ISSN 1997-9347

Components of Scientific and Technological Progress

SCIENTIFIC AND PRACTICAL JOURNAL

№ 6(72) 2022

Paphos, Cyprus, 2022

Journal "Components of Scientific and Technological Progress" is published 12 times a year

Founder
Development Fund for Science and Culture
Scientific news of Cyprus LTD

The journal "Components of Scientific and Technological Progress" is included in the list of HAC leading peer-reviewed scientific journals and publications in which the main scientific results of the dissertation for the degree of doctor and candidate of sciences should be published

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UDK 334.012

Organizational Problems of Creating a Production Company and Ways of their Solution

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Key words and phrases: company; entrepreneur; innovation; production company; value chain.

Abstract. The purpose of this article is to systematize the principles and scenarios for the creation of a company, justification and formation of its architecture. The existing approaches explain the performance of an enterprise, but do not concern the mechanism of its origin. Therefore, it becomes relevant to solve the following problems: to define a company as a subject of economic activity, and proposed the scenarios that underlie the creation of a company. The article theoretically substantiates the need for an entrepreneur to use technological, contractual, strategic concepts of enterprise performance that complement each other, as well as concepts of the value chain and innovation. The scientific hypothesis considers the fact that the driving force behind the creation of an enterprise is the activity of an entrepreneur who consistently designs and implements it. The method of the research is mathematical modeling, which allows us to assess the sufficiency of investments for the creation of an enterprise and its effective functioning.

The creation of a company is accompanies by a number of problems that must be solved simultaneously. The advice that exists in the literature and the Internet is optimistic, and economics does not even consider this problem, bringing different points of view on the company functioning, which takes into account only one side. Therefore, the company creation, despite the abundance of recommendations and teachers, remains the art of chosen ones who succeed, although a lot of people are engaged in this activity. The creation of a large and long-term successful company is the lot of a few, whose names are widely known, and their memoirs are a success.

A company is understood as an administrative structure that:

- aims at generating income to its owner by meeting the needs of the population, business and the state in goods and services;

- carries out economic activities on the basis of long-term contracts with personnel, suppliers in order to minimize costs;
- creates and develops markets, new technologies, products and competencies;
- minimizes its costs through specialization, innovation and production scale.

Discussing the numerous reasons for company formation, none of the economic theories explains how a company appears or what considerations an entrepreneur is guided by when creating it. An entrepreneur can be the owner, or he can be a confidant of the owner, but in any case, he risks his own property. To explain the phenomenon of the company formation, let us turn, first of all, to the activities of an entrepreneur. Entrepreneurship, as a special form of economic activity, is proactive, voluntary, independent, associated with risk and responsibility for the effective use of entrusted property, innovative and investment activities to create a new or repurpose an existing company for the production of goods (provision of services) in order to generate income by people interested in its systematic receipt (actually an entrepreneur, owner, investor, state). Entrepreneurship simultaneously implements the following functions in the economy:

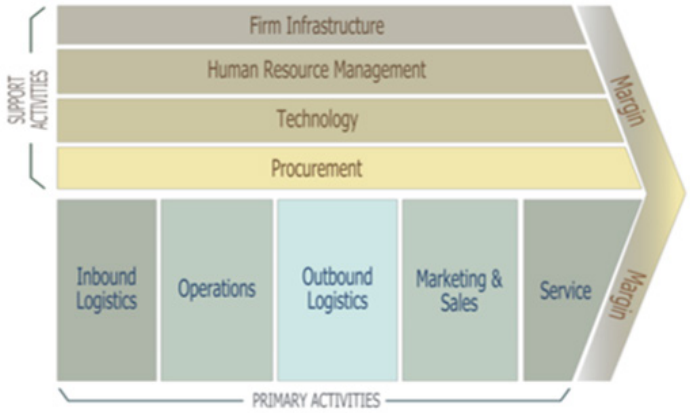
- creative (integration of economic resources into a single whole – a company);
- economic (creating a tool to meet the needs for goods and services);
- profitable (organization of income generation by owners);
- creative (creation of new products, services, technologies, communications, needs and markets);
- the discovery of new economic opportunities (creation and implementation of innovations in economic activity);
- legislation improvement (improvement of the economic activity of the state).

The subject of entrepreneurial activity – an entrepreneur, having received property at his disposal, creates a company that must ensure the systematic receipt of income by the owner, investor, and the state. The state is interested not only in receiving income, but also in employment of the population and saturation of the market with the necessary goods (services) produced on its territory. An entrepreneur is not a position, not a status, it is a role, talent, vocation, which can be big or small.

The first problem that an entrepreneur solves is the choice of products that the company will produce, focusing on the consumer and market capacity, taking into account its functional purpose. These products must meet the requirements of the consumer, have novelty and be original enough to be noticed and chosen by the consumer. This applies primarily to the properties of the product, including its quality and price. The capacity of the market must provide such a volume of sales of this product that the main requirement of the owner is fulfilled: the funds invested in the company must bring income that satisfies him. Therefore, the entrepreneur must find out the market interest in certain products, on the one hand, and, on the other, organize production on the required scale. If it is supposed to release several types of products, then the entrepreneur focuses on the presence of common operations in value chains. In what follows, the value-added chain of a product is understood as a sequence of operations for the products manufacture and their components, which increase its readiness for use for its intended purpose.

The presence of certain logistic and managerial operations and business processes is associated with the distribution of value chain operations between companys. The use of the same business processes for the production of various types of products allows increasing the scale of production, using technological equipment without downtime.

In order to identify the sources of competitive advantage by analyzing certain types of



Source: Competitive Advantage. Creating and Sustaining Superior Performance by Michael E. Porter

Fig. 1. M. Porter's Value Chain Model

company activities by M. Porter in his work "Competitive Advantage: How to Achieve High Results and Ensure Its Sustainability", a value chain as a set of activities of a company (primary and secondary) aimed at creation of consumer value is presented, due to which the buyer's interest in a product or service is aroused [7]. In his model, M. Porter considers the entire architecture of the company, including the main, logistics and managerial business processes (Fig. 1). The value chain "divides the company's activities into strategically important activities in order to study the costs, existing and possible means of differentiation" [7]. Porter includes in its "value chain model":

- as basic elements: inbound logistics, operations, outbound logistics, marketing and sales, services;
- as technical support: procurement, technology development, personnel management, organizational infrastructure.

But when creating a company, an entrepreneur, seeking to minimize costs, is forced to turn his attention, first of all, to the choice between the main business processes and logistics, which characterize the supply of components necessary for the production (external logistics).

The task of creating a company can be formulated as follows: determining the maximum income of the owner based on the limited funds that he can allocate or attract to create a company through:

- the absence of restrictions on the variety of the manufactured nomenclature and the presence of restrictions on the number of operations in the chains of added value of products;
- restrictions on the variety of the produced nomenclature and the absence of restrictions on the number of operations in the value-added chains of products.

In the first case, the problem is solved by highlighting the general operations of value chains of various types of products, which allows to achieve the scale of production, allowing the owner to receive income that satisfies him. At the same time, "leading" operations should be innovative in nature, which allows the company to reduce costs to the maximum and thereby achieve competitive advantages. The "leading" chain operations must make a significant contribution to the received income due to either reduction of expenses in distance per unit of production, or by increasing the price of a device unit, which should differ in quality enlarged functionality, ergonomics and other properties substantial in the eyes of the consumer. "Leading" operations

are focused on

- application of innovative technologies and equipment;
- availability of the necessary competencies and sufficient qualifications of personnel and management, as well as their interest in using these achievements.

Each operation of the value chain in the production system of the company is represented as a business process that can be detailed to the level of the workplace, which is determined by the capabilities of the technological equipment used. Such companies are characterized by the use of more versatile technological equipment, which makes it possible to switch from one type of product to the production of another with no extra cost. Examples of such companies are light industry enterprises (textile, knitwear, footwear), food industry, trade enterprises (retail). For such companies, a change in the nomenclature of manufactured products does not lead to the need to change technological equipment but causes its reconfiguration. And the product's life cycle is less than the life cycle of technological equipment. For this type of companies, the payback period is shorter, which is for companies with a limited range of products.

In the second case, the task of creating a company is to establish a specialized production, in which its scale is focused on a volume of output, that, with a restriction on the variety of the nomenclature, allows one to get income that satisfies the owner. The greater the coverage of operations in the product value chain, the greater the specialization of production and the income of the company and the owner. The total number of value chain operations is limited by the funds allocated for the company establishment.

When creating a company, one of two scenarios can be realized.

1. The first scenario is to maximize product output (service delivery) by minimizing the number of value-added chain operations for the selected product range. Due to this approach, the scale of economic activity necessary for making a profit is carried out. At the same time, in the production process, common technologies and equipment are used, the competence of personnel, management (including planning, organization, accounting and control). Typically for this kind of companies, increased attention is focused on logistics. Such companies can be identified as technology-oriented.

2. The second scenario is to maximize the output of products (services) by maximizing the number of value-added chain operations while minimizing the nomenclature and its assortment, that is, the efficiency of economic activity is achieved through narrow specialization. This allows you to achieve the required production scales with minimal costs per unit of production. Such companies can be identified as product-oriented.

It can be assumed that in the implementation of the first and second scenarios, the competencies of the company's personnel are multidirectional. For the mathematical model of a technology-oriented company, the maximum permissible set of product types (nomenclature) I is specified, for the production of which a set of business processes J are required. For each type of product, a vector is specified that determines the sequence of using business processes for its production $J_i \subset J$, i.e. not every business process j is involved in the production process of product i. For each business process $\forall j \in J$, the following are specified: the cost of fixed assets c_j, as well as the capacity (throughput) b_j. For each type of product $\forall i \in I$ the costs for its production $a_{i,j} > 0$ are given for each business process j_i and the profit f_i obtained from the sale of each unit of production.

Investment in setting up a company is limited to D. The value x_i is used as independent variables, which characterizes the volume of products i production. Then the task of assessing the feasibility of creating a company according to the first scenario is to determine the values of the variables $\{x_j\}$ that maximize the functional characterizing the profit, i.e.

$$F = \sum_{i \in I} f_i x_i \rightarrow \max,$$

subject to the following restrictions:

– the volume of production is limited by the available investments for $j \in J$

$$\sum_{i \in I} a_{i,j} x_i > 0 \rightarrow A_j = \sum_{j \in J} (c_j + \sum_{i \in I} a_{i,j} x_i);$$
$$\sum_{i \in I} a_{i,j} x_i = 0 \rightarrow A_j = 0;$$
$$\sum_{j \in J} A_j \leq D;$$

– the capacity (throughput) of each business process should not be exceeded

$$A_j \neq 0 \rightarrow \sum_{i \in I} a_{i,j} x_i \leq b_j \; \forall j \in J.$$

The mathematical model is designed to assess the possible profit value and determine the list of nomenclature on which the created company should rely. In this case, it is assumed that the products' sales are carried out instantly after manufacture. This assumption is valid for companys embedded in the value-added chain of products, i.e. supplying under long-term contracts the necessary components for the product purchased by the end user.

In the proposed model, the value $a_{i,j}$ can be considered as the main parameter, which characterizes the amount of working capital involved in the production using the business process j. This value depends not only on direct production costs, but also on the cost of the supplied materials and a number of other components, such as the required qualifications of the personnel. The amount of profit f_i also significantly depends on the strategic economic zones in which the products are sold.

Therefore, each of the above parameters should be the result of analytical studies related to predicting the state of the external environment of the company being created. The result of the forecast cannot be unambiguous, since for each option of the forecasting process, various assumptions are used that have a significant impact on the values of the parameters. The proposed model makes it possible to assess not only a promising range of products, but also, indirectly, possible strategic economic zones, in case, for example, we consider different types of products sold in different strategic economic zones. In this case, it will be advisable to use another criterion of the problem:

$$F = \sum_{i \in I} p_i f_i x_i \rightarrow \max,$$

where p_i is the probability of selling product i in the current period.

We assume that for a product-oriented company a variety of product types I is set. Investments in setting up a firm are limited to $D = D_1 + D_2$, where D_1 is investment in fixed assets, and D_2 is in working capital. The distinction between investments in fixed assets and working capital has not been established in advance, therefore, several options are expected to be considered. It is required to determine the type of product from a given set $i \in I$ and the volume of its output, which ensures the maximization of profits due to the scale of production and the use of innovative technologies and the organization of economic activity. As an independent variable, we take the value x_i, representing the volume of output $i \in I$. The unit price c_i has also been determined. In addition, for each type of product from a given set $\forall i \in I$, a set of components is defined that are required to create a unit of output i and the corresponding operations in the

value chain $j_i \in J_i$. Each operation in the value chain $\forall j_i \in J_i$ can be represented as a business process within the production structure of the company. Moreover, any implemented business process $\forall j_i \in J_i$ is characterized by $\{d_{k,j,i}, q_{k,j,i}\}$, where $d_{k,j,i}$ is a variant of the production capacity k (k = 1, 2, …), and $q_{k,j,i}$ is the investment required to create this version of the business process for this product.

For each type of product $\forall i \in I$ and for all components j_i required to create a unit of this product, the set j_i is set:

$$\{a_{i,j}, b_{i,j}, p_{i,j}\},$$

where $a_{i,j}$ – variable costs of creating a unit of product i using business process j; $b_{i,j}$ – the amount of production capacity required to create a unit of product i using business process j; $p_{i,j}$ – the cost of purchasing the i components necessary to create a unit of production from a third-party manufacturer in case it is inexpedient to create a business process j_i. The last parameter, taking into account the volume of production x_i, determines the volume of external deliveries in the logistics system of the company, the component j_i.

Each required product component can either be produced in-house using a business process representing the operation of the value chain or obtained from a partner using a logistics system operating in the company. Therefore, it becomes necessary to use an additional independent Boolean variable that takes two values:

$$y_{i,j} = \begin{cases} 1, \text{if operation } j_i \text{ is represented by a business process} \\ \text{in the production structure of the company,} \\ 0, \text{if operation } j_i \text{ as a business process is not included} \\ \text{in the production structure of the form.} \end{cases}$$

If operation j_i is included as a business process in the production structure, then the value added in products is $(a_{i,j} + b_{i,j})$. If operation j_i is not included in the production structure, then the value added in production is $p_{i,j}$. When the business process of any operation $j_i \in J_i$ is included in the production structure of the company, the required investments in fixed assets are determined by the value:

$$q_{k,i,j}, \text{ when } b_{i,j}\, x_i \le d_{k,i,j},\ k = 1, 2, \ldots . \qquad (*)$$

Then the task of assessing the feasibility of creating a company according to the second scenario is to determine this type of product $i \in I$, the volume of production x_i and the composition of business processes from the operations of the value chain, defined on the set of values of the variables $\{y_{i,j}\}$, which deliver the maximum functional characterizing the amount of profit, i.e.:

$$F = \max_i \sum_{j_i \in J_i} x_i (c_i - (a_{i,j} + b_{i,j})\, y_{i,j} - p_{i,j} (1 - y_{i,j})),$$

when the constraint is fulfilled:

– by the amount of available investments in fixed assets D_1, i.e.:

$$\sum_{j_i \in J_i} q_{k,i,j}\, y_{i,j} \le D_1 \ \forall i \in I,$$

where k is determined from the condition (*);

– by the amount of available investment in working capital D_2:

$$x_i \sum_{j_i \in J_i} a_{i,j} y_{i,j} + p_{i,j} (1 - y_{i,j}) \le D_2;$$

– for the volume of production i:

$$x_i^{\min} \le x_i \le x_i^{\max},$$

where $x_i^{\min}$ is determined based on the probable break-even point of production volumes of i product; $x_i^{\max}$ is determined based on the maximum predicted demand for product i.

It should be borne in mind that part of the value chain operations must necessarily be present in the production structure of the company being created. These are, first of all, assembly and its operations. But the components necessary for the production of the company's products can, both be produced by the company itself, and supplied by other market participants, since everything depends on the ratio between the values ($a_{i,j} + b_{i,j}$) and $p_{i,j}$.

Other situations are also possible in which the capabilities of the used operation j_i cannot be fully used, and the equipment used for the functioning of this operation is very expensive. If operation j_i is technological, i.e. the result of its implementation is the next processing of the components necessary for the product, and then this operation must be included in the production structure of the company. If the result of the operation j_i is a component, which is then sent to the assembly of products, then the execution of this operation can be carried out by another economic agent.

Therefore, the presence of the parameters of the proposed models allows, as a result of multivariate calculations, not only to determine and justify the best architecture of the company from the management point of view. The result of the entrepreneur's activity is an efficiently operating company that consistently brings income that satisfies the owner. The created architecture of the company, including the production, logistic, organizational and management structures, as well as the information system that ensures their functioning. As the company matures, the entrepreneur transfers his responsibilities to the management, endowing him with the necessary resources, powers, and responsibility, defining subordination relationships within the organizational structure.

The considered two scenarios make it possible to create a company and assess the possibility of its successful functioning based on the available volume of investments. The first is based on limiting value chain operations in order to maximize the variety and output of the item. The second is based on the limited nomenclature in order to maximize the number of value-added chain operations. The criterion is the owner's income. For the presented scenarios, mathematical models have been developed that make it possible to assess the sufficiency of investments for the creation of a company and its effective functioning.

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Организационные проблемы создания производственной фирмы и пути их решения

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Ключевые слова и фразы: инновация; предприниматель; производственное предприятие; фирма; цепочка добавленной стоимости.

Аннотация. Целью настоящей статьи является систематизация принципов и на этой основе сценариев создания фирмы, обоснования и формирования ее архитектуры. Существующие подходы объясняют существование предприятия, но не касаются механизма его возникновения. Поэтому становится актуальным решение следующих задач: определение фирмы как субъекта экономической деятельности и сценариев, которые лежат в основе создания фирмы. В статье теоретически обосновывается необходимость использования предпринимателем технологической, контрактной, стратегической концепций функционирования предприятия, которые дополняют друг друга, а также концепций це-

почки добавленной стоимости и инноваций. Научной гипотезой рассматривается тот факт, что движущей силой создания предприятия является деятельность предпринимателя, который последовательно проектирует и реализует проект. Методом настоящего исследования является математическое моделирование, которое позволяет оценить достаточность инвестиций для создания предприятия и его эффективного функционирования.

UDK 005.6

Software Standardization

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Key words and phrases: enterprise management; quality assurance; production processes; software.

Abstract. The purpose of the paper is to compare the available quality standards and find their strengths and weaknesses. The main tasks of the research are to search for available software quality standards; to make a comparative analysis of existing quality systems; to describe the system for quality standards implementation.

Software development companies, based on the analysis of current quality systems, can choose standards based on their goals.

During the study, the following methods were used: comparative analysis; systematization of data; expert research method; foresight research.

The study revealed the pros and cons of four standards. Organizations that create software can implement these standards gradually, step by step. And choose the standard that best meets the current needs and capabilities of the company.

Introduction

One of the fastest growing industries in the world is the software industry. To continue such rapid development, enterprises need to create high-quality software, although there is no unambiguous meaning for this definition. Nevertheless, this term can include rapid response to customer requests and ensuring the quality of procedures in complex development projects. The choice of quality standards will be a decisive point affecting the future of the organization in particular and the industry as a whole.

Quality standards

The purpose of Software Quality Management (**SQM**) is to manage the quality of the development process and the final product presented to users. Among other things, the SQM regulates aspects that relate to the organizational structure of the enterprise and its internal resources necessary for quality management. The first quality management systems were aimed at monitoring production workshops, focusing on statistics and random sampling. In the 21st century, quality systems are aimed at motivating employees, initiatives, and transparency

Table 1. Pros and cons of ISO 9000

Pros	Cons
Control of key processes	Long development and certification period
Increasing marketing attractiveness	Difficult to implement
Employee Training Management System	Difficult to maintain enthusiasm for the system
Effective risk management	Additional documentation

of business processes. In this direction, there are several standards for the software industry.

ISO 9000

The ISO 9000 family of standards refers to those management systems that are designed to assist organizations in meeting the requirements of customers and other parties, as well as in compliance with legislative or regulatory requirements for products [1].

Since the standard was originally developed to regulate the manufacturing industry, it has a number of strengths and weaknesses in its application in the field of software, which are described in Table 1.

This standard has a number of disadvantages that arise when implementing it in an IT organization. To level them, an improved version of ISO 9000-3 has appeared, it is necessary to use ISO 9001 for computer software. Scope of application of the standard: software development, delivery, installation and maintenance. At its core, it is an improved version of the old ISO 9001 standard. Many previous regulations remain in it, but new rules have been added that apply only to software.

ISO 9000-3

ISO 9000-3 is generally regarded as a global quality standard. Software development companies that want to apply for international contracts must comply with ISO standards. This standard was created exclusively for use in the field of software and contains special steps for the implementation of the ISO 9000 standard [2]. However, the standard is not suitable if you need to release software quickly, it cannot provide the necessary quality in a short time. Also, the main drawback of ISO is the lack of continuous improvement processes. This has led to the emergence of completely new standards.

Capability maturity model (CMM)

The first methodology that has been developed for the software field. The model describes the principles and tools that are designed to improve the level of their business processes while moving away from a fragmented and chaotic system [3]. The model consists of 5 maturity levels. At the first level, it is clear that there are few or no processes in the organization. Success is achieved mainly through individual initiative and effort, the result is unpredictable. At the second level, processes are monitored at the project stage with the help of office work. The success of the project in this case will be based on the success of a similar project. At the third level, process tracking occurs throughout the enterprise. When an organization is at the fourth level, it

Table 2. Pros and cons of ISO 9000-3

Pros	Cons
Recognized worldwide	Not designed specifically for software development
One fixed level of quality management	Describes the development process in no detail
General recommendations for evaluating processes and products	Does not facilitate discussion of quality issues

Table 3. Pros and cons of CMM

Pros	Cons
Aimed at software development	Internally focused
Structured quality characteristics facilitate discussion of quality issues	Defines different levels, but does not help to choose the level for the organization
Easy to create quality systems	

Table 4. Pros and cons of CMMI

Pros	Cons
Combines the latest and best practices	Additional documentation costs
Cost reduction due to reduced marriage	Not suitable for small organizations
Applicable to production, personnel management, software development	Takes a lot of time and effort to implement
Result-oriented and measures key performance areas	Requires changes in the organization and culture of relations

should use quantitative goals for management. At the last, fifth level, the organization constantly has new goals in response to new technologies and requests, processes are cost-effective. The main focus of the model is on improving processes based on the goals that the organization plans to achieve.

CMM measures the maturity level of an organization by determining whether the organization performs specific actions listed in key performance areas (**KPIs**), without paying attention to whether the completion of such actions leads to the desired result.

Capability Maturity Model Integration (CMMI)

The CMMI model allows you to implement only the best practices of many developed CMMs. This allows enterprises to choose for themselves which indicators they want to improve and which disadvantages from a variety of models they want to avoid [4]. Each level of this model can be divided into the degree of integration with CMM. A feature of CMMI is in specific steps in improving processes at the enterprise and the ability to manage both development and organizational processes in it.

CMI is also an organization-based approach, but the main difference from CMM is that it uses a more results-oriented approach in identifying and measuring key performance areas.

Conclusion

The quality certificates do not always reflect the real capabilities of the enterprise in software development. This should not lead to the abolition of software standards, but rather to the improvement of old and the emergence of new ones. However, current standards are sufficient to ensure quality without taking into account particular cases. The CMM methodology provides more options for software quality assurance than ISO standards, but is not suitable for organizing work within an enterprise, debugging business processes. Therefore, initially the campaign may focus on ensuring the quality of processes inside and use ISO standards, and then implement the CMM model. The difficulty lies in choosing between CMM and CMMI, since they are similar. But for the implementation of the CMMI model, a more in-depth approach is needed with the identification of optimal indicators for the enterprise and the introduction of an integrated model. As in the previous version, the enterprise can choose the CMM model, and then switch to CMMI, since it takes into account more aspects during development. Current standards allow us to build a gradual model of software development quality, moving from the organization of the organization's processes to the development processes.

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Стандартизация программного обеспечения

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Ключевые слова и фразы: обеспечение качества; программное обеспечение; производственные процессы; управление предприятием.

Аннотация. Цель данной работы – сравнить имеющиеся стандарты качества и найти их сильные и слабые стороны.

Основные задачи работы: поиск доступных стандартов качества программного обеспечения; сравнительный анализ существующих систем качества; описание системы внедрения стандартов качества.

Компании, занимающиеся разработкой программного обеспечения, на основе анализа текущих систем качества могут выбрать стандарты исходя из своих целей.

При проведении исследования были использованы методы: сравнительный анализ; систематизация данных; метод экспертного исследования; форсайт исследование.

В результате исследования были выявлены плюсы и минусы четырех стандартов. Организации, создающие программное обеспечение, могут внедрять эти стандарты постепенно, шаг за шагом и выбирать стандарт, который наиболее соответствует текущим потребностям и возможностям компании.

UDK 624.139.26

Influence of Design Factors on the Optimum Size of the Extension of the Bored Piles

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Key words and phrases: pile foundations, bored piles, expansive piles, optimum expansive dimensions.

Abstract. In construction practice, the choice of extension dimensions for bored piles with an extended foot is determined by the borehole development technology and the size of the extension.

The purpose of this article is to determine the relationship between the design characteristics of bored piles and the specific bearing capacity of the pile.

The work addresses the following objectives: analysis of changes in specific bearing capacity depending on the design characteristics of the bored pile; selection of the most rational pile size with optimum heel dimensions.

It is assumed that the economically optimum size of the extension will depend on the design dimensions of the bored piles.

The paper shows that the optimum dimensions of the heel depend considerably on the design factors of the pile. A rational choice of pile design characteristics can significantly improve the economics of design solutions by reducing the material consumption for production.

Introduction

Drilled piles with an extended footing are one of the best known types of foundations. However, the selection of optimum pile and footing dimensions is still insufficiently studied. At the same time, calculations show that by designing these structures with optimal parameters their cost can be reduced by 20–40 % (depending on soil conditions).

In [2] an optimality criterion for the design of such structures was proposed – the ratio of the specific bearing capacity of piles with an extension to a conventional one.

A methodology for determining the optimum pile and heel dimensions (radius of extension $X_{opt.}$) is also proposed there.

Mission statement

To assess the optimality of the design, we use the methodology outlined in [2].

In order to determine the increase in pile volume due to the heel, an index m is used, which is equal to the ratio of the volume of piles with an extension to a normal pile. It depends on the shape of the extension. For TICE piles (with a hemispherical extension) it is equal to:

$$m = V_{wid}/V_p = 1 + 2X^3/(3r^2\ell) - X/\ell,$$

where X is the radius of the extension, r is the borehole radius, ℓ is the pile length.

In order to determine the increase in the load-bearing capacity of a pile due to widening, the K-value (ratio of the load-bearing capacity of a pile with widening and a normal pile) is used. It depends on the type of load on the pile. For vertically loaded piles K is equal to:

$$K = F_{d\ wid}/F_{d\ p} = (RX^2 + 2rf\ell)/(Rr^2 + 2rf\ell),$$

where $F_{d\ wid}$ and $F_{d\ p}$ the vertical load bearing capacity of the piles, determined according to [1].

In this case, the design efficiency of such structures will be equal:

$$(F_{d\ wid}/F_{d\ p})/(V_{wid}/V_p) = K/m.$$

It is assumed that adopting the most rational pile size will give an increase in bearing capacity at the same cost.

Solution methodology

These expressions make it possible to determine the specific load-bearing capacity K/m for different pile dimensions r and ℓ.

According to this method the index of rationality of application of widening K/m is calculated at change of radius of widening X for concrete conditions (ground – fine sand, ground characteristics according to [1] R = 2,000 kPa, f = 28 kPa; borehole radius = 0.1 m, pile length ℓ = 3.0 m; widening form in the form of hemisphere).

From the calculation, it can be seen that the K/m value rises to K/m = 4,010 at:

$$X_{opt.} = 0{,}421 \text{ m at first, and then decreases.}$$

This calculation is then used as a benchmark for comparison.

