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CONTENTS / 目录

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Russian SMEs' decision to enter foreign markets

A.V. