---|
| Comfort | 0,11 | 5 | 4 | 4 | 5 | **-0,2** | **-0,2** | **0,0** |
| Landing | 0,1 | 4 | 4 | 4 | 4 | **0,0** | 0,0 | **0,0** |
| Composition of materials | 0,09 | 4 | 2 | 2 | 3 | **-0,5** | **-0,5** | **-0,3** |
| Tailoring quality | 0,05 | 3 | 4 | 4 | 4 | 0,3 | 0,3 | **0,3** |
| Color spectrum | 0,06 | 3 | 1 | 1 | 1 | **-0,7** | **-0,7** | **-0,7** |
| Design | 0,08 | 4 | 3 | 3 | 4 | **-0,3** | **-0,3** | **0,0** |
| Prestige | 0,01 | 2 | 1 | 1 | 1 | **-0,5** | **-0,5** | **-0,5** |
| Package | 0,04 | 2 | 2 | 1 | 2 | 0,0 | **-0,5** | **0,0** |
| Trademark | 0,02 | 2 | 1 | 1 | 2 | **-0,5** | **-0,5** | **0,0** |
| Price | 0,07 | 4 | 3 | 5 | 3 | **-0,3** | **0,3** | **-0,3** |

The calculations showed that, in comparison with competitors, the overall competitiveness of JSC "Svitanak" is lower than the competitiveness of JSC "Kupalinka" (2.64 < 2.73) and JSC PTF "8 March" (2.64 < 2.91) the final coefficient of the overall competitiveness of each of the enterprises below the reference value (3.36). In addition, the final coefficient of competitiveness of each of the enterprises has a deviation from the indicators of an ideal product (3.36 > 2.91 > > 2.73 > 2.64).

The table on the right provides information on the relative deviation from the standard for each position of the analyzed enterprises. The relative deviation of indicators from the standard varies from -0.7 to 0.3. So, for example, according to expert estimates, the products of JSC "Svitanak" for children deviate from the ideal in the following parameters: comfort, composition of the material, colors, design, prestige, brand, and price. However, in terms of planting, distribution channels and product packaging, the assessments of the experts of JSC "Svitanak" for children are equal to the reference ones. And in terms of the quality of tailoring, the products of JSC "Svitanak" are higher than the standard ones.

To quantify the level of competitiveness of the products of the enterprises under consideration, the calculation of the coefficients of competitiveness of the goods was

made [4]. Comparing the indicators, we can conclude, that children's products, for example, JSC "Svitanak" has the lowest coefficient of competitiveness in comparison with similar products of competing factories.

The results of the analysis are presented in Table 2 and illustrated in the histogram (Fig. 1).

Table 2 – Competitiveness ratios

| | Analyzed p/p "Svitanak" | Competitor 1 "Kupalinka" | Competitor 2 "March 8" |
|---|---|---|---|
| Group index, $I_1$ | 1,96 | | 2,23 |
| Group index of the sample, $I_2$ | 2,5 | 2,5 | 2,5 |
| Competitiveness coefficient, K | **0,78** | **0,82** | **0,89** |

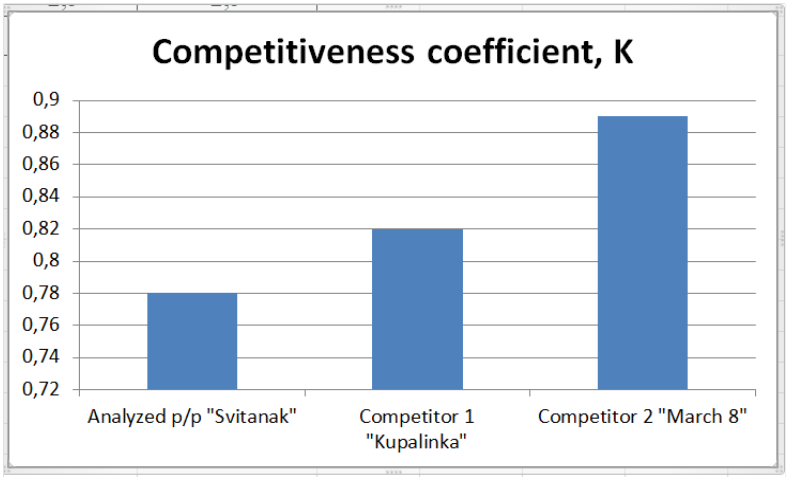


Figure 1 – Competitiveness ratio

As a result of the study, the weaknesses of the children's products of JSC "Svitanak", JSC "Kupalinka" and JSC PTF "8 March" were identified, which the specialists of these enterprises should pay attention to and properly approach the solution of this problem. In the future, the textile industry, as part of the light industry of Belarus, should be focused both on the maximum possible satisfaction of effective demand in the domestic market, and on achieving the greatest results in foreign markets. The proposed calculation model is universal and can be used to assess the competitiveness of any kind of industrial products.

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# CHAT-BOTS AS A TECHNOLOGY FOR THE INTERACTION OF ECONOMIC ENTITIES

# ЧАТ-БОТЫ КАК ТЕХНОЛОГИЯ ВЗАИМОДЕЙСТВИЯ ЭКОНОМИЧЕСКИХ СУБЪЕКТОВ

***Yashava G.A.*, *, Vardomatskaya E.U.**, Hachaturian M.V.***
*Vitebsk State Technological University, Belarus*
*e-mail: gala-ya@list.ru*, elena101.vard@gmail.com**
***Яшева Г.А.*, *, Вардомацкая Е.Ю.**, Хачатурян М.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: automation, machine learning, chat-bot, artificial intelligence, digital marketing, customer service.*
*Ключевые слова: автоматизация, машинное обучение, чат-бот, искусственный интеллект, цифровой маркетинг, клиентский сервис.*

*Abstract. The article analyzes the possibilities of using chat-bots as one of the automation tools in digital marketing. The types of chat-bots, their advantages for business are considered, and an assessment is made of the effectiveness of their implementation in the organization's business processes.*
*Аннотация. В статье проанализированы возможности использования чат-ботов как одного из инструментов автоматизации в цифровом маркетинге. Рассмотрены виды чат-ботов, их преимущества для бизнеса, и выполнена оценка эффективности их внедрения в бизнес-процессы организации.*

Automation is the most relevant trend in various business areas. More and more eCommerce companies are integrating machine learning and adopting chat-bots, which are becoming an important factor in the development of enterprises.

A chat-bot is a program that simulates a conversation with a user in natural language, allowing him to interact with a digital device as if he were a real person.

The bot processes the user's request and gives him the necessary response. Messaging – both text and voice – can take place in instant messengers, on a website, in a mobile application or through a phone.

Chat-bots are one of the highly effective AI-powered tools in terms of digital marketing automation. Today, most business websites are equipped with chat-bots that provide instant customer support instead of operators. Chat-bots answer the simplest queries, matching them to knowledge base articles and content based on clarifying questions. This technology can be further enhanced by using historical data and questions from previous consumers to create more personalized conversations. All this helps to reduce the waiting time for a response from the support service, and allows operators to focus on more complex tasks.

Marketing, sales and customer service are already reaping the benefits of chat-bot adoption, especially when combined with artificial intelligence and machine learning, the combination of which affects the analysis of customer behavior and service levels. Chat-bots become a «good friend» for the buyer; as a result of the growth of positive user experience, the retail business is becoming more efficient.

Currently, the following types of chat-bot s have been developed and are being used:

Chat-bots based on rules. Such chat-bots interact with the user based on the keywords in the request. Often, the bot itself prompts the user to select a keyword, since it is almost impossible to find all the words that a person is able to use in a question.

If the bot does not find the keywords embedded in its program in the request, it will not be able to give an answer. Usually in such cases, the user will be redirected to a "real" employee.

- Operates based on keywords and does not answer questions that do not contain keywords.
- Not able to learn from previous user experience, so improvements need to be done manually.
- Communication seems robotic.
- Quick and easy implementation.

Chat-bots based on artificial intelligence. AI-based chat-bots rely on NLP techniques, as well as speech recognition and text processing methods using neural networks. Such bots will answer the user even if he entered a non-standard question. The main advantage is the ability to self-learn.

- Uses NLP to recognize user input.
- Independently learns based on Machine Learning algorithms.
- Communication looks more realistic.
- The implementation process is more complex and takes more time.

Chat-bot is used to automate the following processes:

- Making an application, accepting an order, booking a ticket, etc.
- Technical support: answers customer questions about your product around the clock.

- Product recommendation: selects a suitable product for the customer based on a request or previous purchase experience.
- Mass mailings: timely notifies customers about promotions and sales.
- Collecting contact information: finds out from the user how to contact him and passes the information to the manager.

An important methodological issue is the evaluation of the effectiveness of chat-bots. Chat-bots can bring value in many ways in both business intelligence and business intelligence. By tracking trends in conversations and focusing on the type of customer, the chat-bot is able to generate reasonable, targeted offers that increase the chances of a purchase.

These targeted recommendations are part of the current vogue for personalization as a way to improve customer experience. Gartner research on personalization has found a growing need for personalization among customers, who are often willing to pay more for a service that provides a personalized experience. Collecting information about the user based on their interaction with the chat-bot will help companies meet this need.

In the field of business intelligence, chat-bots are a fast and effective tool that helps managers to monitor various aspects of the company's work directly and make informed decisions. Chat-bots contain the most up-to-date information (on KPIs and other metrics) available on demand at any time, and this is their key advantage.

Chat-bots are capable of more than just collecting user data. Text sentiment analysis is often used in social networks to study opinions about a product or service. It can be integrated into chat-bot s to determine the mood of the customer, which is especially valuable for combating user churn.

Also, sentiment analysis helps companies to better understand their customers. Information about which elements of the service are especially useful for different people, and which most influence the decision to purchase a product or service, is invaluable. Technologies aimed at understanding the full range of human emotions in the processing of dialogues with buyers have great potential.

As a result of the study, the following benefits of chat-bots for business have been identified:

1. Ideal employee

- Available 24/7. The bot never gets tired, never pretends not to see your message, and never takes sick leave. It is ready to help users even during weekends or non-working hours.
- Multitasking. Able to conduct conversations with hundreds of customers at once and at the same time remain no less productive than on the first day after the vacation.
- Economical. The chat-bot does not require a salary increase. It does not demand payment for its work at all. It works on sheer enthusiasm.

2. Positive customer experience. The chat-bot reduces customer waiting time. Studies have confirmed that a robotic helpdesk responds three times faster than a real person. This is probably the reason why chat-bots increase customer satisfaction by 24 %.

3. Collection of customer data. Communicating with the user, the chat-bot collects information about him and transfers it to other departments. The resulting data can be used by the marketer to improve their interaction with customers. For example, to send more personalized emails or to offer products and services that will interest a potential buyer.

4. Increase sales. Bots accompany and advise the client throughout the entire path to the purchase. They personalize the user experience based on previously collected information. Thus, bots are always ready to give the user recommendations that will interest him.

Thus, the creation of a chat-bot and its use is an important step in modernizing the image of business organizations, allowing them to move on to more efficient work. With the help of a chat-bot, informing employees is simplified, the internal processes of the enterprise are optimized, and working time is saved. All this increases the efficiency of the organization as a whole, making it more competitive, which in modern conditions is an important criterion for the success of the company. Chat-bot technology, as well as technologies used in conjunction with it, is already changing user experience, «humanizing» interaction with software systems, taking it to a new level. It should also be noted that there are ample opportunities for using chat-bot technology in business, since it allows you to reduce costs and adapt to the needs of the consumer as much as possible, which is critical in a highly competitive market.

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# DIRECTIONS OF FORMATION OF FINANCIAL SECURITY

# НАПРАВЛЕНИЯ ФОРМИРОВАНИЯ ФИНАНСОВОЙ БЕЗОПАСНОСТИ

***Zelenkevich M.**, Zhang Yuelong*****
*School of Business BSU, Belarus*
*e-mail: marina.zelenkevich@gmail.com*, bsuzhang@gmail.comy***
***Зеленкевич М.Л.**, Чжан Юэлун*****
*Институт бизнеса БГУ, Республика Беларусь*

*Keywords: economic security, financial security, financial development, financial depth, financial inclusion, financial stability, financial efficiency, financial regulation.*

*Ключевые слова: экономическая безопасность, финансовая безопасность, финансовое развитие, финансовая глубина, финансовая инклюзивность, финансовая стабильность, финансовая эффективность, финансовое регулирование.*

*Abstract. The report considers the directions of formation of financial security, which are based on the financial development of the country, defines indicators for assessing financial development, including indicators of financial depth, financial inclusiveness, stability and efficiency. In order to achieve financial security, the necessity of taking into account the contradictory nature of the presented directions of financial development is proved. The complex nature of achieving financial stability has been determined, in particular, an important factor in achieving it in conditions of high risks has been identified – this is the improvement of the financial state and the formation of the foundations for a coordinated policy of the governments of individual countries in the field of counteracting external shocks.*

*Аннотация. В докладе рассмотрены направления формирования финансовой безопасности, которые базируются на финансовом развитии страны, определены показатели оценки финансового развития, включающие показатели финансовой глубины, финансовой инклюзивности, стабильности и эффективности. С целью достижения финансовой безопасности доказывается необходимость учета противоречивого характера представленных направлений финансового развития. Определен комплексный характер достижения финансовой стабильности, в частности выявлен важный фактор ее достижения в условиях высоких рисков – это совершенствование финансового регулирования и формирование основ для согласованной политики правительств отдельных стран в области противодействия внешним угрозам.*

In scientific publications, economic security is considered as the need to achieve stability in economic development, independence from external influence, and includes the protection of the economic interests of the country [1]. Economic security includes its separate types: social, investment, demographic and others [2]. Since modern economic development is inextricably linked with the financial sector, it is necessary to talk about such a phenomenon as financial security, which is based on the country's sustainable financial development and acquires new characteristics.

By now the studies of the relationship between financial and economic development have undergone significant changes. If previously financial development was assessed only by the financial depth indicator, the current stage of the financial market and financial institutions is analyzed additionally from the standpoint of such parameters as inclusiveness, stability and efficiency. Indicators of financial depth are combined, depending on the financial market sector, into three groups: first – indicators of banking system development (ratio: the volume of loans issued by commercial banks to GDP; the volume of bank deposits to GDP; net interest margin to total interest-bearing assets of the banking system, etc.). Second – indicators of securities market development (ratio of capitalization of stock markets, corporate and government bonds to GDP, etc.). Third – indicators of insurance sector development (specific shares of accumulated On the basis of these characteristics it is possible to compare the significance of individual sectors of the financial market, as well as to analyse the countries depending on the specific shares of these sectors [3].

The noted characteristics of the development of the financial system and, accordingly, financial security indicate the multidimensionality and complexity of the financial system: for example, its depth does not always ensure the breadth of access to financial services, a high level of its efficiency – its stability, etc. More recent studies have also confirmed that these indicators are not always achieved simultaneously. For example, policies aimed at increasing the affordability of consumers with low creditworthiness can lead to a systemic crisis, thus jeopardizing financial stability. Similarly, an increased focus on achieving financial stability can exacerbate inequalities in financial inclusion, reducing the savings and investment opportunities of the population. Consequently, each of the presented characteristics may be due to the socio-economic situation, financial policy and the existing investment conditions in the country.

Modern scientific research proves the need to shift the emphasis in the analysis from the policy of stimulating financial deepening to the policy of improving financial inclusion. According to the OECD definition, "financial inclusion is the ability to obtain affordable formal (regulated) financial products and services in a timely manner and under adequate conditions, including by expanding the scope of their use by all social groups through current and innovative ways, including the improvement of financial awareness and literacy" [4]. At the same time, it is necessary to distinguish between the concepts of "the widest possible dissemination of financial services" and "use of financial services", because even in countries with a highly developed financial

system not all economic agents resort or would like to resort to some financial services, although they are quite accessible to them. The rejection of financial services may also be due to ethical or religious considerations.

In the concept of accessibility of financial services, the main parameter is the general level of development of the financial system, and not its structure. When comparing individual countries, the quality and availability of financial services are of paramount importance, and not who exactly – banks or the securities market that provides them. In fact, the banking sector and the securities market complement each other, expanding the range of services.

Along with financial accessibility, researchers and policy makers today focus their attention on such a characteristic of financial development as financial stability. The peculiarity of the modern financial market is its effective regulation based on achieving two goals – economic growth (by increasing financial depth) and financial stability. The state economic policy, which manages to solve both problems simultaneously, is considered optimal. The formation of a balance between different structural elements of the financial sector is more conducive to higher rates of long-term economic growth than an emphasis on financial depth alone. In other words, calls for accelerated growth, the so-called "financial acceleration", will certainly lead to worse results than the development of the financial sector in all areas: depth, accessibility, stability and efficiency.

There is no many scientific research on the relationship between financial stability and economic growth, despite its high practical relevance. The empirical evidence is rather limited and not definitive. As a rule, the issue is investigated by identifying the relationship between financial development and economic growth during periods of financial instability. The literature identifies three main channels through which financial instability can affect this relationship: uncertainty about the fundamental value of financial assets, future returns, and investor behaviour; deteriorating borrowing conditions due to tighter credit conditions; increased costs of firms and households associated with the servicing of credit [5].

The point of view of the Belarusian scientist and practitioner D.L. Kalechits, according to which the assessment of financial stability is complex and affects not only the financial sector, but also its relationship with other segments of the economy [6]. In our opinion, the list of tasks for assessing financial stability in the context of globalization should be supplemented by the task of determining the possibilities of forming a coordinated policy of the governments of different countries in the field of counteracting external threats.

To characterize the current state of the financial market, it is advisable to use indicators to assess its efficiency and formulate directions of transition from extensive to intensive way of its development. The emergence of new markets, additional financial intermediaries, exchanges, financial centres, and the use of new financial instruments corresponded to the extensive mechanism. In other words, there was an expansion of borders of the financial field of activity of market subjects. The intensity

consisted in the concentration of capital in the main financial centres, high level of cooperation of national markets, universalization of financial intermediaries' activity. We consider that the intensive financial development in the long-term period is formed on the basis of supplementing the mechanism of market regulation by the state policy aimed at the excess of the growth rate of production factors productivity over the growth rate of capital volumes. An efficient financial system is characterized by both high level of financial depth indicators and relatively even participation of economic entities in the formation of efficiency indicators, including net interest margin (the share of interest-earning assets as a percentage of total assets), overheads (as a percentage of total assets), the ratio of bank expenses to income (as a percentage). These values should be taken into account in addition to the system of indicators characterizing financial development.

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UDC 332.05

# SMART CITIES: CHARACTERISTICS AND WORLD TRENDS

# УМНЫЕ ГОРОДА: ХАРАКТЕРИСТИКА И МИРОВЫЕ ТЕНДЕНЦИИ

***Zhuchkevich O.***
*Vitebsk State Technological University, Belarus*
*e-mail: olga_zh17@ mail.ru*
***Жучкевич О.Н.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: smart city, urbanization, intelligent systems, digitalization, infrastructure.*
*Ключевые слова: умный город, урбанизация, интеллектуальные системы, цифровизация, инфраструктура.*

*Abstract. The article analyzes global trends in urbanization. The content of the concept of Smart City is determined, its main features and constituent elements are determined. The results of the ranking of smart cities in the world are presented. The main directions for the implementation of the typical digital platform project Smart City (Region) in Belarus are considered.*
*Аннотация. В статье проанализированы мировые тенденции урбанизации. Определено содержание понятия «Умный город», определены его основные черты и составляющие элементы. Представлены результаты рейтинга умных городов мира. Рассмотрены основные направления реализации проекта типовой цифровой платформы «Умный город (регион)» в Беларуси.*

The current global trend is an increase of the number of cities and urban population (table). In 2022, the global urbanization rate was 57 %, including 83 % in North America, 81% in Latin America and the Caribbean, 75 % in Europe, 67 % in Oceania, 52 % in Asia, Africa – 44 % [1].