Results and discussion

Let's compare the efficiency of using an extension when the borehole radius r increases by a factor of two for conditions: r = 0.2 m; ℓ = 3.0 m; R = 2,000 kPa and f = 28 kPa.

$$X_{opt.} = 0.66 \text{ m; } K/m = 3.351.$$

Compared to the control case, doubling the borehole radius r results in a 3,351/4,010 = 0,84 times lower maximum K/m of the pile and a 0.66/0.421 = 1.57 times higher $X_{opt.}$.

Let's compare the effectiveness of applying an extension when ℓ increases by a factor of two for conditions: r = 0.1 m; ℓ = 6.0 m; R = 2,000 kPa and f = 28 kPa.

Table 1. K/m values depending on the heel radius X at ℓ = 3.0 m and r = 0.1 m (control)

X, m	*m*	*K*	*K/m*
0.10	0.972	0.472	1.011
0.20	0.978	1.000	1.022
0.30	1.050	1.880	1.790
0.40	1.222	3.113	2.547
0.50	1.528	4.697	3.074
0.60	2.000	6.634	3.317
0.70	2.672	8.923	3.339

Table 2. Comparison of broadening efficiency for some ground conditions

X, m	*m*	*K*	*K/m*
0.10	0.994	1.000	1.006
0.20	1.056	2.119	2.007
0.30	1.250	3.985	3.188
0.40	1.644	6.597	4.013
0.50	2.306	9.955	4.317
0.60	3.300	14.060	4.261
0.70	4.694	18.910	4.029

$X_{opt.}$ = 0.53 m; *K/m* = 4.329.

Compared to the control case, a doubling of the pile length ℓ results in a 4.329/4.010 = 1.08 times increase in the highest *K/m* of the pile and a 0.53/0.421 = 1.26 times increase in $X_{opt.}$.

Conclusions

A doubling of the borehole radius results in a 16 % decrease in the highest K/m, a doubling of the pile length ℓ results in an 8 % increase in K/m.

The value of $X_{opt.}$ depends considerably on the size of the pile.

A doubling of the borehole radius r results in a 57 % increase in $X_{opt.}$, a doubling of the pile length ℓ results in a 26 % increase in $X_{opt.}$.

The most rational pile dimensions are the smallest diameter and the longest length, with optimum heel dimensions.

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Влияние конструктивных факторов на оптимальные размеры уширения буронабивных свай

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Ключевые слова и фразы: буронабивные сваи; сваи с уширением; свайные фундаменты; оптимальные размеры уширения.

Аннотация. В практике строительства выбор размеров уширения буронабивных свай с уширенной пятой определяется технологией разработки скважины и размерами уширителя. Целью данной статьи является определение зависимости между конструктивными характеристиками буронабивных свай и удельной несущей способности сваи. В работе решаются следующие задачи: анализ изменения удельной несущей способности в зависимости от конструктивных характеристик буронабивной сваи; выбор наиболее рациональных размеров сваи при оптимальных размерах пяты.

Предполагается, что экономически оптимальные размеры уширения будут зависеть от конструктивных размеров буронабивных свай.

В работе показано, что оптимальные размеры пяты существенно зависят от конструктивных факторов сваи. Рациональный выбор конструктивных характеристик сваи позволяет существенно повысить экономичность проектных решений, снизив расход материала на производство.

UDK 72

Tactical Urbanism as a Practice of Quick "Renewal" of Urban Environment and the Formation of New Public Spaces

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Key words and phrases: city; public spaces; tactical urbanism; urban environment; urban renewal.

Abstract. A concept of tactical urbanism has been examined in this paper. Main purposes and forms have been explained. The study also provides examples that clearly reveal the methods of tactical urbanism. The practice that uses the techniques of tactical urbanism correlates with the general world trend, which is characterized by the acceleration of all processes. However, bureaucratic costs slow down many works, including works on improvement of public spaces. Short-term programs can launch the process of developing spaces in the long term.

Introduction

The term "tactical urbanism" term appeared not so long ago. It was at the beginning of the 2010s, when Michael Lydon and Anthony Garsia paid attention to this theme in their book with the same name. The book presents some short-term small modifications of urban spaces which can trigger the process of development of territories and in the long term have a chance to become successful attractive spots for citizens in the future.

In many ways, tactical urbanism emerged as an answer to the traditional intricate long bureaucratic processes with complex hierarchies that prevent many places from changes with the prompt request from citizens. It represents one of the modern trends of development of public spaces which is about flexibility, implying precisely the above-mentioned fact in the previous sentence. Tactical urbanism does not require large investments, the complexity of the construction of individual buildings and their long life span. It is also important to note that with this flexibility tactical urbanism offers no one-size-fits-all solutions. It captures the local dynamics of urban areas and creates the conditions for special nuanced responses to the needs of the "new life". One must realize that such techniques are not suitable in all situations and sometimes the catalyst for development is not short-term changes, but global projects transforming the space around them.

The peculiarities of tactical urbanism lie in its ability to break away from the "big planning" process and pay attention to smaller local details, which at the same time play a serious role in the development strategy of the districts.

Purposes of tactical urbanism

As it was mentioned above, tactical urbanism has one global purpose: to make space flexible and attractive to people. However, one must also understand that there are some differences in the reasons of its application, even though they are all closely intertwined.

Zero stage

Methods of tactical urbanism are sometimes used as an analytical technique before carrying out a planned landscaping to find out what residents need, to understand what spatial scenarios will work best and to avoid mistakes in the future design. For residents it is an opportunity to get acquainted with the possible future of the urban interior and get rid of the fear of the unknown before the future point of attraction. This mechanism is illustrated by the experiment with the design strategy of Penrith Main Street in Australia. While the main provisions of the project, which took a very long time to be agreed upon, were approved, it was decided to convert a section of the street, a little used by traffic and people, into a temporary park that would be open only for a year. The mayor's office allocated $40,000 for this work. Intensive workshops with the participation of local residents, architects, and various government officials were held. Their work resulted in a one-piece park that was opened within a month. An independent consulting firm analyzed feedback and opinions and found that while not all property owners were happy, the new pedestrian flow increased foot traffic to some of the stores and cafes in the neighborhood, contributing to the economic development of the neighborhood. Local residents and businesses liked the park, so the authorities decided to extend its existence and launched a similar project in another part of town. This method has also the effect of "activity" when the implementation of an improvement project is delayed [1].

Quick renewal of the area

This method is used to quickly change the area giving birth to a new public space which is possible to do at minimal cost. Thus, it can be done by local residents to create the amenities they need, to show the bureaucracy a clear opportunity for changes. This form is often expressed as a protest, advocating the "reclaiming" of the city. Objects that are already morally and physically obsolete and are of no value or urban practices that neglect the interests of city residents are targeted in such cases.

In another case, stores or cafes in this way seek to increase their outreach outside the premises attracting new visitors, for example, by equipping an adjacent section of the street with parklets.

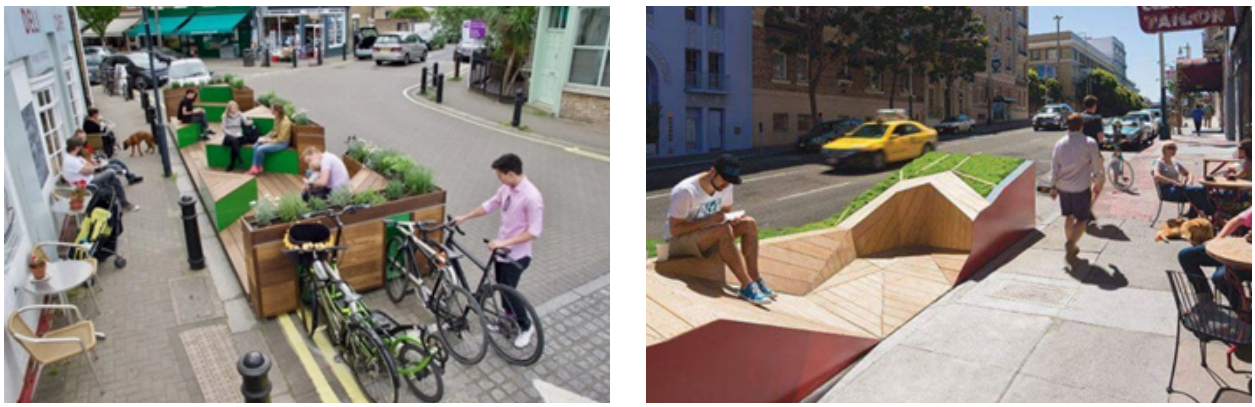

Fig. 1. Parklets on city streets

Fig. 2. A rarely used vacant lot in Brooklyn near the Manhattan Bridge

Creating new points of communication and life scenarios for citizens

The main task of tactical urbanism is to bring people together. Since the space must meet the demands of an already existing local point, it implies co-creative design together with the local inhabitants. This dense interaction facilitates their further communication and the construction of social ties.

Birth of the new or modification of the old?

In general, there are two scenarios tactical urbanism works with. On the one hand, it can create a point of attraction where it was previously impossible to imagine. For example, it works this way with a type of urban interior like the street. If you take away a couple of lanes of traffic from the automobile road, you can organize a bike lane on this space and equip a parklet, so the arranged place is likely to become quite popular.

In another case, it is the organization of some existing space, creating new facilities in it and attracting life there. For example, there are many cases where food trucks and modular furniture have been brought to empty parking lots resulting in citizens having flocked to these areas.

Since 2013, the same vacant lot has been revitalized five times a week by food trucks.

Where does the change come from?

First of all, the initiative comes from local residents who are trying to “reclaim” their city from cars, uncomfortable conditions, etc. In this way in most cases it comes hierarchically from the bottom and is directed upwards, where the main motivation is to improve the city for own comfortable use. It is not always possible for civic activists to address their request directly to the authorities. When such a situation occurs, most often the intermediaries can be developers, entrepreneurs or associations of businessmen, those persons to whom the creation of public spaces can bring a material benefit. It is easier for them to interact with officials and their rationale for the economic development of municipal units is more meaningful in communication with the authorities.

There are situations in which the initiative comes from local authorities. In this case, mayors, city councilors and municipal departments turn to specialists who can participate in the design of public spaces and establish communication with civic organizations for productive communication and co-creative design. Advocacy organizations, architects, artists, design and

Fig. 3. Park(ing) days

planning firms can help here. They carry out their pre-project analysis and, on the basis of its results, begin their work on the territory.

Examples of tactical urbanism

If we talk about the practice of tactical urbanism, it is worth mentioning that we can distinguish short-term variants of changing spaces as well as long-term ones.

Short-term ones can last from one day to several weeks and include the days of fairs, temporary road closures, and park(ing) days (the days when activists of tactical urbanism and citizens buy out parking spaces and unfold lawns on them and create small public spaces out of improvised means).

Speaking of long-term programs, we often mean laying out lawns, marking out bicycle paths, and arranging street furniture.

Here we can think of parklets, which have become a very popular tool for tactical urbanism. They are an initiative to continue the idea of park(ing) but unlike them, parklets are involved in long-term programs. San Francisco has a program called “Parks instead of Pavement”, which is based on the philosophy of using unused street spaces as low-cost small parks using parklets. A special manual for this program was developed there explaining how parklets should be designed and how to interact with authorities to get approval.

The practice of blocking central city roads for temporary public spaces is very popular. One of the most famous examples of this tactic is the metamorphosis of the Times Square. Back in 2009 there was heavy car traffic which frightened pedestrians and created a completely unfriendly environment for walking on one of the city’s main streets. Then it was decided to close off the access to cars for a while as an experiment. The result was impressive, as people were delighted with disposal the popular street of cars, everyone was happy to use the proposed modular furniture. From the economic point of view, the nearby infrastructure received more income and showed positive changes, so the traffic flow was redistributed and there was no increase in travel time for car users. The scheme of action is extremely simple but the positive consequences make a global difference to the lives of citizens. Thus, the temporary solution in New York has become permanent, and this tactic is being tried in other major cities around the world.

In addition to the above-mentioned facts, modular structures for food courts, urban workshops, art spaces, containers used to build urban vegetable gardens, etc. are fairly obvious

Fig. 4. “Before/after” shots of Times Square

Fig. 5. Placement of partisan signs

tactical techniques for engaging citizens and creating public spaces. However, the concept of tactical urbanism is actually much broader [1].

One of the foundational programs that started this movement is called “Walking [Your City]”. Its creator made a research which showed that the environment of many cities is not pedestrian-friendly at all; people mostly use cars to get around, even if the distance between the sites is less than 1.5 km. Then an analysis of the places people visited most often was made and a navigation project was developed, which implies the placement of signs in the streets indicating the time people can spend on the way to the desired area. There was also offered a QR code on these signs that would show the map with the drawn route. Thus, the misconceptions of citizens about distances in everyday life would be destroyed and the walking around the city would be encouraged.

However, it quickly became clear that it would take a lot of money and time to cooperate with the authorities with such a project. The creator dared to make an attempt to put his project

into practice on his own exploring many ways to implement it without damaging city property and eventually found a safe solution for his partisan signs. His initiative quickly resonated with the citizens and spread far beyond the city limits.

Conclusion

We live in a world of rapid urbanization, and the use of tactical urbanism methods correlates with the situation. Nowadays, all processes in the world are accelerating and bureaucratic red tape slows down many public space improvement works. Planning through action can greatly help with the pressing issue of changing urban interiors.

Obviously, city municipalities are primarily concerned about coordinating citywide projects while local points of public life that local residents need so much are pushed aside or left out altogether, but even large projects take years to process.

Minimal investment, participation of various local activists, creative groups and advocacy organizations are the sum total of possible rapid changes in the direction of a comfortable urban environment.

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Тактический урбанизм как практика быстрого «обновления» городской среды и формирования новых общественных пространств

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Ключевые слова и фразы: город; городская среда; обновление городской среды; общественные пространства; тактический урбанизм.

Аннотация. Рассмотрено понятие тактического урбанизма, его основные цели и формы. Также приведены примеры, наглядно раскрывающие методы тактического урбанизма. Практика, использующая приемы тактического урбанизма, коррелирует с общей мировой тенденцией, которая характеризуется ускорением всех процессов. Однако бюрократические издержки тормозят многие работы, в том числе работы по благоустройству общественных пространств. Краткосрочные программы способны запустить процесс развития пространств в долгосрочной перспективе.

UDK 332.145

Assessing the Risk of Negative Development of the Process of Influence of Regional Human Capital on Socio-Economic Development

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Key words and phrases: regional human capital; socio-economic development; project portfolio optimization; risk assessment; Monte Carlo method.

Abstract. In the current unstable conditions associated with the Covid-19 pandemic, the top management of the region is faced with the task of most effectively achieving the goals of the socio-economic development of the region, taking into account the existing uncertainties and risks. This is possible due to the accelerated development of human capital based on the formation of an optimal portfolio of regional projects for its development. This article develops a method for assessing the possible degree of deviation from the simulated progress in achieving the strategic goals and objectives of the region based on the formation of the optimal structure of public investment that contributes to the development of the human capital of the region. The proposed method is based on the author's dynamic model of the optimal distribution of regional investments that directly or indirectly affect the development of regional human capital. The developed simulation model allows assessing the risks of not achieving the planned increments of the integral and partial indicators of the development of the region due to the outstripping development of human capital and taking into account the importance of strategic priorities. The computational aspects of the application of the model in the conditions of the real development of the Primorsky Territory are studied. The proposed tool can be used by regional authorities as part of monitoring the progress of the region to improve the key indicators of the region and adjust the portfolio of activities for the development of human capital, taking into account the uncertainties of the processes taking place in the region.

Introduction

In today's unstable conditions, the regions face challenges related to the digital transformation

of the economy and social environment. Effective answers to them are possible due to the advanced development of human capital (that is, due to the formation of the competence basis of the territory, which fully meets the modern world market requirements) and the implementation of measures designed both to attract highly qualified specialists and for the full disclosure and development of the potential of existing specialists.

It should be borne in mind that the region, even when solving tasks of high importance, like any other socio-economic system, is forced to function under a number of significant constraints (including resource constraints), which in turn leads to a high demand for a reasonable and effective use of available resources to achieve the set development goals. At the same time, it is worth taking into account that organizations in the region and its population have a direct or indirect impact on the change in the level of human capital in the region.

Therefore, due to the fact that the region is a complex system in which many processes are quite difficult to control, it is necessary to use such tools that will allow:

– first, to identify weaknesses and strengths of human capital development in the region (within the framework of achieving its strategic priorities);

– second, to determine the need for resources to work with the weak and strong points of the human capital development of the region with sufficient accuracy;

– third, to assess the effects of the implementation of measures at the regional level and to form an optimal portfolio of these measures (taking into account the weaknesses and strengths of the region);

– fourth, to assess the risks of deviations from the roadmap of progress towards achieving the strategic goals and objectives of the region associated with economic and political uncertainties in the development of the information ecosystem of society.

The above points to the urgency of the issue related to the development of such economic and mathematical tools for the formation of a portfolio of projects that would most effectively achieve the goals of socio-economic development of the region due to the advanced development of human capital, taking into account the existing uncertainties and risks.

Literature review

Both in classical and modern scientific literature, the problem of assessing the risks of socio-economic development of countries and regions is studied very widely, since risk, as a probability of losses, accompanies any management decision. Being an integral attribute of any process in which limited resources are used to obtain certain benefits in the future, risk is considered both from a fundamental point of view and from the standpoint of the current functioning of risk management systems. The study of the essence of risks in the process of socio-economic and social development is devoted to the works of F.H. Knight, P.G. Grabovoi, O. Morgenstein, N. Luhmann, E. Giddens, W. Beck and other scientists who are the creators of various risk concepts: from the theory of uncertainty and profit by F.H. Knight to the “risk society” by W. Beck (F.H. Knight, 2000; U. Beck, 2010).

To the greatest extent, modeling of regional development risk assessment has become widespread in Russian and Chinese practice (Q. Qiang, C. Jian, 2020; G. Huimin, C. Lianhua, L. Shugang, L. Haifei, 2020), while in Western literature more attention is paid to industry and country models. However, regional risks are increasingly being explored in the economic and sectoral policies of various developing countries, for example, in Africa (L. Patey, 2020; D. Di, L. Luana, D. Lodovico, 2020).

Modern models strive to take into account the maximum number of factors hindering the

sustainable balanced development of the region. In the context of strategic planning based on the definition of development targets, the risks of not achieving the specified target values of development indicators are taken into account based on the ratio of fact and plan in development programs, or as a multiplicative-additive set of risk components of type (1) described in (I.N. Sannikova, T.A. Rudakova, E.V. Tatarnikova, 2015):

$$R(C_i) = \sum_{j=0}^{J} f(A_j), \quad (1)$$

where C_i are the risk components determined, as a rule, by the industries of the region; A_j are the factors of a separate component determined by individual resources.

Therefore, in the paper (N.Z. Solodilova, R.I. Malikov, K.E. Grishin, 2015) modeling of the parameters of the formation and maintenance of a favorable institutional configuration of the business environment in the Russian regions is carried out in order to prevent the risks of budget imbalance. The article (I.R. Kormanovskaya, L.I. Bernasovskaya, 2016) explores different approaches to modeling and forecasting regional risks as benchmarks for possible macroeconomic losses in conditions of uncertainty, using statistical-probabilistic, exponential methods. The methodology proposed in (V.V. Sukhorukova, E.A. Yakovleva, N.A. Azarova, 2017) reflects the modeling of the speed of achieving the targets of socio-economic development of the region in order to overcome the “strategic gap” between goals and fact. The degree of risks of failure to achieve strategic goals is determined by the level of deviation of the forecast value of the indicator from the target using a number of coefficients. The method based on the analysis of econometric multiple regression models was used in the work (S.G. Spirina, R.K. Tonyan, 2015) to assess the cyclicity in modeling financial risks when calculating the financial flows of enterprises in the territory of advanced development.

According to a number of scientists, the lack of a universal approach to forecasting the socio-economic development of regions is an advantage, since it allows you to use several assessment methods at once and get several comparable options for lagging and not achieving development targets. In this case, it becomes necessary to further update regional development programs taking into account uncertainties and risks.

Goals and Objectives of the Study

The purpose of the study is to develop a method for assessing the possible degree of deviation from the simulated progress in achieving the strategic goals and objectives of the region based on the formation of an optimal structure of public investments that contribute to the development of human capital.

To achieve the goal, the following tasks were set:

– to develop a simulation model that allows assessing the risks of not achieving integral and partial indicators of regional development based on the advanced development of human capital and taking into account the importance of strategic priorities;

– to investigate the computational aspects of the application of the model in the conditions of the real development of the Primorsky Territory.

A Model for Assessing the Risks of Not Achieving Regional Development Indicators

Earlier in the paper (L.S. Mazelis, K.I. Lavrenyuk, A.A. Krasko, O.N. Zagudaeva, 2018), a conceptual model for the development of regional human capital was presented. Within

the framework of the conceptual model, a system of indicators describing such categories as regional human capital, socio-economic development of the region and investments in the development of human capital of the region is presented.

It is worth noting that the conceptual model is based on a two-level chain of influence channels:

1) the structure and volume of investments in the indicators of regional human capital;
2) indicators of regional human capital on indicators of socio-economic development.

In the study (L. Mazelis, K. Lavrenyuk, A. Krasko, E. Krasova, E. Emtseva, 2020), a formalization of the conceptual model of the development of the human capital of the region in the form of a mathematical programming problem is proposed, where the channels of influence described above are presented in the form of functional dependencies. The model allows you to find the optimal investment structure by investment areas and years with a planning horizon of *T*.

The structure of investments in the development of human capital for each region will be understood as the following vector function:

$$d_n^t = (d_{1n}^t, \ldots, d_{jn}^t), d_{jn}^t = \frac{x_{jn}^t}{R_n^t}, \quad (2)$$

where $x_{jn}^{\ t}$ is the volume of investments in the development of human capital of the *n*-th region in the *j*-th direction of investment at time *t*; $R_n^{\ t}$ is the total volume of investments affecting the development of human capital of the nth region at time t.

A detailed description of the concept of "investment in the human capital of the region" and a list of investment directions is presented in the work (L.S. Mazelis et al., 2018).

A detailed description of the concept of "regional human capital" and a list of its indicators is presented in the work (L.S. Mazelis et al., 2018).

A vector function is assigned to each region:

$$Z_n^{\ t} = (z_{1n}^t, z_{2n}^t, \ldots, z_{In}^t), \quad (3)$$

where z_{in}^t is the value of the *i*-th indicator of the human capital of the *n*-th region at time *t*; *I* is the number of indicators describing regional human capital; *N* is the number of regions.

As noted earlier, the conceptual model is based on a two-level chain of influence channels, the mathematical formalization of which is presented in the work (L.S. Mazelis et al., 2020) and is given below:

$$W_n^t = (w_{1n}^t, w_{2n}^t, \ldots, w_{Kn}^{\ t}), \quad (4)$$

where w_{kn}^t is the value of the *k*-th indicator of socio-economic development of the *n*-th region at time *t*; *K* is the number of indicators of socio-economic development of the region.

Functional dependencies of the impact of investments in the development of regional human capital on the indicators of regional human capital:

$$RCZ_{ln}^t = g_l(RCZ_{ln}^{t-1}, x_{1n}^{t-1}, \ldots, x_{Jn}^{t-1}, x_{1n}^{t-2}, \ldots, x_{Jn}^{t-2}, x_{1n}^{t-3}, \ldots, x_{Jn}^{t-3}), \quad (5)$$

where RCZ_{ln}^t is the value of the *l*-th main component of human capital for the *n*-th region at time *t*; *l* is the number of the main component, *l* = 1, …, *L*.

Functional dependences of the influence of indicators of regional human capital on indicators of socio-economic development of the region:

$$w_{kn}^{t+1} = f_k(w_{kn}^t, RCZ_{1n}^t, \ldots, RCZ_{Ln}^t). \quad (6)$$

The weighted average degree of achievement of the target values of the resulting indicators of socio-economic development of the region on the considered planning horizon is used as the objective function. Thus, the objective function has the following form:

$$ISE_n^t = \sum_{k=1}^{K} v_k^t \cdot \frac{w_{kn}^t}{\hat{w}_{kn}^t}, \quad (7)$$

where v_k^t is the weighting factor characterizing the importance of the k-th indicator of socio-economic development of the region at time t; w_{kn} is the target value of the k-th indicator of socio-economic development of the n-th region on a given planning horizon.

It is also worth noting that in the work (L.S. Mazulis et al., 2020), a number of assumptions about the process of development of regional human capital, formalized in the form of restrictions, were made to build the model.

Based on the above, the following model is proposed for the formation of an optimal structure of public investment directions:

$$\begin{cases} ISE_n^T = \sum_{k=1}^{K} v_k^T \cdot \frac{w_{kn}^T}{\hat{w}_{kn}} \to \max, \\ w_{kn}^{t+1} = f_k(w_{kn}^t, RCZ_{1n}^t, \ldots, RCZ_{Ln}^t), t = 0, \ldots, T-1, \\ RCZ_{ln}^t = g_l(RCZ_{ln}^{t-1}, x_{1n}^{t-1}, \ldots, x_{Jn}^{t-1}, x_{1n}^{t-2}, \ldots, x_{Jn}^{t-2}, x_{1n}^{t-3}, \ldots, x_{Jn}^{t-3}), t = 1, \ldots, T, \\ x_{jn}^t = d_{jn}^t \cdot R_n^t, \sum_{i=1}^{I} d_j^t \le 1, t = 0, \ldots, T-1, \\ \alpha_j \le d_{jn}^t \le \beta_j, n = 1, \ldots, N, t = 0, \ldots, T-1, \\ \varphi_k \le \frac{w_{kn}^{t+1} - w_{kn}^t}{w_{kn}^t} \le \psi_k, t = 0, \ldots, T-1, \\ \delta_l \le \frac{RCZ_{ln}^{t+1} - RCZ_{ln}^t}{RCZ_{ln}^t} \le \gamma_l, n = 1, \ldots, N, t = 0, \ldots, T-1, \\ p_k \le \frac{w_{kn}^T}{\hat{w}_{kn}} \le q_k, n = 1, \ldots, N, \end{cases} \quad (8)$$

where $\overline{\alpha} = (\alpha_1, \ldots, \alpha_J)$, $\overline{\beta} = (\beta_1, \ldots, \beta_J)$ are restrictions from below and from above on the volume of investments in each direction; $\overline{\delta} = (\delta_1, \ldots \delta_L)$, $\overline{\gamma} = (\gamma_1, \ldots, \gamma_L)$ are restrictions from below and from above on the relative change of each the main components of human capital for one period of time; $\overline{\varphi} = (\varphi_1, \ldots, \varphi_K)$, $\overline{\psi} = (\psi_1, \ldots, \psi_K)$ are restrictions from below and from above on the relative change of each indicator of socio-economic development for one period of time; $\overline{p} = (p_1, \ldots, p_K)$, $\overline{q} = (q_1, \ldots, q_K)$ are restrictions from below and from above on the degree of achievement of the target value of each indicator of human capital.

The optimized variables in this model are the annual shares of investments in the region in certain areas of investment $d_1^t, \ldots, d_J^t$, $t = 1, \ldots, T$.

The risks associated with various possible scenarios of the development of the external environment affect the results of modeling the process under consideration through uncertainties associated with the functional representation of influence channels. Each parameter of regression dependencies (5), (6) is some estimate of the true value and is actually a random variable determined on the corresponding confidence interval. Accordingly, the optimal investment structure found by model (8) can be considered as a random variable, since it depends on the values of the coefficients of all the econometric dependencies used.

The basic optimal investment structure will be considered the structure found by (8) based on the basic values of the parameters obtained by the least squares method. This investment structure corresponds to the vector of degrees of achievement of the target values of indicators of socio-economic development of the region.

To determine possible deviations from the predicted values of the socio-economic development indicators of the region (8), we will build a simulation model based on the Monte Carlo method.

To quantify the risks in modeling the process under consideration, by (8) we denote the set of all parameters of regression dependencies (5), (6) in the form of a vector (a_{jn1}^{t-1}, …, a_{jnL}^{t-1}; a_{jn1}^{t-2}, …, a_{jnL}^{t-2}; a_{jn1}^{t-3}, …, a_{jnL}^{t-3}; a_{kn1}^{t}, …, a_{knL}^{t}).