Table 1 – Forecast of the urban population by region

| Region | Number, million people | |
|---|---|---|
| | 2030 | 2050 |
| Asia | 2808.26 | 3479.06 |
| Africa | 824.01 | 1488.92 |
| Europe | 572.56 | 598.86 |
| Latin America and the Caribbean | 600.48 | 685.07 |
| North America | 334.78 | 386.69 |
| Oceania | 32.83 | 41.19 |

Source: [2].

Population growth, increased intensity of traffic flows, increased greenhouse gas emissions require new approaches to the management of regions and territories. Ensuring the coordination of logistics flows, solving environmental problems and social issues at the level of the city system is largely due to the use of modern management technologies based on the introduction of the smart city concept. Its relevance is due to the need to improve the comfort and standard of living of the population, optimize logistics flows, increase the efficiency of resource use and reduce the harmful impact on the environment.

A smart city is a city of a new generation, which provides for the effective management of the city system and the provision of a high living standard for the population through the use of innovative technologies.

The key elements of a smart city are the following: urban infrastructure; urban management (smart government); smart buildings; smart urban transport; smart housing and communal services; public safety systems; ecology and sustainable development; smart healthcare.

The development of smart transport is the use of its ecological types, the use of intelligent traffic management systems, the creation of a single information space for the population, the introduction of smart parking.

The volume of the global market for intelligent transport systems in 2020 was estimated at 25378.2 million US dollars, while until 2028 the annual growth rate will be approximately 7 %.

The management of urban infrastructure within the framework of the functioning of a smart city involves the creation of modern infrastructure facilities of various types and purposes: roads, bridges, shopping centers, social facilities, recreation areas. As part of solving logistics problems, the planning of traffic and pedestrian flows within individual streets and sections of roads, the regulation of traffic lights in order to reduce loss of time during movement and reduce emissions of harmful substances into the atmosphere, and intelligent parking management are of particular importance. The use of intelligent systems is of the utmost importance.

Depending on the level of control or automation, these types of infrastructures are divided into the following types:

– Semi-intelligent infrastructure – this infrastructure collects and records data about its own usage, its structural behavior and environmental conditions, but does not have the ability to make decisions based on the information received. Examples of this infrastructure would be maps that capture city pollution or vehicle traffic.

– Intelligent infrastructures are systems that collect data to process and present information in a way that helps a person make decisions. One example of such a framework would be a traffic system that detects heavy traffic and informs drivers so they can make better decisions while driving.

– Smart infrastructure. This infrastructure collects data, processes information and takes appropriate actions completely autonomously (without human intervention) and dynamically, adapting to changing conditions. This classification usually includes smart grids, smart buildings, smart public infrastructure or smart beaches [3].

Urban management is associated with the planning of urban areas, efficient allocation of resources, organization of urban traffic, ensuring the effective functioning of the city's life systems, and the availability of social services.

Smart buildings are characterized by integrated automation, remote control, and the use of smart appliances.

The development of smart transport is the use of its ecological types, the use of intelligent traffic management systems, the creation of a single information space for the population, the introduction of smart parking.

The activities of housing and communal services in the smart city system are based on the use of online accounting systems for the consumption of water, gas, energy, as well as domestic waste and sewage; detection of losses and leaks, repair management; emergency management, etc.

Public security systems of a smart city involve the introduction and use of automated systems that provide information and technical support to the law enforcement service, the development of video surveillance systems and intelligent control systems, road safety, the introduction of systems for informing citizens about emergencies, etc.

The creation of a single digital space in the field of healthcare allows increasing the speed of providing medical services, increasing the level of diagnostics, reducing the number of medical errors and increasing the effectiveness of treatment, and improving the quality of patient care using modern equipment.

Currently, Smart City projects have been implemented in one way or another in 2,500 cities around the world.

The Institute for Management Development (IMD) and the Singapore University of Technology and Design (SUTD) presented the following ranking of the TOP 10 smart cities in 2021: Singapore, Zurich, Oslo, Taipei, Lausanne, Helsinki, Copenhagen, Geneva, Auckland, Bilbao.

At the same time it should be noted that there are leading cities in each region: New York (12th place) leads in North America, Abu Dhabi (28th place) – in the Middle East, Moscow (54th place) – in Eastern Europe, Buenos Aires (98th place) – in Latin America, Cairo (104th place) – in Africa.

The ranking takes into account economic and technological indicators: the level of health and safety, mobility, opportunities, development and growth prospects [4].

As for Belarus, in accordance with the approved State Program «Digital Development of Belarus» for 2021–2025, the project «Smart Cities of Belarus» is being implemented. It provides comprehensive regional development through the consistent and large-scale implementation and integration of digital solutions based on information and communication technologies. For the development of smart city technologies in all regions of the country, it is planned to create a regional state standard digital platform «Smart City (Region)», a national geoportal, development a regional information and communication infrastructure, create and development standard services in various areas of urban life.

The project «Smart Cities of Belarus» should ensure the construction of a modern regional management system as a basis for carrying out activities for a comprehensive digital transformation of the economy and social sphere of Belarus [5].

At present, along with the implementation of the republican digitalization projects, digital technologies are being introduced in certain regions of the country. Cities with a population of more than 80 thousand people, namely: Orsha, Baranovichi, Pinsk, Novopolotsk, Polotsk, Mozyr, Lida, Borisov, Soligorsk, Molodechno, Bobruisk, for which pilot digital transformation projects are being developed [5].

The implementation of infrastructure reforms is carried out at the level of the Ministry of Communications and Informatization, the Ministry of Transport and Communications, the Ministry of Internal Affairs, the Ministry of Natural Resources and Environmental Protection, the State Property Committee.

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## SECTION 3. LANGUAGE EDUCATION FOR SPECIFIC PROFESSIONAL SKILLS

UDC 37.01

# ETHNO-PEDAGOGICAL COMPETENCE OF A TEACHER

# ЭТНОПЕДАГОГИЧЕСКАЯ КОМПЕТЕНТНОСТЬ ПЕДАГОГА

***Bolbas V.S.***
*Mozyr State Pedagogical University named after I.P. Shamyakin, Belarus*
*e-mail: bolbasws@yandex.ru*
***Болбас В.С.***
*Мозырский государственный педагогический университет им. И. П. Шамякина, Республика Беларусь*

*Keywords: ethnocultural education, multiculturalism, ethnopedagogic competence, ethnopedagogic competence, ethnopedagogic approach.*
*Ключевые слова: этнокультурное образование, поликультурность, этнопедагогическая компетентность, этнопедагогические компетенции, этнопедагогический подход.*

*Abstract. The necessity of the ethnopedagogic competence of a modern teacher is substantiated, its structure and essential content are revealed, the author's definition of this concept is proposed, the main directions of using the ethnopedagogic approach in education are clarified.*
*Аннотация. Обосновывается необходимость этнопедагогической компетентности современного учителя, раскрывается ее структура и сущностно-содержательное наполнение, предлагается авторское определение этого понятия, уточнены основные направления использования этнопедагогического подхода в образовании.*

The issues of ethnopedagogical training of teachers are given a significant place in the works of such scientists as P. A. Apakaev, G. N. Volkov, E. P. Zhirkov, V. A. Ivanov, T. B. Ilyina A. V. Kaisarova, M. B. Kozhanova, D. A. Krylov, V. G. Krysko, L. V. Kuznetsova, E. L. Mikhailova, A. P. Orlova, A. B. Pankin, T. N. Petrova, M. G. Kharitonov, S. N. Fedorova, V. K. Shapovalov, etc. They have developed many aspects of improving the ethno-pedagogical training of teachers, substantiated the structure and content of ethno-cultural competence, defined pedagogical conditions for the formation of ethno-cultural competence, gave a general characteristic of ethno-pedagogical competence, presented criteria and levels of formation of ethno-pedagogical competencies, and also disclosed other issues of this direction with varying degrees of depth. Naturally, the inexhaustibility of the topic

under consideration implies its further study both from the standpoint of theoretical and methodological justification and from the standpoint of practical implementation in pedagogical reality of relevant scientific developments. In this paper, I would like to comprehensively and holistically present the most important ethnopedagogic competencies as necessary components of the professional competence of a modern teacher.

Currently, there are various definitions of pedagogical competence, but, in fact, they all boil down to the fact that it means readiness for pedagogical activity, including the possession of a specialist with a certain set of relevant knowledge, skills and abilities and the ability to apply them in real practice. Competence, which is most often interpreted as the possession of certain competencies, is a set of personality qualities manifested in a specific activity. The competence of a teacher, on the one hand, is due to the versatility of general professional knowledge, on the other hand, it cannot be limited only to them, unlike many other professions. The competence of a teacher consists of three main components: general cultural, professional and social. As noted above, the most important component of the competence of a modern teacher is ethno-pedagogical competence, based on the ethno-cultural and ethno-social characteristics of society.

Today, the teacher is entrusted with performing, in addition to traditional, new functions aimed at the social adaptation of children in a multicultural society and the resulting features of the organization of the educational space, as well as the formation of a culture of interethnic relations. Scientists investigating this problem conclude "that a modern teacher, regardless of what stage of professional development he is at, should become an ethnopsychologist, ethnoculturologist, social pedagogue, ethnoconflictologist, ethnodidact, etc. – that is, a specialist (expert) on multiculturalism (interculturalism) or multicultural pedagogical interaction" [1, p. 73]. In connection with the above-mentioned trends in the development of education, one of the most important places should be given to the professional characteristics of the future teacher of ethnopedagogic competence.

Ethnopedagogic competence is based on familiarity with the general culture of an ethnos, depends on the degree of mastery of ethnopedagogic culture and is determined by the activity of a teacher as a subject of an ethnocultural-oriented educational process. The ethnopedagogic competence of the teacher provides the solution of three most important tasks. Firstly, it helps to increase the overall effectiveness of the educational process by directly fulfilling the requirements of the principle of cultural conformity of education, secondly, it promotes the growth of national consciousness, the revival of national culture, the preservation of national values, thirdly, it promotes effective multi-ethnic educational activities in a multicultural environment, where, in parallel with unification, the importance of the ethno-national component increases personality, the formation of its ethnic and civic identity. Recently, the attention of researchers has been mainly focused on the third task. For example, A. P. Orlova concludes: "The ethno-pedagogical training should be based on the principle of multiculturalism" [2, p. 5]. One cannot disagree with all this, but one must bear in mind

that the first task is more fundamental and its solution automatically favors the solution of the second and third tasks, therefore it should always be in the field of view of both theorists and practitioners as fundamental. Another thing is that the relevance of the problems of the polyethnic world today has made it extremely popular to consider ethnopedagogical training precisely from the perspective of multiculturalism. But in general, I did not want a self-sufficient, fundamental and system-forming ethno-cultural direction to turn into an auxiliary, even if the most important component of multicultural education.

As for the essence of the concept of "ethnopedagogic competence", today there are many definitions that differ from each other not so much in meaning as in content. Almost all of them agree that ethnopedagogic competence is based on ethnopedagogic knowledge and the teacher's ability to apply them in modern educational practice. Generalizing such approaches, A. V. Kaisarova concludes in her dissertation research: "Ethnopedagogic competence is a set of ethnopedagogic knowledge and skills that allows a teacher to design the educational process in such a way as to achieve the maximum purposeful and consistent inclusion of the pedagogical heritage of people in it..." [3, p. 7]. M. G. Kharitonov, trying to concretize the ethnopedagogical knowledge of the teacher, presents them as "knowledge of: folk pedagogy; folklore; ordinary, informal, everyday, traditional and natural pedagogy; the wisdom of education; pedagogical wisdom; folk pedagogical culture; traditional pedagogical culture; traditional culture of education; traditional education; diverse forms of their functioning in reality" [4, p. 76]. In the same vein, R. V. Komrakov defines ethnopedagogical competence, emphasizing that it represents the professional and personal quality of a future specialist and "includes the formed possession of integrative ethnopedagogical knowledge, skills, skills that allow teachers to productively use the possibilities of ethnopedagogy in working with children" [5, p. 6]. Similarly defines the concept under consideration by E. F. Vertyakova, who states: "Ethnopedagogical competence – this is the student's possession of knowledge and skills in the field of folk pedagogy and ethnopedagogy" [6, p. 18].

Analyzing these and other definitions, we can conclude that they lack universalization in combination with an emphasis on the active use of national pedagogical experience. Based on this, we can propose the following definition: ethnopedagogic competence is the ability and direction of using ethnopedagogic knowledge and achievements of national educational experience in pedagogical activity to increase its effectiveness. From this definition it follows that the substantive basis of competence is ethnopedagogical knowledge. It is also important to focus the specialist on their application in everyday practice. And of course, the determining factor of ethnopedagogic competence is the direct use of all this potential in pedagogical activity. In general, the analysis of the content of ethnopedagogic competence allows us to distinguish the following components in its structure:

• motivational-need-based – based on the value orientations of ethnopedagogic activity, reflects the level of inner aspiration and the degree of moral and psychological

readiness for its implementation, performs motivational and stimulating functions, determines the activity of the teacher's position;

• cognitive knowledge – is fundamental, covers directly ethnopedagogical knowledge and related ethnocultural, ethnopsychological, ethnomethodic and other knowledge, is characterized by formed ethnopedagogical thinking, provides a high degree of theoretical preparedness of the teacher;

• organizational-praxiological – acts as a determining indicator of a teacher's readiness for directly practical professional activity, shows the measure of mastering the skills and abilities of ethnopedagogization of the educational process, reveals the creative abilities of a teacher, is a criterion of a specialist's preparedness in this direction.

Ethnopedagogic competence is one of the subcompetencies of the professional competence of a modern teacher. As it is known, the professional competence of a teacher, as a system of relevant competencies, is determined by the totality of his theoretical and practical readiness for the implementation of educational activities Ethno-pedagogical competence also presupposes the possession of a number of competencies: ethnocognitive, ethno-cultural, ethnopsychological, ethno-conflictological, ethnomethodic, ethnocommunicative, ethno-educational, etc., the formation of which in modern conditions should be given a significant place in pedagogical universities and not only in them.

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# NATURE-BASED EDUCATION AS AN ACTUAL DIRECTION OF PEDAGOGICAL THEORY AND PRACTICE IN THE CONTEXT OF SOCIAL TRANSFORMATIONS

# ПРИРОДОСООБРАЗНОЕ ВОСПИТАНИЕ КАК АКТУАЛЬНОЕ НАПРАВЛЕНИЕ ПЕДАГОГИЧЕСКОЙ ТЕОРИИ И ПРАКТИКИ В УСЛОВИЯХ СОЦИАЛЬНЫХ ТРАНСФОРМАЦИЙ

***Bolbas G.***
*Belarusian State Pedagogical University named after Maxim Tank, Belarus*
*e-mail: bgv78@mail.ru*
***Болбас Г.В.***
*Белорусский государственный педагогический университет имени М. Танка, Республика Беларусь*

*Keywords: nature-based upbringing, the principle of nature-based education, folk ducation, nature-based learning, nature-based education, human nature, pedagogical theory and educational practice.*

*Ключевые слова: природосоообразное воспитание, принцип природосообразности, народное воспитание, природосообразное обучение, природосообразное образование, природа человека, педагогическая теория и образовательная практика.*

*Abstract. The article actualizes the ideas of nature-based education as one of the directions of modern pedagogical theory and educational practice. The author reveals the essence of nature-based education, analyzes and identifies its specific features in the system of pedagogical categories and concepts. The content-semantic multidimensionality and complexity of this pedagogical phenomenon are determined. Special emphasis is placed on the relevance of his ideas in the conditions of new challenges of modernity, at the stage of the entry of civilization into the stage of instability, crisis states and instability.*

*Аннотация. В статье актуализируются идеи природосообразного воспитания как одного из направлений современной педагогической теории и образовательной практики. Автором раскрывается сущность природосообразного воспитания, анализируются и выявляются его специфические особенности в системе педагогических категорий и понятий.*

*Определяется содержательно-смысловая многомерность и сложность данного педагогического феномена. Особый акцент делается на востребованности его идей в условиях новых вызовов современности, на этапе вхождения цивилизации в стадию неустойчивости, кризисных состояний и нестабильности.*

The life activity of modern man proceeds in conditions of global and unpredictable changes, which is caused, according to scientists, by the entry of civilization "into the stage of instability, crisis states and instability" [1, p. 7]. The growth of environmental problems, economic and political tension, the crisis of the social and spiritual spheres manifested themselves even more forcefully in the XXI century. The events and phenomena that are taking place lead to doubts about the correctness of the chosen path of human development and convincingly prove the need to search for new strategies of civilizational development that can ensure "overcoming cardinal global crises that threaten the destruction of civilization and even the self-destruction of humanity" [1, p. 6].

Education, as the sphere most sensitive to changes and conditions of uncertainty, faces the requirements of constant modernization, reform, introduction of innovative technologies, etc. Such processes in combination with unfavorable stressful conditions inevitably lead to serious consequences for the psychophysical and social health of subjects of educational activity. As a result, teachers have more frequent cases of professional stress and burnout, students have didactogeny, neurotic disorders, depression, etc. A more general consequence of such phenomena, however, as well as their root cause, is a violation of the balance and balance between man and the environment, harmony with oneself as a biological, social and spiritual being.

The indicated problem is complex in nature and one of the primary tasks of pedagogical theory and educational practice should be to change their orientation towards nature conformity. This idea is not new, however, every time at critical moments in the development of society, we return to it and rethink it in the conditions of a changed socio-cultural context, finding in the phenomenon of naturalness both simple and eternal truths and new meanings that represent a fulcrum for modern pedagogical science.

Naturalness as a methodological guideline and the value-semantic basis of education, in our opinion, makes the use of the term "naturalness education" quite justified, expedient and correct. Also, the rich experience of theoretical understanding of this phenomenon, accumulated over centuries by pedagogical science, allows us to define nature-based education as a separate direction of pedagogical theory and practice. It is based on the ideas of the absolute priority of the general laws of the development of nature, deep scientific knowledge about human nature, which determines his needs, capabilities and abilities in the process of development and formation, as well as the need to harmonize the relationship of the individual with the environment of his life. It is in nature-like education that the actual tasks of activating the human factor, cultivating environmental, resource-saving thinking and behavior of the younger generation, the demands of society and time for the formation of an integral

and harmonious personality capable of creative creation and self-realization in conditions of uncertainty and complexity of the external environment find expression.

The term "nature-based education" itself is not often found in scientific works, which, however, does not exclude the existence of the phenomenon designated by it in science. The basis for its use, as a rule, is the "obviousness" of the meaning contained in the name, which, at first glance, does not require delving into the meaning of the concept. The term is also used as a derivative of the well-known and scientifically grounded principle of naturalness in pedagogy, which again leads researchers away from the task of revealing the essence of naturalness education.

Despite the fact that the ideas of nature-based education form the basis of various existing pedagogical directions, there is no holistic and systematic idea of the pedagogical phenomenon accumulating these ideas. Attempts to define nature-based education are carried out mainly in the context of ethnopedagogy. So, N. I. Ivanova interprets nature-based education as "education, which in all its main characteristic properties corresponds to the nature of the subjects of education, as well as the nature of the ethnos and the laws of Nature as a whole" and brings it closer to folk education [2, p. 10]. At the same time, the author associates the main goal of nature-based education with "the realization of the principle of nature-based, corresponding to the essence of man as a cosmo-bio-social being," which indicates the mediation of education by the principle of nature-based, as well as its coordination primarily with human nature, which reflects the surrounding world in all its environmental diversity [2, p. 11]. In the context of the paradigmatic approach by Professor V. A. Lukov revealed the paradigm of nature-based education, which, according to the author, replaces the authoritarian paradigm, making it a challenge, and precedes the paradigm of education in a peer group. The author connects it with the names of Ya. A. Komensky, Zh.-Zh. Rousseau, I. G. Pestalozzi and A. F. Disterveg call the ideas of "freeing the child from strict control, creating situations when he himself learns to do the right thing" an advantage, and the individualism of the paradigm is a limitation [3, p. 143].