The dependences of the shares of investments in the areas of investment and the degree of achievement of the target values are denoted as follows:

$$d_{jn}^{t+1} = f_j(a_{jn1}^{t-1}, \ldots, a_{jnL}^{t-1}; a_{jn1}^{t-2}, \ldots, a_{jnL}^{t-2}; a_{jn1}^{t-3}, \ldots, a_{jnL}^{t-3}; a_{kn1}^{t}, \ldots, a_{knL}^{t}), \quad (9)$$

$$\frac{w_{kn}^{t+1}}{\widehat{w}_{kn}} = g_k(a_{jn1}^{t-1}, \ldots, a_{jnL}^{t-1}; a_{jn1}^{t-2}, \ldots, a_{jnL}^{t-2}; a_{jn1}^{t-3}, \ldots, a_{jnL}^{t-3}; a_{kn1}^{t}, \ldots, a_{knL}^{t}). \quad (10)$$

Quantitative risk determination is carried out according to the following algorithm:

1) using a pseudorandom number generator, we play out the value of each coefficient for all regression dependencies used in the model;

2) for each generated set of coefficients, by solving the model (8), we find the optimal structure of investments and the degree of achievement of the target values of each indicator of socio-economic development of the region;

3) based on the obtained sample of solutions (8), for a sufficiently large number of implementations of each indicator, we will construct a sample distribution function that will allow us to estimate the probability of deviation down from the predicted value by more than a given amount.

Approbation of the Model Using the Example of Primorsky Krai

The method described above can be applied in real conditions. Let's consider an example of determining possible deviations from the achieved values of socio-economic development indicators predicted by the model (8) for the Primorsky Krai. A description of the construction of functional dependencies (5) and (6), as well as indicators of socio-economic development obtained as a result of using the author's optimization model for Primorsky Krai are presented in the work (Mazelis L.S. et al., 2020).

Note that a change in the values of the coefficients of regression dependencies "down" indicates a negative external environment, and a change in the values of the coefficients "up", on the contrary, indicates a favorable one.

After conducting simulation experiments, we will highlight the parameter values for the most

Table 1. The main scenarios for a part of the coefficients of regression dependencies

Coefficient	Scenario		
	Worst	Best	Most likely
a_{1n1}^{t-1}	-3×10^{-5}	-1×10^{-5}	-1.85×10^{-5}
a_{2n1}^{t-1}	-2×10^{-5}	1×10^{-5}	0
…	…	…	…
a_{1n1}^{t-2}	-1×10^{-5}	1×10^{-5}	0
a_{2n1}^{t-2}	1×10^{-5}	4×10^{-5}	2.70×10^{-5}
…	…	…	…

Table 2. Fragment of simulation of coefficients

No	Coefficients of regression dependencies						The degree of achievement of indicators of socio-economic development		
	a_{1n1}^{t-1}	a_{2n1}^{t-1}	…	a_{1n1}^{t-2}	a_{2n1}^{t-2}	…	w_{1n}^{3}	…	w_{17n}^{3}
1	-1.21×10^{-5}	-1.91×10^{-5}	…	0.94×10^{-5}	2.42×10^{-5}	…	1.06	…	1.14
2	-1.20×10^{-5}	0.12×10^{-5}	…	0.66×10^{-5}	1.12×10^{-5}	…	1.05	…	1.22
3	-2.84×10^{-5}	-0.21×10^{-5}	…	-0.31×10^{-5}	3.22×10^{-5}	…	0.97	…	1.04
…	…	…	…	…	…	…	…	…	…
100	-2.13×10^{-5}	-0.36×10^{-5}	…	0.26×10^{-5}	3.74×10^{-5}	…	1.01	…	1.06

Table 3. Fragment of risk assessment results

Indicators	The degree of achievement of indicators of socio-economic development			
	w_{1n}^{3}	…	w_{16n}^{3}	w_{17n}^{3}
Average value	1.04	…	0.79	1.02
Standard deviation	0.21	…	0.05	0.14
Variation coefficient	0.20	…	0.06	0.14

likely, worst-case and best-case scenarios. In this case, the maximum specified deviation “down” is the worst case scenario, the maximum specified deviation “up” is the best scenario. As the most likely scenario, consider the values of regression coefficients for Primorsky Krai from the work (Mazelis L.S. et al., 2020). Table 1 shows a fragment of scenarios for coefficients.

Next, using a pseudorandom number generator, we play the value of each coefficient for all regression dependencies used in the model 100 times. Using the obtained coefficient values, we calculate the indicators of the degree of achievement of the target values of the indicators of socio-economic development of the Primorsky Territory according to the model (8). A fragment of the obtained values of the degrees of achievement of the indicators of the Primorsky Territory is presented in Table 2.

After the simulation, we will conduct a risk assessment for the degrees of achievement of

the target values of indicators of socio-economic development of Primorsky Krai, where the degree of risk is the coefficient of variation. The results obtained are shown in Table 3.

Analyzing the results of Table 3, it can be noted that for all degrees of achievement, the maximum coefficient of variation is 0.37 for the indicator w_{11n}^{3} (the volume of shipped goods of own production, works and services performed by own forces by the type of economic activity "Manufacturing" per capita). This suggests that the change in the coefficients of regression dependencies has the greatest degree of influence on this indicator. At the same time, the minimum coefficient of variation is 0.06 for the indicator w_{16n}^{3} (the proportion of break-even (including profitable) organizations).

Conclusion

Within the framework of this paper, a method has been developed to assess the possible degree of deviation from the simulated progress towards achieving the strategic goals and objectives of the region based on the formation of an optimal structure of public investments that contribute to the development of human capital. Possible deviations from the predicted achievable values of indicators of socio-economic development of the region are determined on the basis of Monte Carlo simulation, where the values of each coefficient for all regression dependencies used in the model are played out using a pseudo-random number generator. Risk assessment is carried out on the basis of the obtained scenario simulations.

The computational aspects of the proposed method are considered when assessing the possible degree of deviation from the simulated progress on 17 indicators of socio-economic development of Primorsky Krai. As part of the example, 100 simulations were carried out, based on the analysis of which the coefficients of variation for the degrees of achievement of the target values of all indicators of socio-economic development of the region, which are considered as degrees of risk, were found. Note that the coefficients of variation of the degrees of achievement for all indicators are in the range from 0.06 to 0.37.

The proposed tool can be used by regional government bodies as part of monitoring the progress of the region to improve the key indicators of the region based on the advanced development of human capital. The developed method allows regional management to adjust the portfolio of human capital development activities taking into account the uncertainties and risks of the processes taking place in the region.

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Оценка риска негативного развития процесса влияния регионального человеческого капитала на социально-экономическое развитие

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Ключевые слова и фразы: метод Монте-Карло; оптимизация портфеля проектов; оценка рисков; региональный человеческий капитал; социально-экономическое развитие.

Аннотация. В современных нестабильных условиях, связанных с пандемией Covid-19, перед топ-менеджментом региона стоит задача наиболее эффективного достижения целей социально-экономического развития региона с учетом имеющихся неопределенностей и рисков. Это возможно за счет опережающего развития человеческого капитала на основе формирования оптимального портфеля региональных проектов по его развитию. В данной статье разработан метод оценки возможной степени отклонения от моделируемого продвижения по достижению стратегических целей и задач региона на основе формирования оптимальной структуры государственных инвестиций, способствующих развитию

человеческого капитала региона. Предложенный метод базируется на авторской динамической модели оптимального распределения региональных инвестиций, напрямую или косвенно влияющих на развитие регионального человеческого капитала. Разработанная имитационная модель позволяет оценивать риски недостижения планируемых приращений интегрального и частных показателей развития региона за счет опережающего развития человеческого капитала и с учетом важности стратегических приоритетов. Исследованы вычислительные аспекты применения модели в условиях реального развития Приморского края. Предложенный инструмент может использоваться органами регионального управления в рамках мониторинга продвижения региона по улучшению ключевых показателей региона и корректировать портфель мероприятий по развитию человеческого капитала с учетом неопределенностей протекающих в регионе процессов.

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Belt and Road Initiative and Through the Lens of "Tianxia" Concept

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Key words and phrases: Tianxia concept; International relations; International economics; International relations theory; philosophical concepts; China.

Abstract. The object of research in this paper is the Belt and Road Initiative, and the subject is the consideration of this initiative from the point of view of the "Tianxia" concept. The article analyzes the sources in order to explain the relationship between traditional philosophical concepts and modern, in particular, economic processes. Using the example of the Belt and Road initiative, the hypothesis put forward was confirmed: the relevance of classical Confucian views in assessing current events, which emphasizes the importance of understanding them when interacting with China.

Until recently, the theory of international relations ha been mainly focused on the development of interaction between Western countries. This was commonly due to what Waltz called the need to rely on the analysis of the behavior of the great powers of the time period and analyze the historical processes directly related to them. "Non-Western" concepts left the theorists' field of vision, creating a situation in which Eastern political systems remained incomprehensible. At the same time, the analysis of these systems is very relevant at the present time because of the rapid development of the region. In this article, we drew attention to the concept of "Tianxia" (天下 – under the Sky) in the context of China's Belt and Road ('一带一路') Initiative.

The main origins of the generation of a different worldview in Asian countries, in general, and China, in particular, are:

1) philosophical centers independent of Western ones;
2) historical determination;
3) cultural and linguistic paradigm that influence the perception of reality;
4) the form of organization of society and public administration.

An important idea on which the system of views on China's international interaction is based is the idea of the "Tianxia", which belongs to the concept of Confucianism. Historically, the Chinese emperor was seen not only as the head of state, but also as the "Son of Heaven", who is an intermediary between the world of people and the world of spirits. It should be noted that in the Confucian worldview, unlike the Western one, there is no idea of equality. Hierarchy is an important characteristic of the social structure. At the same time, inequality does not mean hegemony and exploitation, but the relationship of "father" and "son", in which the superior

element, in addition to the ability to lead. It has its own responsibilities to subordinate elements.

Initiatives to create the Silk Road Economic Belt and the Maritime Silk Road were put forward by Chinese President Xi Jinping in the fall of 2013 during speeches in Astana and Jakarta. This initiative is a reflection of China's desire and willingness to take a politically and economically leading position in the modern world. At present, land and sea projects are practically not separated and are considered as a continuation of the opening policy in the new conditions for the functioning of the Chinese economy.

The dominant concept of relations with neighboring countries in modern Chinese diplomacy is usually denoted by four characters – 亲, 诚, 惠, 容 (friendliness, sincerity, mutual benefit and tolerance). When discussing the initiative, it was mentioned that in the past few decades, China has considered external resources for development, and now it is ready to share its own resources, promoting the development of foreign partners. This item corresponds to the philosophical concept described above, based on which the top of the hierarchy not only uses the lower elements for their own purposes, but also has obligations to them, and harmony in relations between elements is impossible without mutual respect and goodwill. At the same time, the ambitious project is not only a range of opportunities for economic development, but also a decisive step for China on the path to global leadership.

It should be noted that in the context of the discussion of this initiative, the official Chinese media actively promotes the concept of true justice and benefit (正确的义利观) and emphasizes that China, as the initiator of the project, must "give more and receive less, first give, then receive", which also correlates with the concept of the under-heaven.

Summing up, we emphasize the importance of considering different from Western points of view on the theory of international relations. Using the example of the attitude towards the initiative to form the Silk Road Economic Belt, we have proved that the classical philosophical concepts characteristic of China are reflected in the functioning of modern economic and political projects, which emphasizes the importance of pluralism in views on international cooperation.

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Инициатива «Один пояс, Один путь» через призму концепции «Поднебесной»

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Ключевые слова и фразы: Китай; концепция Поднебесной; международная экономика; международные отношения; теория международных отношений; философские концепции.

Аннотация. Объектом исследования в данной работе является инициатива «Один пояс, Один путь», а предметом – рассмотрение данной инициативы с точки зрения концепции Поднебесной. В статье производится анализ источников с целью объяснения взаимосвязи традиционных философских концептов и современных, в частности, экономических процессов. На примере инициативы строительства Экономического пояса Шелкового пути была подтверждена выдвинутая гипотеза релевантности классических конфуцианских воззрений при оценке нынешних событий, что подчеркивает важность их понимания при взаимодействии с Китаем.

UDK 339.9

Practical Aspects of the Introduction of the Geographical Factor Diversification Method in the Realities of Trade Union

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Key words and phrases: Belt and Road; cooperation transportation construction; gravity model; trade cooperation.

Abstract. A transport component is one of the key factors in terms of the movement of resource flows and has a great impact on the development of trade and integration entities in the regions. China, as a country with a rich history of trade and investment relations, is promoting the Silk Road project for the development of trade and integration education. The purpose of the research is to study the role of geographical distance in trade between countries, and in this regard; the research objective is to provide mathematical interpretation to form the geographical diversification of countries. The research methods based on the diversification of countries, using the principle of the most effective implementation of methods regulating the flow of resources are used. The hypothesis assumes that a smaller distance favorably contributes to the development of trade due to the reduction of logistics and transport costs. The result of the study is a summary table with the specified parameter of the complex distance between countries and a mathematical apparatus for its calculation.

Introduction

The Silk Road Trade and Integration Association is a new concept and a way of cooperation that will play an important role in creating new and changing existing attractors of resource flows of the participating countries of this project. However, the current form of the project is in its infancy, characterized by some unresolved problems, characterized by weak or insufficiently developed mechanisms of interaction and influence. One of the most significant in terms of the impact on resource flows is the factor of geographical remoteness, and as its derivative trade and transport infrastructure.

The purpose of the study

This article analyzes the model developed on the basis of the Tinbergen gravity model of

Table 1. The results of the calculation of the model in the statistical description

Parameter	Number of samples	Median value	Standard deviation	Max	Min
ln X	25	21,334	1,940	24,813	14,227
ln Y		24,796	1,563	28,338	20,414
ln DIS		0,313	1,217	1,135	-2,981

trade, expanded by the relative interpretation of the distance factor between countries, and based on it, a method of regulation is proposed, consisting in the diversification of territories for the effective realization of resource potential.

1. Relative geographical distance

Geographical distance (**DIS**). As a rule, the greater the geographical distance between two countries, the higher the risks and transportation costs, which negatively affects the realization of resource potential. According to the distance calculation method introduced by Isidro Sologa [1], the relative geographical distance formula is:

$$DIS_{ij} = GDP_{ij} / GDP_w \times DIS, \quad (1)$$

where DIS_{ij} is the relative geographical distance between country *i* and its trading partner country *j* per year; GDP_j is the gross domestic product (**GDP**) of country *j* per year; GDP_w is world GDP per year, and DIS is the absolute distance between the capitals of the countries.

After substituting this parameter in formula (1) into the general equation of the gravitational model [2] and further reduction to the logarithmic form, we obtain:

$$\ln X_{ij} = b_0 + b_1 \cdot \ln Y_{ij} + b_2 \cdot \ln DIS_{ij} + \mu_{ij}, \quad (2)$$

where X_{ij} is the export flows of country *I* to country j per year; Y_{ij} is the difference in the economic scale of the countries in the studied year, and DIS is the absolute distance between the capitals of the countries.

To simplify the calculations, the following boundary conditions were adopted:

1) the export component is based on trade turnover, trade in services is not taken into account;

2) the distance between countries is taken between the capitals;

3) China is selected as the exporting country.

At the same time, measured data, rather than qualitative data, were mainly used to build the model, so it may be ambiguously interpreted, but it allows you to arrange the variables as they influence. A regression model with random effects was chosen for processing, this approach allows us to describe a function with a set of input data generated during economic interaction.

2. Application of the model

Currently, the main recognized scope of the Silk Road trade and integration education covers

Table 2. Complex distance index for participating countries

Country	Value	Country	Value	Country	Value	Country	Value
Russia	–3,828	Uzbekistan	-0,194	India	-4,213	Iraq	-0,781
Croatia	-0,238	Kazakhstan	-2,123	Singapore	-0,999	Iran	-1,623
Serbia	0,127	Pakistan	-0,531	Vietnam	-0,417	UAE	-1,301
Ukraine	-0,951	Turkmenistan	0,171	Thailand	-0,803	Egypt	-1,253
Belarus	0,115	Afghanistan	0,128	-	-	-	-
Hungary	-0,030	Azerbaijan	-0,190	-	-	-	-
Slovakia	-0,327	Tajikistan	0,065	-	-	-	-
Poland	-1,893	Kyrgyzstan	-0,412-	-	-	-	-
Czech	-0,867	-	-	-	-	-	-

5 regions: Central and Eastern Europe, Central Asia, Southeast Asia, and the Middle East. Taking into account the availability of complete data, 25 participating countries are considered in this paper: 9 from Europe, 8 from Central Asia, 4 from Southeast Asia, 4 from the Middle East. The data were collected from open sources [4] and used to study the proposed model, the results are presented in Table 1.

The control variable *Y*, the economic scale of the countries, was positive in all the regression results, confirming the main conclusion of the gravity model that trade flows between the two economies are directly proportional to their resource potential.

Geographical distance was negative in most of the regression results, which means that the further the geographical distance between two economies, the smaller their bilateral trade flows, which once again confirms the main conclusion of the gravitational model. that trade flows between two economies are inversely proportional to geographical distance.

3. Regulation of the flow of resources on a geographical basis

Based on the results of the model, it is proposed to further divide the countries into different subgroups within the trade and integration association, each group was assigned a certain “weight” indicating the priority of implementing measures to manage resource potential in the respective subgroups. Such a gradation by “weight” in this work is indicated as a complex distance.

To describe the concept of a complex distance, a method of mathematical interpretation is used in order to attach a certain “weight” to the actual position of the resource potential of countries.

According to the results of the calculation of the gravitational model (formula (2), the *i*-th coefficients for *H* and *DIS* were 1.032 and 0.164, respectively. Using formula (3) and (4), we obtain the relative weight of the parameter for parameter *j* (f_j) and the complex distance for country *i* (a_i) obtained by the inverse transformation method:

$$f_j = b_j / \sum_{j=1}^{2} b_j,\ j = 1, 2 \Rightarrow f_1 = 0.863;\ f_2 = 0.137, \quad (3)$$

$$\alpha_i = \sum_{j=1}^{2} X_{ij}'\, f_j / \sum_{j=1}^{2} f_j,\ i = 1, 2, \ldots, 25. \quad (4)$$

The complex distance reflects only a relative value, which can only be interpreted by comparative analysis, so that the value can be negative [3]. The smaller the value, the greater the potential for effective management of resource flows, while countries with a greater integrated distance have less potential. The data for the countries that were considered in this article are presented in Table 2.

Table 2 shows that the countries located closer to China have a greater potential (a smaller complex distance), which is quite understandable by the logic of the proposed model, but it is worth noting that proximity is not always a success factor, since Turkmenistan or Afghanistan have a high index and are inferior to Kazakhstan by several orders of magnitude due to the difference in resource potential.

The results obtained are divided into four groups formed by the application of the resource flow management method, taking into account the geographical features of the mutual location along with the resource potential of the countries:

$$(-\infty; -0.7); (-0.7; -0.3); (-0.3; 0.1); (0.1; +\infty).$$

Conclusions

The leading countries in the interval $(-\infty; -0.7)$, i.e. with the lowest complex distance in relation to China are: Russia, Kazakhstan, India, Iran, and Poland. Activities in them based on the Silk Road trade and integration education have the least barriers to trade cooperation, the lowest transaction costs and represent local attractors of resource potential in geo-economic coordinates, the development potential of which allows in the future to influence and manage the resource flow in neighboring countries with a higher integrated distance.

The participating countries should strive to promote further integration and development of trade and investment activities, eliminate or compensate for geographical barriers and economic inequality in order to reduce the complex distance between them. This kind of policy will allow introducing the most universal methods of resource potential development without excessive diversification into subgroups.

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Практические аспекты внедрения метода диферсификации по географическому фактору в реалиях торгового образования

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Ключевые слова и фразы: гравитационная модель; торгово-интеграционное образование «Шелковый Путь»; транспортная модель.

Аннотация. Транспортная составляющая является одним из ключевых факторов с точки зрения движения потоков ресурсов и оказывает большое влияние на процессы по развитию торгово-интеграционных образований в регионах. Китай как страна, имеющая богатую историю торговых и инвестиционных отношений, продвигает проект по развитию торгово-интеграционного образования «Шелковый Путь». Цель работы заключается в исследовании роли географического расстояния в торговле между странами, в связи с этим ставится задача математической интерпретации, которая будет применяться для формирования географической диверсификации стран на методах, основанных на разделении стран по принципу наибольшей эффективности внедрения методов регулирования потоков ресурсов, с учетом гипотезы о том, что меньшее расстояние способствует развитию торговли в связи с уменьшением логистических и транспортных издержек. Результатом исследования является сводная таблица с указанным параметром комплексной дистанции между странами и математический аппарат по его вычислению.

UDK 021

Transformation of the Library Space: Youth Expectations and Marketing Approach

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Key words and phrases: library; generation Z; motivational factors; positioning; marketing.

Abstract. This article studies the attitude of young people to libraries, as well as the determination of motivational factors affecting the frequency of use of library services. The aim of the study is to identify key indicators of the attractiveness of the modern library space in the perception of generation Z. The research methods were a secondary analysis of the experience of organizing the activities of the leading library complexes of the world and the Russian Federation, as well as a primary study of the opinions of representatives of generation Z in the form of an Internet survey. The result was the development of practical recommendations for improving the library space based on elements of the marketing mix to increase the loyalty of modern Russian youth. This work may be of interest to representatives of the administrative and managerial level of libraries, educational structures and public organizations interested in the youth audience and cooperating with libraries.

The technological transformation observed today in the economic, political, and socio-cultural spheres of society radically changes the human environment, stimulating him to adapt to the new realities of the outside world. The changes concern not only market areas, where the speed of response directly determines the possibility of survival and competitiveness of companies. The need to adapt to the demands of modern society has also affected such a traditionally oriented institution as the library. If representatives of the older generation are still loyal to the usual format of the organization of the spatial environment and the content of library services, the younger generation increasingly refuses to visit libraries, choosing alternative forms of obtaining information and knowledge.

Today, there are 1.2 billion young people aged 15 to 24 in the world, which is 16.5 % of the world's population. According to forecasts, by 2030 this figure will increase by 7 % and reach almost 1.3 billion people. There are 24.3 million young people in Russia [1]. In a decade, this category of the population will determine the economic, political, scientific, technological, and socio-cultural structure of both our country and the world. Therefore, it is already important to understand and analyze the reactions of buzzers to the phenomena occurring in the world.

Within the framework of the topic discussed in the article, motivational factors affecting the frequency of library visits by representatives of the so-called generation Z are of particular interest for study. At the same time, this generation has pronounced behavioral features and a unique structure of ideas about the format of the future library.

This article deals with the study of the perception of the modern library space through the eyes of young people, as well as the determination of motivational factors affecting the frequency of use of library services.

Being one of the oldest cultural institutions, the library is undergoing a period of significant transformation today, expanding its functionality and changing the nature of interaction with various categories of stakeholders. The modern library is an automated information center that serves users both locally and remotely and provides them with a wide range of services. It is a center for working with books and information, a center for communication and leisure, a center for the development of intellectual and creative potential of readers [2]. Today there are 320 thousand public libraries in the world and more than 1 million parliamentary, national, university, scientific and research, school, and special libraries. The library system of the Russian Federation has more than 100 thousand libraries. The total volume of all library collections is increasing annually and has already reached the value of 1 billion. 700 million units of storage. The Russian Federation has developed and is implementing a Strategy for the development of Librarianship until 2030, the main tasks of which include replenishing book collections, major repairs of buildings, attracting young professionals and providing libraries with broadband Internet. It is planned to replenish library collections not only with printed publications, but also with electronic books and documents. In the future, it is planned to create digital platforms for library collaboration. Library, archive, and museum information resources will be combined into a single digital space in the future. The main forecast indicators of the Strategy being implemented include an increase in the coverage of the population with library services up to 40 percent; a 3-fold increase in attendance at library events; the receipt of new books in the library collections of public libraries of at least 12 million units annually; an increase in the share of libraries that meet the requirements and standards of resource provision in the total number of libraries up to 30 percent; the share of libraries with broadband Internet access in the total number of libraries – at least 90 percent; the number of modernized libraries for 2030 is not less than 1010 units [3]. The successful implementation of the strategic objectives is largely determined by understanding the reasons and needs of the target groups interacting in the library system.

In this paper, the focus of attention is directed at the youth audience, as the most attractive and promising in terms of service consumption soon. In accordance with the theory of generations of N. Howe and W. Strauss, which assumes the division of people into groups born in a certain period and developing under the influence of the same economic, political, and socio-cultural factors, and, as a result, having similar value attitudes and behavioral orientations, modern youth are commonly called “buzzers” [4]. The main features and values of Generation Z, which was born in the early 2000s, can be called high involvement in information flows and processes, lack of real communication, developed multitasking, as well as problems with attention retention. Buzzers have their own position, diverse interests and a higher level of entrepreneurship compared to previous generations. They are quite pragmatic in terms of planning for the future and often suffer from the fear of missing something important. Therefore, they are always at the forefront of new trends and remain highly competitive. This generation defends its independence, which can lead to confrontation with other generations focused on cooperation [5].

To be attractive to the “digital generation”, libraries must represent a unique accessible

physical and virtual space. Today, experts have formulated the principles of design of youth spaces in libraries of the 21st century. These include [6]:

– spaces for the print fund;
– digital spaces that meet the growing technology needs;
– comfortable seats and working places for visitors;
– spaces that encourage the use of the library as a community center for everyone.

The implementation of the above principles can be observed in the effectively working youth libraries of the world: HoeB4U Hamburg Library for Youth (Germany), Makerspace Connected Community in Melbourne (Australia), Herning Public Library (Denmark), etc. There is also a gradual modernization of library spaces in Russia. Thus, the Russian State Library for Youth (**RGBM**), the Astrakhan Youth Library named after Boris Shakhovsky, the N.V. Gogol Library in St. Petersburg most accurately reflect modern design principles. Moscow library spaces that have a distinct identity and are capable of a clearer positioning in the library environment include the F.M. Dostoevsky Library, the Garage Library of Contemporary Art, the Artplay Photo Library, the S.M. Eisenstein Cinema Art Library, Music Library, Library of Urban Stories, and Gaidar's Central City Children's Library [7]. These complexes have a clear positioning and are precisely focused on the target audience. These examples of library spaces have a successfully implemented marketing concept and can serve as a guide for other organizations.

The problem raised in this paper is the lack of up-to-date information about the views of Russian youth regarding the format of the library space, which will encourage them to regularly visit libraries. The purpose of the study is to determine the expectations of buzzers from a modern library, as well as to develop recommendations for improving interaction with representatives of generation Z. The theoretical methods of research were system analysis and synthesis, critical analysis, generalization, and explanation, as well as methods of situational, logical and statistical analysis aimed at solving the problem. During the research, the following methods of collecting empirical information were used: analysis of secondary data from open sources and primary research of motivational factors and expectations of generation Z regarding the perfect library space through an Internet survey on the platform Sociotrix.com [8]. The results of the study can be useful to representatives of the administrative and managerial level of libraries, educational structures and public organizations interested in the youth audience and cooperating with libraries.

The total sample size of the study conducted by the author among representatives of generation Z was 363 respondents. Distribution by gender indicator was as follows: 274 female participants and 89 male participants. Most of the respondents (81.8 %) were aged 18–21, 9.6 % were aged 14–17, 8 % were aged 22–25 years, and a small part of the respondents (0.6 %) were under 14. The social status of most respondents was university students (228 people / 62.8 %), 52/14.3 % of the surveyed combined work and study. An equal number of the respondents study at school and work (7.7 % in each category), students at colleges and special secondary educational institutions accounted for 21 participants (5.8 %). A small percentage were respondents in search of work and applicants (1.4 % and 0.3 % respectively).

The overwhelming majority of the survey participants associate the library with books (291); with the space of silence, comfort, and tranquility (270); with information, science, and knowledge (108); with educational or work process (68). We should also mention the association with space. Furniture (shelves, racks, lamps, tables, etc.) is clearly fixed in the minds of young people (38). The negative connotation is associated with a specific smell and dust (29), non-modernity and outdated format (22), the library staff (20). Thus, the main associative series in relation to libraries among young people has a well-established traditional idea.