Along with nature-based education, the terms "nature-like education", "nature-based upbringing", "nature-based pedagogy" are used. The differences between them are due to both the semantic content of the concept of "naturalness" and the meanings of the terms "upbringing", "training", "education", "pedagogy". In addition, "education" can be used both in a narrow sense ("the process of forming social and spiritual relations") and in a broad sense ("mastering the totality of social experience: knowledge, practical skills, skills, methods of creative activity, social and spiritual relations" (I. F. Kharlamov [4, p. 56]), which will also be decisive for the interpretation of the phenomenon. Nature-based education in a broad sense includes nature-based upbringing and can be identical to the concept of "nature-like education" defined by Z. I. Tyumaseva "a type of education that in all its main manifestations and characteristic properties corresponds to the natural states, qualities, properties, aspirations and inclinations of all subjects of education, as well as the natural states and qualities of the main educational factors" [5, p. 160].

At the same time, we believe that it is in the broad meaning of the term that the syncretic unity of education and training is reflected, which correlates with the consistency and integrity of the idea of naturalness. The use of the term is justified in the case of understanding education in a narrow sense, since the phenomenon of natural diversity was initially correlated with the process of human development and formation, and then refracted to the learning process. Let 's agree with the scientific position of G. Yu. Belyaev, that "ideas about the conformity of education to nature existentially take priority over ideas about the conformity of learning to nature" [6, p. 51]. In support of his thought, the scientist appeals to the legacy of the founder of nature-based education: "It was Ya. A. Komensky (and, apparently, for the first time in the history of science in general and pedagogy as part of it) who deduced the foundations of didactics, that is, the theory of learning from the basic concepts of nature-like education (and not vice versa!)" [6, p. 53]. However, it should be clarified here that the Czech teacher did not differentiate pedagogy into the theory of education and didactics, although he operated with these terms. In the "Great Didactics" this knowledge is presented in organic unity and integrity and is often identified as a whole with education. It also strengthens the justification of the correctness and expediency of the term "nature-based education" that the process of education remained paramount throughout the historical development of Russian pedagogical thought.

Thus, nature-like education is a unique pedagogical phenomenon that has a centuries-old history and is distinguished by its content-semantic multidimensionality and multi-aspect. His ideas are reflected in many areas of pedagogical theory and practice, respond to the challenges of modernity and require a systematic and holistic study in the context of a changed reality.

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# INTEGRATED APPROACH TO FOREIGN LANGUAGE LEARNING AT TECHNICAL UNIVERSITY

# КОМПЛЕКСНЫЙ ПОДХОД К ОБУЧЕНИЮ ИНОСТРАННОМУ ЯЗЫКУ В ТЕХНИЧЕСКОМ ВУЗЕ

***Burdyko O.V.***
*Vitebsk State Technological University, Belarus*
*e-mail: burdyko76@mail.ru*
***Бурдыко О.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: Integrated learning, fluency, proficiency, professionally-oriented foreign language, ICT.*
*Ключевые слова: Интегрированное обучение, беглость, владение, профессионально ориентированный иностранный язык, ИКТ.*

*Abstract. The article deals with the problem of the use of the suitable ways of students' foreign language fluency and proficiency development by means of ICT through a university English teaching course. The article is based on the idea of using modern technologies and digital educational resources in teaching a foreign language.*
*Аннотация. В статье рассматривается проблема использования подходящих способов развития свободного владения иностранным языком у студентов средствами ИКТ в рамках курса обучения английскому языку в вузе. В основу статьи положена идея использования современных технологий и цифровых образовательных ресурсов в обучении иностранному языку.*

The contemporary generation of students is characterized by their confidence of media, their technological multitasking capabilities, and their tendency toward all possession new. Virtual communication and connections are playing substantial roles in people's interactions has enters each position of life, one of them is education. In the period of globalization, the Internet becomes a prevalent factor for adapting to the modern environment. There are many recourses opened now for learning and teaching languages. Nowadays, in the education system charges certain requirements for the training of professionally educated students, taking into account, that every student is different from the other. Furthermore, they affect how the student responds to different types of teaching and approaches in the lesson as well as how or otherwise successful they are at learning the language. Some of these differences are the motivation of the student, the student's personality, language level, learning style, learning strategies, previous background with language and age.

Knowledge of foreign languages is an imperative for any professional qualifications. Learning foreign languages acknowledges a person to expand their communication capabilities, vision, improve the level of culture. English is still leading, which is related with the creation of the world economic, informational, cultural space.

According to the principal requirement of professionally-oriented foreign language teaching is the need to bring the content and methods of its teaching closer to the practical needs of students. This requires a thorough study of the assignments and goals facing a certain contingent of students, obligatory consideration of interests and motivation. First of all this applies to the choice of material, its critical understanding, taking into account the professional specifics of students and the level of language competence.

Teaching a professionally-oriented foreign language we can determine visual, auditory, kinaesthetic, group, individual, reflective, impulsive learning styles that are very common for professionally-oriented foreign language lessons. Students who have different learning styles learn in various ways and therefore must be taught in various ways. It is important to keep in mind however, that students might not fall into any specific category of learning style. Different cultures might use some learning styles less than others might and students may always change or develop their learning styles.

According to our research, all the first-year students are different from each other and learn in different ways. In order to teach teenagers and adults rather than children, some student characteristics like past language learning experience and learning strategies are more relevant. It is best to discover our first-year students' characteristics by asking them or observing them.

In our professionally-oriented practice, we use a communicative approach which is based on the teaching model of appropriate social language through communication in real-life situations. It includes such parameters as motivation, purpose, informative value, novelty, pragmatism, functionality, and the nature of the interaction between a teacher and a student, as well as the system of speech means. The syllabus involves flexibility and diversity of learning tools, their consistency with the ultimate goal of training as well as the student's social and personal needs.

In our professionally-oriented English learning practice for first-year students at Vitebsk state technological university, we can distinguish a few learning strategies. Repeating words that are new to the students repeatedly in their head until they commit them to memory. Guessing the meaning of words that are unknown to the students. Asking someone who speaks the language to repeat what they have said; making a recording of yourself speaking, then listening to it and analyzing and correcting your speaking and pronunciation; experimenting and taking risks by using the language that the students have just learnt in conversations with others. Making the decision to use the foreign language as much as you can by talking to tourists. Asking the teachers or your friends or classmates to give you their opinions about how well you use your language. Recognizing which area of vocabulary that you need to learn or practice and then learning it. Making the decision to write all the new words, the students come across in every lesson on a separate card.

We must admit that different students use dissimilar strategies. According to our research, the strategies that are used by first-year students most successfully are dependent on the student's personality and learning style. Therefore, it means that there are no strategies to be considered 'best'. However, our research shows clearly that use

of strategies is sure to make the learning more successful and that first-year students can be trained to use them.

We consider that all first-year students differ from each other and learn in different ways. In order to teach teenagers and adults rather than children, some student characteristics like past language learning experience and learning strategies are more relevant. It is best to discover our first-year students' characteristics by asking them or observing them. We gave them questionnaires at the end of a lesson asking whether they like the activities that we did in the class and why. They could also ask them what methods they did not like and what they did. Since the characteristics of learners may not be fixed, the lecturer must not make the mistake of thinking that the student can learn only in a specific way. This is limiting the student. It is possible to train the students to try using dissimilar learning strategies and to be aware of them. A lecturer who is teaching a large group cannot always meet the learner characteristics of each student. Therefore, lecturers can try to change their teaching methods and vary them. In this way, they can match the learner characteristics of a range of first-year students.

Due to our research, we find out, that first-year students developing positive disposition in the direction of technology will build a relationship between them and fluent speaking, which will allow them to increase their opportunities and become immersed in the process of learning. As more and longer students use computers as information sources and cognitive tools, their learning achievements will depend on the influence of the technology support. Thus, the aim of our research is to find out the suitable ways of students' foreign language fluency and proficiency development by means of ICT through a university English teaching course.

We applied the way to develop university students' English fluency and proficiency through content of language-integrated learning with ICT is the application of a high-level internet-based project in the learning process. This project aims to provide students with the opportunity to examine a serious issue in depth. It is possible to work beforehand on some of the language areas useful for the activity, for example, giving opinions, agreeing and disagreeing. However, this will depend on the level of your students. A good command of language is ideal for groups. In our university, we practice it with students of pre-intermediate level groups and above. For this project, we usually have three lessons. During the first and probably the second of the suggested three classes it is necessary to have an access to the Internet, optionally, an access to the video recording equipment for the third lesson. During the first stage, you should make your students benefit with their research in the topic and for the subsequent discussion of their findings, if time is available. In the second lesson, we divided the students into four groups, working on a special TV debate on the issue of brilliant scientists: 1. TV debate presenters; 2. Awarded scientists; 3. Scientists fans; 4. TV studio audience. As during the final third lesson, we had an actual debate, so the students had to prepare their speech for the debate. It is convenient to use prompt cards with instructions for each group. For example, brainstorm what your students know about world known scientists.

As a conclusion, it is important that both the lecturer and students see the use of ICT as an intrinsic part of the learning process rather than as an essential component that has nothing to do with their regular study programme. We would therefore recommend that, if you plan to use the Internet, you should talk to your students and explore the reasons for using this resource with them. This can be done at lower levels in their own language or in English with higher-level students. It is necessary to talk to your students about why the Internet content may be useful to them and discuss their attitudes to ICT in general – when they use the Internet, and what for. It is important to show them how the course book and other materials can be enhanced by extra material from the Internet. Above all, do your best to make clear that this is not an entertainment, not something that you are just using to fill in the time.

ICT is a great resource to make university English lessons diverse and accessible. It gives a great chance to implement authentic material into the learning process and create real-life environment for foreign language communication.

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## MODERN INFORMATION AND COMMUNICATION TECHNOLOGIES IN TEACHING FOREIGN LANGUAGES

## СОВРЕМЕННЫЕ ИНФОРМАЦИОННО-КОММУНИКАЦИОННЫЕ ТЕХНОЛОГИИ В ПРЕПОДАВАНИИ ИНОСТРАННЫХ ЯЗЫКОВ

***Izmailovich O.***
*Vitebsk State Technological University, Belarus*
*e-mail: izmaov@gmail.com*
***Измайлович О.В.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: information and communication technologies; Internet resources, foreign language teaching; multimedia technology; distance learning.*

*Ключевые слова: информационно-коммуникационные технологии, интернет-ресурсы, преподавание иностранных языков, дистанционное обучение.*

*Abstract. The use of information and communication technologies in teaching of foreign languages is necessary for effective learning. It is given a brief description of some information and communication technologies and the features of their application are described.*

*Аннотация. Показана необходимость внедрения в образовательный процесс вуза информационно-коммуникационных технологий, способствующих эффективному решению ряда дидактических задач в процессе преподавания иностранных языков. Дана краткая характеристика и рассмотрены*

*особенности применения некоторых информационно-коммуникационных технологий, используемых для продуктивного обучения иностранным языкам.*

The almost universal use of the internet, of smartphones and of connectivity has opened up enormous opportunities for language learning and teaching. Technology has heavily impacted almost every aspect of our lives, and education is no exception. In the technological era, the classrooms transformed from teacher- centered to student-centered. This came as a result of wanting to focus more on the students. A student-centered classroom means that the learning responsibility is put on the student with the intention of getting them out of the shell and teaching to become independent. Through many technological tools that teachers have at their disposal, they try to make the learning process fun, interactive, and informational for students by engaging them and giving a sense of independence. Technology hasn't only changed the way teachers deliver their lessons and how students learn; it has also made education in general more accessible to millions of students through online classes and online resources. Technology creates a more engaging learning environment. It improves collaboration and incorporates different learning styles. It also boosts motivation and allows students to self-pace.

To meet the requirements and the challenges of the globalized world, developing digital practices in the language class has become a necessity. Even though the introduction of computers and the Internet in foreign language teaching has been a controversial issue, it is nowadays largely agreed that it impacts positively on the learning process.

There is no more doubt that the use of information and communication technologies (ICT) has positive effects on foreign language teaching and a large amount of literature is available on the topic; however, its impact is highly dependent on the way it is used and the teachers' motivation. Indeed, technologic equipment and connectivity without human implication is not sufficient to improve teaching; to be considered as an efficient tool, ICT requires an actual engagement of the teacher and a well-defined pedagogical project [1]. The following impacts seem to be the most obvious ones when using ICT to support foreign language teaching:

- the possibility to adapt easily the teaching materials according to circumstances, learner's needs and response;
- information and communication technologies allow to react upon and enable the use of recent news, they offer access to authentic materials on the web;
- quick feedback can be possible;
- possibility to combine/use alternately (basic) skills (text and images, audio and video clip...);
- lectures become more interesting and less ordinary which boosts learners' engagement;
- information and communication technologies enable to focus on one specific aspect of the lesson (pronunciation, vocabulary...).

In spite of contrasts that may exist in terms of educational environment, there is significant evidence of the benefits and advantages that the use of ICT can have on learners Here are some of them [2].

1. Creates a more engaging learning environment. Technology can encourage students to participate in the classroom actively. While some students might find the experience of talking in front of their classmates intimidating, the online classes might have the opposite effect on them. They might feel more comfortable expressing themselves in writing by joining discussions on discussion boards that online courses offer. Not to mention the lessons that become more interactive and interesting for students to follow. It may also help with communication between students. While some find it awkward to ask colleagues for help on particular subjects, communicating online might be easier for them.

2. Improves collaboration. Over the years, professors have seen an increase in collaboration between students whenever they involve technology in the classroom. Unlike lecture-based classes where students stay passive and wait for the teacher to disseminate information for them, and most of it isn't retained, in the classes where technology is involved, students tend to collaborate more, and the percentage of the retained information increases too.

3. Incorporated different learning styles. You can't find two identical students. They all have different learning styles. That's why it's difficult for the teachers to create a lesson plan that incorporates all of the different learning styles. With the help of technology, this has become possible. Some students learn best by hearing, so you use videos or podcasts in the classroom; some students prefer using pictures to visualize what they're learning, and some might learn best on their own, so they use online learning. Technology helps teachers become creative in ways of teaching.

4. Boosts student motivation to learn. When we do something that we enjoy, we want to do it more. Simple as that. That's how technology can boost students' motivation to learn. Most students have been raised with technology, and they're used to it. So they don't have a problem with it, quite contrarily, they enjoy using it. Through technology, active learners remain engaged with the lessons and it encourages the students who aren't that active to find something that will make the learning process easier and fun for them.

5. Makes self-paced learning possible. Schools continue to have rigid schedules that students must follow. However, technology is reducing that rigidity. Technology makes it possible for students to study at a pace that fits them. Self-paced learning has opened the door to education to many individuals around the world.

We can't deny the advantages of using technology in the classroom. But, we also can't deny its disadvantages [3].

1. Students might lose their interest to learn. Seeing that most of the learning resources are stored online or in computers, students might develop poor learning habits and create a lazy attitude toward learning. Some might even think that they don't even have to go to school since they can find everything they need to know online. Who needs school when you have Google, right?

2. Students might become vulnerable to pitfalls of technology. The computer can be a source of problems as much as it is an invaluable tool. This is mostly true for students who lack technical skills to maximize the functionality of the device. Computer malfunctions, as well as technical problems, can result in students losing their assignments and other important materials, which, in turn, can cause high levels of stress.

3. Can diminish the value of online education. Although there isn't any research that can show how personal interaction affects students' performance, there is data that indicates that students enrolled in online classes are more likely to have lower grades or fail than they are to benefit from them. This may come as a result of the lack of face-to-face interaction between teachers and students in the online classroom. Another reason might be that without a teacher that looks over them, students might get tempted to use technology for other purposes instead of learning online.

When we talk about technologies in education, we mean all types of technologies that are used to enhance the learning experience. Here are a few most used technology tools in education: Electronic Whiteboards, Desktops and Laptops, Projectors, Distance Learning, Virtual Field Trips.

The use of information and communication technologies (ICT) in teaching and learning foreign languages has risen sharply among the educational community. Teachers access and implement innovations without always realizing their full implications for them and their students. However, this is not necessarily a negative thing, because if no one used innovations, little progresses would be made and there would be nothing to evaluate. The article presents certain features of ICT that can be used to good advantage in a rich learning environment, and the use of video as an ICT tool in the foreign language class. It is also discussed the role of the teacher in implementing technologies and we argue that it is the teacher, not the technology who determines the quality of the learning and teaching. There are people who are afraid that the teacher's role would be compromised if we integrate information communication technologies in education; however we militate for a 'techno-humanistic' system, in which teachers, learners and technology would form a lasting meaningful alliance.

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UDC 371

# EDUCATIONAL DIGITAL TRANSFORMATION: ADVANTAGES AND DISADVANTAGES

# ЦИФРОВАЯ ТРАНСФОРМАЦИЯ ОБРАЗОВАНИЯ: ПРЕИМУЩЕСТВА И НЕДОСТАТКИ

***Kopylova N.A.***
*National Research University "Moscow Power Engineering Institute", Russia*
*e-mail: kopylovana@mpei.ru*
***Копылова Н.А.***
*Национальный исследовательский университет*
*«Московский энергетический институт», Российская Федерация*

*Keywords: digitalization, digital transformation, massive online education, massive open online courses.*
*Ключевые слова: цифровизация, цифровая трансформация, массовое онлайн-образование, массовые открытые онлайн-курсы.*

*Abstract. The article discusses the issues of higher education digitalization technologies in modern conditions. The main idea of the educational digital transformation is the movement towards the educational process personalization based on the usage of digital technologies. Massive online education is developing at a rapid pace nowadays. The article provides examples of Massive open online courses (MOOC) such as Coursera, the Academic Earth website, the Russian national platform for open education (NPOE), Stepik and others. The advantages and disadvantages of MOOC are given.*
*Аннотация. В статье рассматриваются вопросы технологий цифровизации высшего образования в современных условиях. Основной идеей цифровой трансформации образования является движение к персонализации образовательного процесса на основе использования цифровых технологий. В настоящее время массовое онлайн-образование развивается стремительными темпами. В статье приведены примеры массовых открытых онлайн-курсов (МООК), таких как Coursera, Academic Earth, Российская национальная платформа открытого образования (НПОО), Stepik и другие. Приведены преимущества и недостатки МООК.*

The main idea of the educational digital transformation is the movement towards the educational process personalization based on the usage of digital technologies. Its important feature is that digital technologies help us in practice to use new pedagogical practices (new models of organizing and conducting educational work), which previously could not take a worthy place in mass education due to the complexity of their realization by means of traditional technologies [1].

Digital technologies are radically changing the content of the disciplines being taught and the form of their presentation. Direct connections to electronic databases,

news, forums are available. Publishing houses specializing in educational literature are increasingly switching to electronic versions of their textbooks and teaching aids.

During practical exercises, you may use social networks. Using Skype, Zoom, Webex, messengers, it is possible to participate in a lesson held by a leading expert. The data of using these platforms especially during the pandemic situation are presented in the article (see Fig. 1–3).