Answering the question “Which of the following libraries in Moscow have you visited over the past year?” most of the survey participants spoke in favor of university libraries (161 people), district libraries (80 people), the Lenin Library (76 people), school libraries (74 people). These are followed by the Library of F. M. Dostoevsky (37 people), the Garage Library of Contemporary Art (29 people), the Russian State Library for Youth (23 people), the Photo Library in Artplay (18 people), the Music Library (12 people), the Gaidar’s Central City Children’s Library (8 people), S.M. Eisenstein Film Art Library (7 people), Urban History Library (4 people). These libraries are positioned today as spaces with an authentic interior.

The frequency of visits to libraries by buzzers varied from “very rare” (127 respondents / 35 %) to “once or twice a year” (57 people / 15.7 %),“once or twice a month” (45 respondents / 12.4 %). Only 6.9 % of the survey participants (11 people) regularly visit the library up to 2 times a week. It is worth mentioning separately about the respondents who do not visit any libraries. There were 101 of them among the survey participants (66 people / 18.2 %) who gave a negative answer to the question about the frequency of visits. Thus, buzzers visit libraries based on their personal needs (work / study). Libraries with authentic content and space are visited by a small number of youth representatives, which indicates insufficient work on popularization and promotion among the youth target audience.

The buzzers participating in the survey attributed the following to the main motivational factors of visiting the library: study (78 %), self-development (49 %), the need for privacy (28.9 %), work (13.8 %), for company (12.7 %), habit (4.7 %). A small number of respondents indicated the opportunity to attend events held in the library and the need for a paper edition of books.

The difficulties faced by young people when visiting the library can be divided into several categories. First, it is the quality of the service provided. Here, the buzzers highlight the lack of the necessary book (59 respondents), a poor assortment, especially in terms of modern and foreign literature (27 respondents), as well as the poor condition of books (6 respondents). Difficulties are caused by the process of collecting/returning literature (15 respondents), a long search for a book (19 respondents), and the procedure for issuing a reader’s card (12 respondents). As a barrier to visiting the library, 23 survey participants identified an inconvenient location, as well as a work schedule (11 respondents noted). The survey participants attribute the unfriendliness of the staff to annoying factors (18 respondents) or the absence of library staff in the workplace (9 respondents). Separately, the survey participants highlight the atmosphere. Thus, 25 respondents are dissatisfied with noise, and 24 respondents are dissatisfied with comfort and interior design. A few representatives of the youth audience spoke out for the lack of information about the events held by libraries (11 people) and poor communication with the reader (8 respondents). For buzzers, it is critically important to have modern equipment in the library. Thus, the lack of digital screens for searching and selecting literature, the lack of sockets and weak WI-FI, the need for an electronic guide and a temperature controller were indicated by 12 respondents. The most important resource for representatives of generation Z is time – 16 survey participants consider visiting the library inefficient. Regarding the “privacy/ crowd” indicator, respondents’ opinions were divided – some need silence and a state of privacy, others spoke in favor of spending time with a large company, having a light snack and an open opportunity to communicate loudly. Only 29 survey participants did not experience any difficulties when visiting libraries today.

Answering the question about specific changes in the visited library, the participants gave the following answers. Thus, 52.9 % of young participants (192 responses) spoke in favor of automated search and selection of books. The installation of modern equipment is considered

relevant by 45.2 % of respondents (164 responses), and 151 respondents (41.6 %) see the redesign of the interior of the library space as appropriate. At the same time, 9.9 % of buzzers prefer to organize the library space in a classical style. 30.3 % (110 responses) would like to increase the efficiency of communication between the user and the library, and 22.6 % would like to expand the range of services provided. 21.8 % of respondents (79 responses) were in favor of reducing the frequency of interaction with library staff; 15.2 % of respondents (55 responses) would like to improve the work of staff. The distribution of opinions regarding the criterion of "proximity / accessibility" of the library is as follows: 35.5 % of respondents (129 responses) are in favor of greater accessibility, and 7.4 % of the survey participants (27 responses) wanted to have the library space more closed. To the above answers were added the wishes of additional outlets for recharging gadgets and requests to reduce the noise level in the library space from both visitors and employees. Thus, there is a trend of technological efficiency, increasing the efficiency of communications, accessibility, and stylization of space.

Answering the question about related functions that a library could perform, the survey participants identified a coworking for the purpose of negotiations and group work (48.5 % / 176 responses); a business center for printing, photocopying, and purchasing stationery (38.6 % / 140 responses). The number of those who supported the thematic club was 26 respondents / 34.7 %; 97 survey participants (26.7 %) supported the opportunity to hold conferences and presentations. The entertainment function (quizzes, quizzes, intellectual games, etc.) as related to the library was positively viewed by 105 respondents (28.9 %); 83 people voted for the exhibition hall (22.9 %), and 36 survey participants (26.4 %) voted for the cinema. Separately, youth representatives highlight the need for a light snack (96 / 26.4 %). The criterion of "expansion/narrowing" of the library functions divided the respondents' opinions almost equally. Thus, 56 respondents (15.4 %) voted for the library as a multifunctional space, and 59 people (16.3 %) voted for a highly specialized space with the preservation of intellectual and cognitive functions.

Most respondents consider personal need and interest in reading (158 responses), as well as production necessity (48 responses) to be the main factors that stimulate visiting the library space. Another key factor for buzzers is the comfort and convenience of the library space, including the characteristics of the location, the design of the exterior and interior of the library (154 responses). The technological nature of the library, the speed and ease of obtaining information services is an incentive for 74 respondents to visit the library. The versatility and related services of the library will be the decisive factor of attendance for 27 survey participants. At the same time, only 6 respondents allocate the opportunity to retire in the library. The availability of free time is an important indicator for 19 respondents, and the work of the library staff is significant for 7 participants. A number of respondents indicated that there is no such factor that would encourage them to visit the library (16 responses).

The answers of the survey participants regarding the technologies of the "library of the future" are quite interesting. Thus, the majority of the survey participants (56.2 % / 204 people) supported the presence of an information board in the library for a quick search of literature; 41 % of respondents (149 people) spoke in favor of digitizing books and the opportunity to view a video series (squeeze) on the book. Almost the same number of buzzers is attracted in the future library by closed capsule booths for personal work, as well as AR/VR technologies to create an atmosphere of relaxation or immersion in book realities (40.8 % / 148 respondents). Artificial intelligence, which helps with the selection of literature, is seen as necessary in the work of libraries by 38 % of survey participants (138 people); 28.7 % of buzzers (104 responses) are interested in watching movies based on books, and 27.3 % of respondents are ready to

visit a virtual tour of the library (99 mentions). A small number of young people who took part in the survey demonstrated a radically futuristic view of the library of the future. Thus, 13.2 % (48 people) were in favor of having a voice assistant to discuss what they read, and 10.5 % (38 people) are ready to replace the library staff with android robots. All the above options are ready to be implemented in the "library of the future" by 12.1 % (44 responses). And a very small percentage of participants (2.2 % / 8 responses) do not see the need for technological equipment of libraries soon.

The respondents showed a particular interest in the question of the library's interior design and possible stylized locations. Thus, most survey participants (51 % / 185 responses) would like to see creative zones in the library space. 29.8 % of buzzers were in favor of historical reconstructions (108 responses); the location of innovations and technologies attracts 25.1 % of participants (91 responses); approximately the same number of buzzers was in favor of a futuristic-fantastic atmosphere 24.2 % (88 responses) and eco spatial library 22.9 % (83 responses). The business zone and modern interior styling were noted by 17.9 % and 14 %, respectively; 17.9 % of the participants (65 responses) spoke for different locations organized in a single library space. A small number of young respondents 6.9 % (25 responses) rejected any stylization of the usual library space.

The question about the possible collection of fees for library services caused the expected reaction among respondents. Almost a half (49.6 %) of respondents were ready to pay for related services; 15.4 % of young representatives were ready to pay for the library services in full; 24.5 % of respondents were categorically against it and 10.5 % found it difficult to answer this question. Thus, the issue of pricing of library services directly regulates the flow of visitors.

Separately, it is worth noting the expectations of representatives of generation Z regarding communication channels. Answering the question "How would you prefer to learn about new products, projects and activities of libraries?" most of the survey participants 79.6 % were expected to support social networks (289 responses); 38 % of respondents prefer to receive information independently through the official website of the library (138 responses); 30.9 % of respondents trust bloggers' reviews (112 responses); 28.1 % would like to receive a personal e-mail newsletter (102 responses); 21.2 % of survey participants have enough official announcements on information stands; 20.4 % of respondents see the expediency of advertising in the subway; 9.4 % of respondents see advertising on transport; 8.3 % see advertising on local television; 4.4 % of young people participating in the survey see advertising in the press. "Word of mouth", as a communication channel, was considered effective by 14.6 % of respondents. Thus, systematic work to improve marketing communications and promote the activities of libraries among the youth target audience is a necessary condition for retaining and increasing the loyalty of buzzers soon.

Considering the trends in the development of librarianship in the Russian Federation, as well as the ideas of young people about the design and functional content of libraries, it is advisable to apply a comprehensive marketing approach for positioning and further promotion among target groups in each specific case. This will allow libraries not only to create their own unique "face", but also to be a competitive thematic space among many similar structures.

Positioning is a process of determining the most advantageous position of a company in the market, aimed at creating a unique, positive, and memorable image in the perception of potential consumers that will stand out among competitors. For proper positioning, the following conditions must be met:

– clear identification of the target market and creation of a detailed portrait of its consumer;
– definition of value orientations and key requests of the target audience;

– creating a service concept that will be simple and understandable for the perception of a potential user;

– conducting promotional activities based on the key benefit of the consumer.

The focus on the target audience, the formation of benefits and values for the consumer, as well as differences and advantages over competitors – all the above will help to avoid positioning errors that adversely affect the quantitative indicators of the modern library.

Clear positioning provides the basis for strategic planning, part of which is an integrated approach to marketing. The 7P marketing mix model seems to be the most complete for improving libraries in accordance with the needs of modern youth. The main elements of the complex include [9].

Product: an offer to the market and the consumer. What characteristics should a library product have to meet the demands of the modern market and representatives of generation Z? An ideal library is created based on awareness and understanding of the needs of young readers. It is necessary to work out the symbols of a specific library brand (name, logo, corporate identity); the main and auxiliary functionality of the library space; determine the components of the quality level based on consumer perception; think over the appearance in detail; focus on the variability/assortment of library services; to work out the support and the level of the accompanying service.

Price: the cost of a set of services is calculated based on the value of the product perceived by the consumer, the cost price, the prices of competing companies and the expected level of profit. Even though most libraries are on the balance sheet of administrative and economic units, and provide services free of charge, it makes sense to work out schemes for obtaining profits from related services. The results of the survey reflect the readiness of the youth audience for partially commercial activities of libraries. The “price” component in the marketing complex includes, among other things, package pricing (the sale of several services at a special price level), the availability of seasonal discounts or promotions; the policy of promotional events, the possibility of price discrimination (preferential categories of visitors), etc. The pricing system in the complex is clearly tied to the positioning of the organization in the market.

Place: the place of sale of library services is essentially a distribution model that determines the availability of a product for the target market, as well as the ability to use library services when the need is actualized. Regarding the library space, it makes sense to work out in detail the conditions and rules for the layout of books, as well as the management of library stocks.

Promotion: ways to disseminate information about the activities of a particular library. Image advertising, promotions, SEO promotion, PR strategy, direct marketing, participation in special events and other promotion tools will allow you to regularly maintain communication with the consumer. The survey conducted by the author of the article revealed the communication channels preferred by the “digital generation”, which must be considered when developing a marketing package.

People: all people who can directly or indirectly influence the attitude of consumers to library services. The survey showed that library staff can become a factor of rejection. Attention should be paid to the psychological features of working with modern youth, as well as improving communication skills with visitors to the library space.

Process: the visitor’s direct “point of contact” with the library. It is the convenience of receiving a service or using it that forms the emotional attachment of visitors. Speed in the digital age is a key indicator of an efficient process. The time resource directly determines the willingness to receive information services by generation Z.

Physical evidence: the interior and exterior of the space is one of the most important factors

shaping the image of a particular library. Emotional, organic, and aesthetic feelings that can originate in buzzers in locations can form a high level of loyalty to the library. Special attention should be paid to the technological improvement of the library space.

Thus, a clear positioning, uniqueness, and accessibility of the physical and virtual space of libraries, as well as a well-developed marketing strategy, can interest the younger generation. Representatives of generation Z feel comfortable among the abundance of information and information noise, are mobile enough, welcome technological innovations, do not have rigid behavioral frameworks and established patterns. They represent the most diverse structure of personalities and individuals who are attracted by creativity, new sensations, new experiences. Relying on these characteristics of modern youth will allow libraries to build a competent positioning concept, work out a marketing strategy and improve communications.

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Трансформация библиотечного пространства: ожидания молодежи и маркетинговый подход

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Ключевые слова и фразы: библиотека; маркетинг; мотивационные факторы; пози-

ционирование; поколение Z.

Аннотация. Данная статья посвящена исследованию отношения представителей молодежи к формату библиотечного пространства, а также определению мотивационных факторов, влияющих на частоту пользования услугами библиотек. Целью исследования является выявление ключевых показателей привлекательности современного пространства библиотек в восприятии поколения Z. Методами исследования стал вторичный анализ опыта организации деятельности ведущих библиотечных комплексов мира и РФ, а также первичное исследование мнений представителей поколения Z в виде интернет-опроса. Результатом стала выработка практических рекомендаций по совершенствованию библиотечного пространства на основе элементов комплекса маркетинга для повышения лояльности современной российской молодежи.

UDC 519.257

Trends in the Turnover of Foreign Trade of the Russian Federation through the Prism of Statistical Research

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Key words and phrases: foreign trade of the Russian Federation; import; trend line; the turnover of foreign trade of the Russian Federation; the volume of trade turnover of the Russian Federation; statistical methods; export.

Abstract. The economy of any modern country cannot develop without proper interconnection with other countries of the world. At this stage, it is assumed that the foreign trade of the Russian Federation is in a very difficult situation, which is why there is a possibility that its indicators will tend to decline. The purpose of the study is to analyze and calculate indicators of the volume of trade in foreign trade of the Russian Federation for the near future. In this regard, the following tasks were set: to study the aspects of export and import, to calculate statistical indicators, to build a trend line based on the data obtained and summarizing the data. Statistical methods, such as the period consolidation method, the moving average method, and the analytical equalization method, were used as analysis tools. As a result of the measures taken, it was revealed that the trend line built as a result of the studies carried out has a downward slope. This suggests that in the near future the volume of foreign trade of the Russian Federation will be reduced.

In modern conditions of the development of the world economic space, international relations are one of the most dynamically developing spheres of the economy, but at the same time, they are significantly influenced by the foreign policy situation. Foreign trade is one of the key factors in the development of international economic relations that contribute to increasing and maintaining the competitiveness of national economies, being, among other things, one of the most important sources of non-tax revenues of the state. In this regard, the study of the development of foreign trade in the current economic conditions is an urgent area of analysis. We consider in more detail the two aforementioned components of foreign trade: imports and exports.

Imports include the import of goods, works, services and results of intellectual activity into the customs territory of the Russian Federation from abroad, without obligations to export back. The state purchasing the goods is the importer, and the state supplying the goods is the exporter. In addition, companies that supply goods and vice versa are also called importers. Currently, the

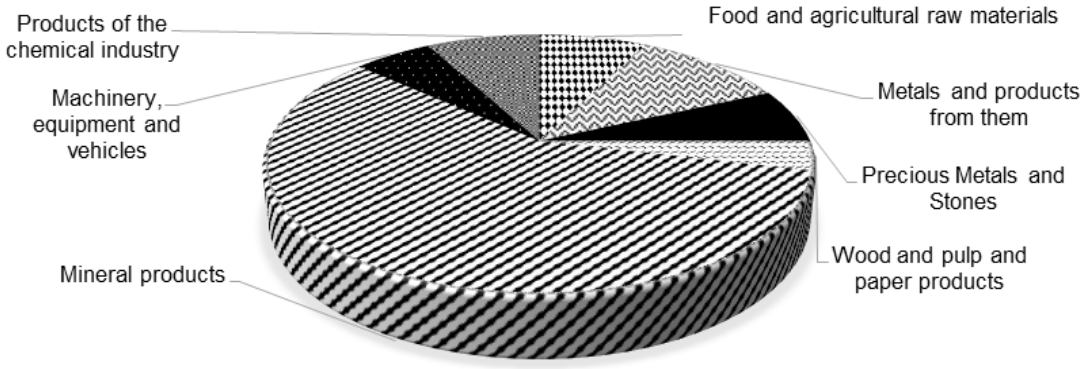

Fig. 1. Structure of export trading in the Russian Federation for 2021

Russian Federation imports various goods that it is advisable to divide into the following groups. We consider some of them.

The first group is electronics and technology. This group includes phones, computers, laptops, refrigerators and much more. The main suppliers are China and Belarus.

The second group is cars. In 2021, 338.9 thousand units of passenger cars were imported into the territory of our country in the amount of $7990.0 million; 33.8 thousand trucks worth $2271.7 million; 1481.3 tons of spare parts for all types of machines worth $10,665 million.

The third group is textiles and shoes. In 2021, in terms of value, the share of supply in this import group increased by 16.2 %, in physical terms by 11.5 %.

Through imports, several goals were achieved, such as expanding production and increasing profits by mastering new domestic markets; expansion, as well as modernization of production potential; expansion of the assortment; saving on replacement of equipment and raw materials with more efficient foreign products. The Russian Federation is a major exporter, and the main share of supplies in the reporting year was: mineral products (57.85 %) (of Russia's total exports); metals and products from them (10.70 %); products of the chemical industry (7.95 %); food and agricultural raw materials (7.60 %); precious metals and stones (6.70 %); machinery, equipment and vehicles (5.55 %); wood and pulp and paper products (3.65 %).

The structure of goods and services export is shown in Fig. 1.

Thus, it is clearly shown that mineral products are in the greatest demand, and machinery, equipment, vehicles, wood and pulp and paper products are in the smallest demand.

Having analyzed all the data, we also revealed the export goals, which consist in: protecting the interests of the state; countering international terrorism; creating conditions for the integration of the economy; increasing the foreign exchange resources of enterprises is an incomplete list of goals and objectives that the state solves through exports.

Statistics of foreign trade in services is a relatively new area, the rapid development of which is associated with a significant increase in international trade in services, which needed to be given not only an adequate quantitative assessment (which was especially difficult to do, taking into account the specifics of services), but also to analyze the current state, identify underlying trends, determine the geographical structure and proportion of various types of services. In order to fully study the aspects of the turnover of foreign trade of the Russian Federation, it is necessary to determine the main countries with which our country performs the main economic operations. Table 1 presents the countries with which Russia has the largest trade turnover, both in the export sector and in the import component. This information is necessary for analyzing

Table 1. Share of major countries in foreign trade of the Russian Federation from 2013–2021, %

№	Country	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	China	10.54	11.29	12.07	14.11	14.86	15.75	16.51	18.34	17.52
2	Germany	8.90	8.95	8.70	8.70	8.54	8.67	8.01	7.34	7.22
3	Netherlands	9.02	9.35	8.35	6.89	6.75	6.87	7.36	5.06	6.04
4	Belarus	4.06	4.02	4.64	5.15	5.24	4.86	4.87	4.95	4.68
5	USA	3.28	3.73	3.97	4.25	3.96	3.66	3.96	4.24	4.44
6	Other countries	64.20	73.66	62.27	60.90	60.65	60.19	59.29	60.07	60.10

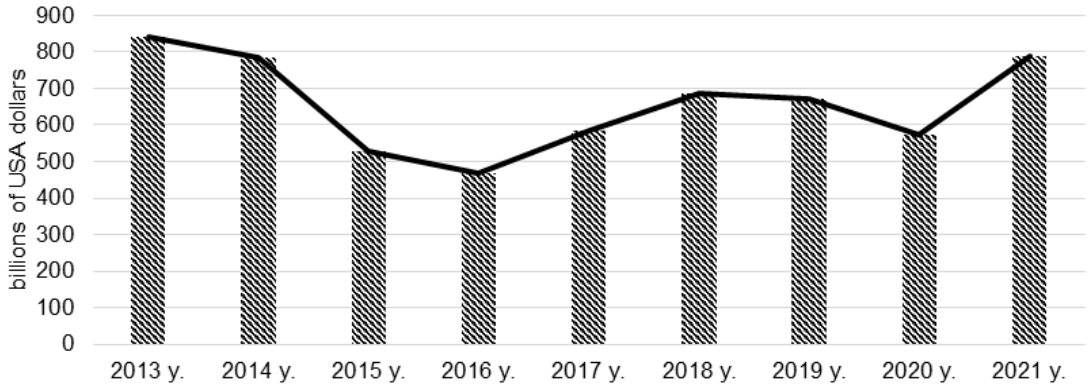

Fig. 2. Change in the volume of trade in foreign trade of the Russian Federation for 2013–2021

international trade, assessing the logistics routes for the supply of Russian products, studying products supplied and exported from the country annually, and not only.

In order to calculate the aligned values, you need to find the key figures a and b. So, $a = 5928.3/9 = 658.70$; $b = -335.4/60 = -5.59$.

Let's substitute these values into the equation $\hat{y} = a + bt$. The corresponding values are displayed in Table 1. We consider the trends in changes in the turnover of foreign trade of the Russian Federation through the prism of statistical research. Figure 2 shows the quantitative values of the volume of trade in foreign trade of the Russian Federation from 2013 to 2021.

The volume of trade in foreign trade of the Russian Federation for 2013–2021 did not have a stable trend, prone to any change in one direction or another, which indicates the instability of the indicator and its reaction to various factors of the external and internal environment. That is why there is an urgent need for serious regulation of this economic category by state bodies.

To identify the trend in the volume of trade in the Russian Federation, we will analyze the data using statistical methods. To this end, we will build an auxiliary table.

It is important to note that the most important stage of statistical research is the construction of a graph based on the results of the studies and visual representation of the data. On the graph, we note the following points and their numerical values: on the X axis we will postpone the years for which the data indicated in Table 1 were obtained, and on the Y axis we will directly postpone the value of turnover volumes in billion US dollars. One of the advantages of this statistical research model is the ability to build a trend line with subsequent forecasting, in which

Table 2 - Auxiliary table to identify the general trend of changes in foreign trade turnover of the Russian Federation for 2013–2021

Year	Turnover volume, in billions of dollars	Period Consolidation Method	Moving average method		Analytical Alignment Method			
			For three years					
		Average for three years	Sum	Average	Year number, t	Squared Number of Year, t^2	Product of parameters, yt	Equalized values, $\hat{y} = a + bt$
2013	842.2	717.67	-	-	–4	16	–3 368.8	681.06
2014	784.4		2 153.0	717.67	–3	9	–2 353.2	675.47
2015	526.4		1 778.9	592.97	–2	4	–1 052.8	669.88
2016	468.1	580.43	1 579.6	526.53	–1	1	–468.1	664.29
2017	585.1		1 741.3	580.43	0	0	0.0	658.70
2018	688.1		1 945.2	648.40	1	1	688.1	653.11
2019	672.0	678.0	1 932.7	644.23	2	4	1 344.0	647.52
2020	572.6		2 034.0	678.00	3	9	1 717.8	641.93
2021	789.4		–	–	4	16	3 157.6	636.34
Total	5 928.3	–	–	–	0	60	–335.4	5 928.30

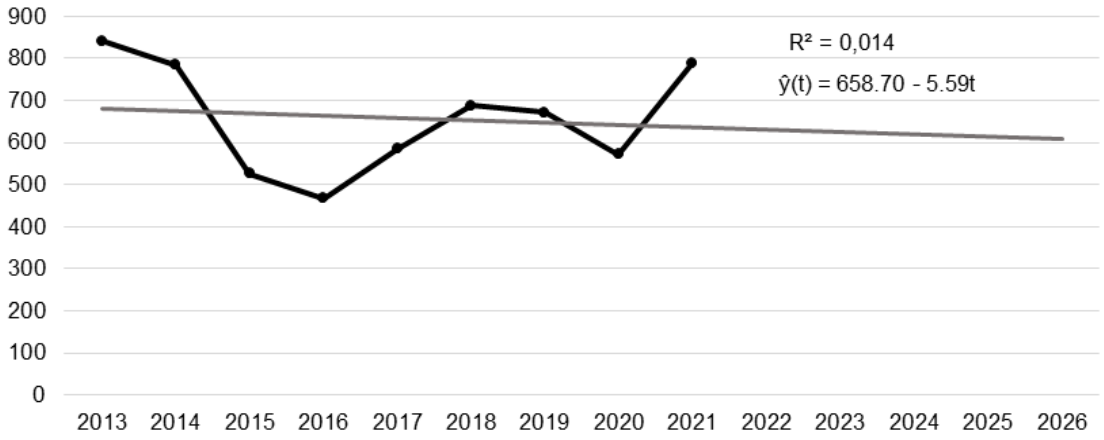

Fig. 3. Dynamics of foreign trade turnover of the Russian Federation, US billion dollars

it is possible to track how the indicator we are studying will change in the foreseeable future. The main tool for graphical analysis is trend. Charles Doe gave the following understanding of the trend: when a trend occurs, various fractures appear on the price graph, moving in the direction of price movement. So, the trend line is a universal tool for technical analysis, with which you can identify in which direction the analyzed indicator is moving.

Calculations have shown that the average turnover of foreign trade of the Russian Federation for 2013–2021 was US 658.70 billion dollars. On average, the turnover of foreign trade decreased by $5.59 billion annually. Fig. 3 clearly shows that the volume of trade in the Russian Federation with continuing foreign policy trends will decrease until 2026, which we analyze. It amounted to about US 600 billion dollars in this reporting period, respectively.

Having analyzed all the above, we can conclude that in the economic sphere a lot of attention is paid to trade aspects, and foreign trade is no exception. As a rule, such studies are based on the materials of official statistics of countries and international organizations, as well as on official methodological recommendations on statistics developed by international organizations. One of the priority areas of Russia in foreign trade is close communication with the CIS member countries (Belarus, Moldova, Armenia, Azerbaijan, etc.), since the interest of the Russian Federation lies in the presence of a large market for finished products. As for exports and imports, the first indicator exceeds the second, and displays the trade balance in a positive amount. According to the Federal Customs Service of the Russian Federation, for 2021. Russian foreign trade turnover grew by 37.9 % (789.4 billion dollars), which exceeded not only the level of pandemic 2020, but also the pre-crisis 2018–2019. Thus, foreign trade is one of the key factors in the economic sphere, reflecting the general situation of the country.

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Тенденции изменения оборотов внешней торговли РФ через призму статистических исследований

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Ключевые слова и фразы: внешняя торговля РФ; импорт; линия тренда; обороты внешней торговли РФ; объемы товарооборота РФ; статистические методы; экспорт.

Аннотация. Экономика любой современной страны не может развиваться без должной взаимосвязи с другими странами мира. На данном этапе предполагается, что внешняя торговля РФ находится в очень непростом положении, именно поэтому существует вероятность того, что ее показатели будут иметь тенденции к сокращению. Целью исследования данной статьи является анализ и расчет показателей объемов товарооборота внешней торговли РФ на ближайшую перспективу. В этой связи выделены следующие задачи: изучение аспектов экспорта и импорта, расчет статистических показателей, построение линии тренда на основе полученных данных и обобщение данных. В качестве инструментов анализа используются статистические методы, такие как метод укрупнения периодов, метод скользящей средней и метод аналитического выравнивания. В результате проведенных мероприятий было выявлено, что линия тренда, построенная в результате проведенных исследований, имеет нисходящий наклон. Это говорит о том, что в ближайшее время объемы внешней торговли РФ будут сокращаться.

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COMPONENTS OF SCIENTIFIC AND TECHNOLOGICAL PROGRESS
№ 6(72) 2022
SCIENTIFIC AND PRACTICAL JOURNAL

Manuscript approved for print 21.06.22
Format 60.84/8
Conventional printed sheets 7.67
Published pages 5.46
200 printed copies

16+

Printed by Zonari Leisure LTD. Paphos