Figure 1 – The data of using Skype by the users

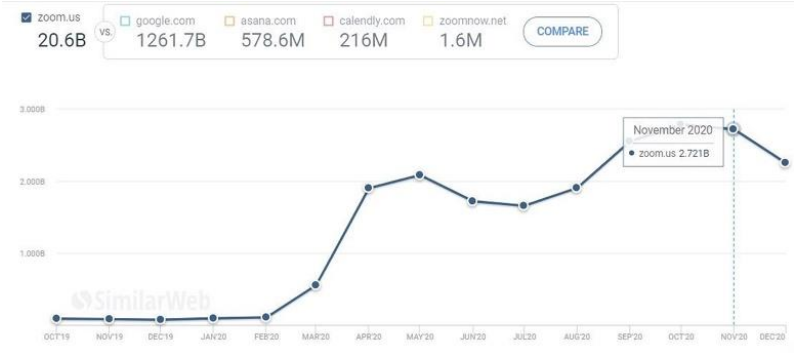


Figure 2 – The data of using Zoom by the users


Figure 3 – The data of using Webex by the users

Massive online education is also developing at a rapid pace. Since the late 1990s, lecture video recordings by educational institutions and individual teachers began to appear on the Internet. In the early 2010s, full-fledged interactive courses with tests appeared. Some popular courses currently have hundreds of thousands of students.

MOOC (Massive open online courses) is a training course with massive interactive participation using E-learning technologies and open access via the Internet. It is one of the distance education forms. In addition to traditional curriculum materials such as videos, reading, and homework, massive open online courses provide the ability to use interactive user forums to help building and maintaining communities of students, teachers, and assistants.

MOOC Coursera cooperates with universities and students. After completing courses and passing tests and exams, students receive full-fledged certificates. The technical platform is both the Coursera website and the mobile app for iPhone and Android.

Since 2009, the Academic Earth website has been launched, which hosts video lectures by professors of Moscow Technical University, Berkeley, Harvard, Princeton, Stanford, Yale on economics, political science, mathematics, physics, chemistry, history, philosophy, literature, psychology, etc.

The Russian national platform for open education (NPOE) is also working successfully. So, since 2016, for all courses at the Higher School of Economics at NPOE, users after passing the test with personal identification can receive a confirmed certificate that is an actual analogue of an academic transcript, which can be accepted for transfer by other universities.

Another MOOC is Stepik. It first appeared in 2013. It develops adaptive learning algorithms, helps in conducting Olympiads and retraining programs. The idea of Stepik is open and convenient education in different spheres: computer science, mathematics, statistics, biology, engineering, natural sciences, foreign languages. Using Stepik a person can study material individually, whenever he/she wants choosing suitable level of education [3].

There are several advantages of using MOOC, as well as, disadvantages.

Table 1 – Advantages and disadvantages of MOOC

| Advantages | Disadvantages |
|---|---|
| Mass and globality | Lack of direct communication |
| Free access, opportunity of flexible schedules | Technical difficulties |
| Attracting teachers from the most prestigious universities | The difficulties of building a course |
| A rich but concise presentation of the theory | Requiring a good level of IT competence for students |
| Multimedia content of educational materials | Insufficient English proficiency |
| The latest interactive and information technologies | Problematic enforcement of intellectual property |
| Mutual verification of tasks | Difficulty in privacy and data protection |
| Intercultural learning | Course Funding Sources |
| Gamification (awards, ratings, badges) | The difficulty of student self-organization |

It should be noted that the university transformation under the digitalization influence during the knowledge economy formation is a multicomponent process that does not develop equally in its various areas.

Now consider the digitalization advantages as a factor in the educational transformation:

1. The growth in demand for knowledge while increasing its availability due to digitalization.
2. Through the digitalization of the graduates' (future employees) knowledge the university contributes to the economy digitalization.
3. Greater accessibility of education.

There are the following disadvantages of digitalization as a factor in the education transformation.

1. The close connection between the education digitalization and the educational service market brings the entire negative things of the market into education. A student is seen as a source of money, not a person, not the future of a state or a nation. The competition in modern education is for money that follows a student, and not for the minds, for the "heads".
2. The translation of all educational programs into English or any other foreign language for the education export leads to the loss of the national specifics of education.
3. The teachers' work is becoming precarious work, which creates socio-economic threats.

The noted advantages and disadvantages of digitalization can be concretized using the example of distance learning. The main advantages of distance education are well known:

- enriching the traditional educational process by introducing video components into the course curriculum,
- using online tests,
- checking written works for plagiarism
- remote round-the-clock access to course materials,
- the delivery of study papers online,
- exchange of current organizational information,
- the absence of spatial and temporal restrictions due to the place and time of the behavior of classes,
- the habitual perception of information in digital form by today's students.

But the main advantage of digital education is economic that is the reduction in the administering the educational process cost.

The disadvantages of distance education are also obvious:

- the time of direct interaction between a student and a teacher is reduced to a minimum;
- the possibility of individual teacher work with each student is reduced;
- the student preparation for the practical use of scientific knowledge is in question;
- ethical issues of digitalization have not been resolved [2].

As a result, the channel of implicit knowledge transmission from person to person is narrowed; students do not acquire social skills necessary for future work; the teacher's personality, their work becomes not important.

In conclusion we should mention that the labor market requires a qualitatively different content for training of graduates. Digitalization affects not only the content of education, but also its organization. A teacher from the bearer of the transferred knowledge and skills turns into a navigator who helps to navigate the knowledge bases.

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## USAGE OF DEBATES FOR THE DEVELOPMENT OF IT BEGINNER STUDENTS' FOREIGN LANGUAGE COMMUNICATIVE COMPETENCE

## ИСПОЛЬЗОВАНИЕ ДЕБАТОВ В ПРОЦЕССЕ ФОРМИРОВАНИЯ ИНОЯЗЫЧНОЙ КОММУНИКАТИВНОЙ КОМПЕТЕНЦИИ СТУДЕНТОВ IT-ПРОФИЛЯ НА НАЧАЛЬНОМ ЭТАПЕ

***Palubinski P.S.***
*Belarusian State University of Informatics and Radioelectronics, Belarus*
*e-mail: pavel.palubinski@gmail.com*
***Полубинский П.С.***
*Белорусский государственный университет информатики и радиоэлектроники, Республика Беларусь*

*Keywords: debates, foreign language communicative competence, IT students.*
*Ключевые слова: дебаты, иноязычная коммуникативная компетенция, студенты IT-профиля.*

*Abstract. The article deals with the technologies and formats of organising and holding debates for the development of IT students' foreign language communicative*

*competence; describes structural elements of debates; reveals features and peculiarities of debate formats used in classrooms of beginner students studying a foreign language.*

*Аннотация. В статье рассматриваются технологии организации и форматы проведения дебатов в процессе формирования иноязычной коммуникативной компетенции студентов IT-профиля; описываются структурные элементы дебатов; выявлены характерные черты и особенности, присущие форматам дебатов, применяемым на занятиях в группах студентов, изучающих иностранный язык на начальном этапе.*

As of today, the idea of holding debates in student classrooms is not revolutionary. Debates are a formalised discussion based on preplanned speeches by participants who have directly opposite points of view on the issue under discussion in order to convince a third (neutral) party, called judges, that the arguments of certain participants are better than those of their opponents [1, p. 171]. From the fields of political and rhetorical discourse, debates were successfully transferred to educational discourse. As a teaching method, they are widely used in a variety of disciplines to develop oral communication skills, self-confidence, empathy and tolerance for different views, teamwork, logical and critical thinking of students, to form their argumentation skills, eloquence, leadership skills, etc.

The scientific literature devoted to the study of debates describes a large number of formats of conducting them. However, there is a certain set of structural elements typical of any debate format. These elements are as follows.

1. Statement – a topic, a subject of discussion.
2. The debater – a student with a predefined role.
3. Two sides of speakers – for and against the statement.
4. Concluding speeches of the parties that close the debates and sum them up.

The use of debates in teaching foreign languages is focused on the development of the student's personality, on the activation of their potential, which is achieved by using a personal-activity and communicative approach in teaching foreign languages [2, p. 4]. Debate technology fully complies with the principles of these approaches and therefore is successfully used by foreign language teachers. The experience of using debates in teaching IT students has shown that this technology is more successfully used in groups of students with a level of foreign language proficiency which allows them to maintain communicative interaction in a very wide range of situations and contexts. However, as pedagogical practice has shown, the use of debates is also possible in groups of IT students, whose communication skills are limited because they are at the initial stage of learning a foreign language – they can exchange information exclusively on the range of topics studied, using sentences with simple constructions in their speeches.

The right choice of the debate format is one of the most important conditions for the successful application of this technology for teaching students. In groups of IT beginner students, it seems most appropriate to hold debates of a simplified organisational structure which allow participants to focus directly on the process of

communication in a foreign language. Debates held in such formats are as close as possible to natural communicative situations. Also, debates of a simplified organisational structure are suitable for teachers who begin working with this pedagogical technology – debates have a multicomponent structure, and as practical experience is gained in applying the debate method in the educational process, it is reasonable to move from simple structures to complex ones.

Let us consider the examples of the debate formats that, in our opinion, are the most suitable for getting started with this technology.

1. One-on-one debates.

Practical experience shows that for the initial stage of working with debates, it is worth choosing the one-on-one format. With this format, there is no need to make efforts to perceive and analyse the statements of several participants, and students can concentrate only on formulating their own thoughts and on the perception of their opponent's speech. When participating in one-on-one debates, students speak for a short period without preparation. Emphasis is placed on the application of basic speaking skills, without the need for complex vocabulary. The time allotted for the performance of each side can be changed based on the situation in a particular group of students.

2. Round table debates.

This format has a more complex structure in relation to the one-on-one debates. Additional participants are added: the "chairperson", who acts as a leader of the debate process, and the "neutrality", who does not take a position "for" or "against". One of the students with a higher level of foreign language proficiency should be chosen for the role of a chairperson. The speech "for" and the speech "against" are represented by more than one participant. The number of participants on each side must be the same. As the name implies, the format involves the arrangement of participants at a round table, or in places located in a circle. The time allotted for the performance of each side can be changed based on the situation in a particular group of students.

The format has the following features:

- the informal atmosphere of the debate reduces the fear of public speaking;
- the involvement of the majority of students of a particular group in a limited time is ensured;
- there is an opportunity to focus on the details of the issue under discussion.

3. Open forum.

This format is organised like public meetings to discuss a controversial issue. The chairperson announces the topic and asks participants to speak. The participants present their arguments. Often one of the given arguments is chosen and put to a vote at the end of the debate. A feature of the format is that the participants are not required to speak, they can act as listeners – this ensures the development of speaking skills in conditions close to natural. Also, this feature helps to overcome the fear of public speaking. Participants have enough time to analyse each other's statements, which makes participation in debates more comfortable for beginner students.

The format has the following features:

- it is possible to involve a large number of participants in the process;
- it is possible to consider and repeat narrow questions of the material of the topic being studied;
- there is an opportunity to hold debates in the form of a role-playing game.

For the three formats described, it is important to announce topics well in advance so that participants have the opportunity to prepare. Firstly, it reduces the stress level of participants who, due to their individual characteristics, experience difficulties in the face of the need to speak out in public. Secondly, the preparatory stage makes debates more informative and will allow participants to gain new knowledge.

So, debates are a teaching method, which can be defined as a communicative situation modelled on the basis of a controversial issue, where participants hold different points of view and prove them to the opponent, while refuting their position. Most of the debate formats described by modern researchers are used to work with students who have well-developed skills of speaking in a foreign language. The article describes the debate formats that have been successfully applied in classrooms of students at the initial stage of learning a foreign language.

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## FROM THE HISTORY OF MACHINE TRANSLATION AND COMPUTATIONAL LINGUISTICS

## ИСТОРИЯ РАЗВИТИЯ МАШИННОГО ПЕРЕВОДА И КОМПЬЮТЕРНОЙ ЛИНГВИСТИКИ

***Stepanov D.A.***
*Vitebsk State Technological University, Belarus*
*e-mail flvstu@gmail.com*
***Степанов Д.А.***
*Витебский государственный технологический университет, Республика Беларусь*

*Keywords: computational linguistics, machine translation, rule-based MT, corpus-based MT, example based MT, automated translation.*

*Ключевые слова: компьютерная лингвистика, машинный перевод, метод, основанный на правилах, корпусный метод, автоматизированный перевод.*

*Abstract. The article discusses the current state of such a scientific area of linguistics as computational linguistics, and one of its key objects - machine translation, the history of its emergence and development.*

*Аннотация. В статье рассматривается современное состояние такого научного направления языкознания, как компьютерная лингвистика, и один из его ключевых объектов – машинный перевод, история его возникновения и развития.*

In our time, it is difficult to imagine human life without the use of digital technologies – computers and gadgets. Computerization has become an integral parameter of the functioning of society, it undoubtedly affects the quality of development of any social institutions and the standard of living in general. Taking into account the globalization processes in the modern world, the frequency and clarity of the transmission of information in different languages, here we refer to translation, have become an important part of communication both within the Internet and in building real connections in intercultural communication. Computational linguistics began to attract the attention of scientists from various scientific fields in the 1940s and 1950s of the 20th century, even before the creation of powerful electronic computing systems.

On the one hand, we mean "computational linguistics" as "one of the areas of applied linguistics, in which computer programs, computer technologies of organization and data processing. On the other hand, this is the area of application of computer language models in linguistics and related disciplines" [1].

In foreign linguistics, various aspects of computational linguistics in different periods were considered in the works of N. Chomsky, V.H. Yngve "A model and a hypothesis for language structure" (1960), M. Halliday "System and function in language" (1976), J. Bresnan, R. Kaplan "A competence-based theory of syntactic closure. The mental representation of grammatical relation" (1982), T. Vinograd "Computer Software for working with language" (1984), V. Raskin "Natural Language Processing for Information Assurance and Security: Overview and Implementations" (2000), Y. Wilks "Computational linguistics: History" (2006), A. Clark, S. Lappin "The handbook of computational linguistics and natural language processing" (2012).

In Russian linguistics the following works are worth mentioning: O.S. Kulagina "Research on machine translation" (1979), Yu.N. Marchuk "Problems of machine translation" (1983), G.V. Chernov "Machine translation and applied linguistics. Problems of creating an automatic translation system" (edited by G. V. Chernov, 1986), N. D. Andreev "The main directions of the experimental laboratory of machine translation" (1986), N. N. Leontiev "Knowledge base and automatic translation (project multilingual information and reference system)" (1989).

We believe that the links between computational linguistics and academic linguistics in its classical sense are not as numerous and obvious as it might seem at first. In the middle of the 20th century. two prominent scientists W. Yngve and N. Chomsky disagreed about the representation of the mathematical aspects of the structures of the language and its representation in computer encoding. The polarity of opinions lay in

the nature of tree representations (in short, the modeling of specific meanings and the processing of words in complex sentences), as well as the role of processing procedures and resources in the calculation of syntactic structure [1]. W. Yngve argued that such computations should take into account the memory size limits for intermediate structures, which, in his assumption, correspond to the inherent limitations on language processing. N. Chomsky, in turn, to describe such processes, resorted to such a term as "language performance", which is used to describe "the actual use of the language in specific situations".

In the 1960s attempts have been made to program Chomsky's transformational grammars for parsing sentences: the largest and longest attempt was made at International Business Machines (IBM) in New York. The attempts were generally unsuccessful in the sense that the programmed grammars parsed almost nothing beyond the sentences for which they were designed, and even in the case of sentences, gave a large number of interpretations between which it was impossible to choose. The latter was the lot of almost all parsers until recent statistical developments, including the original Harvard Kuno and Oettinger parsers, which were developed in 1962, and parsers based on the more complex linguistic grammars of the 1970s and 1980s.

In the 1980s the formalism of lexical-and-functional grammar, created by scientists R. Kaplan and J. Bresnan (1982) [2], and the functional unification grammar of M. Kay (1984), were developing thanks to the grammar of M. Halliday, also known as a unifying logical paradigm for grammar processing, which appeared with the Prolog programming language.

It must be said that in scientific and popular science literature, machine translation is often erroneously identified with computer-aided translation. However, these concepts shall be delimited.

Machine translation is one of the areas of computational linguistics that studies automatic translation from one language to another using automatic programs (Google Translate, DeepL, Yandex Translate). Automated translation is a translation performed by the translator using computer tools: applications, online dictionaries (Reverso Context, Abby Lingvo), etc. The concept of machine translation arose in the second half of the 20th century and was first used by Warren Weaver, an American scientist, who put forward the concept of MT in 1947 after the development of the first computer. Weaver's idea was based on the concept of "Interlingua" (Interlingva). “Interlingua is an international auxiliary language developed in 1937–1951. International Auxiliary Language Association (IALA))” [2].

The main methodological principles of machine translation allow us to distinguish two main types of it: rule-based MT (RBMT) – a method based on rules, and corpus-based MT (CBMT) – a method based on corpora, respectively, it is customary to talk about two approaches to machine translation: rule-based and corpus-based. In addition, machine translation can be carried out using methods such as tree-based method (tree-based method), example-based (based on an example) and rule-based statistical (rule-based statistical method). Currently, the rule-based statistical method (RBSMT) is most often used. Rule-based machine translation methods use bilingual dictionaries

and handwritten rules to translate texts from the source language into the target language. However, manual translation of writing rules is a time-consuming task. In addition, rules are difficult to maintain, as well as difficult to transfer from one domain to another and from one language to another. Thus, rule-based systems are difficult to scale for open domain translations and multilingual translation.

In 1954, Georgetown University, in collaboration with the now well-known computer manufacturer IBM, completed the first Russian-English machine translation experiment using an IBM-701 computer, showing that there is a future for machine translation: the problem of machine translation was relevant for the next ten years. years, but its active development stopped with the release of the report of the Automatic Language Processing Advisory Committee (ALPAC) in 1966. In 1965, Natural Learning Processing specialists held the first International Conference on Computational Linguistics, which was devoted to parsing and translation based on rule-based ma-chine translation. Since the 1970s RBMT methods have become more thorough. In 1978, SYSTRAN, one of the first machine translation companies, released a commercial translation system that became one of the best-known examples of a commercially successful rule-based system at the time. Google used SYSTRAN until 2007 [3].

In the early 2000s with the advent of bilingual corpora of natural languages, linguists in Russia and foreign countries began to pay great attention to the problems of corpus linguistics. Machine translation uses three corpus methods: Example based machine translation (EBMT), Statistical machine translation (SMT) and Neural machine translation (NMT). If we talk about the history of the issue, then back in the mid-1980s. The EBMT method was proposed, which allows translating source texts by extracting pairs of similar sentences from a bilingual corpus. Translation results using EBMT methods are of high quality if similar pairs of sentences can be found. The practical implementation of the theory of N. Chomsky was associated with the problem of the limitedness of programmed texts, which did not have great functionality and processed the context and meaning of language units only within one sentence. Later, machine translation introduced such methods as rule-based MT (RBMT) – a rule-based method, and corpus-based MT (CBMT) – a corpus-based method. First, the rule-based method is actively used to create bilingual dictionaries. However, its complexity lies in the fact that the manual translation and writing of the rules are carried out directly by the researcher. Thus, rule-based systems are labor intensive for open domain translations and multilingual translation.

After some time, when scientists began to actively develop corpus linguistics, several corpus types of machine translation were formed: based on examples (Example Based Machine Translation / EBMT), statistical machine translation (Statistical Machine Translation / SMT) and neural machine translation (Neural Machine Translation / NMT). Despite the complexity and significant drawbacks in working with corpora, these methods have contributed to the improvement of machine translation and were able to advance computational linguistics.

In general, there is still a long way to go to achieve high quality machine translation. It is necessary to develop new methods that could combine symbolic rules and neural networks to further improve the quality of translation. Fortunately, the use of machine translation in real-world applications continues to provide more and more data, driving the rapid development of new machine translation methods.

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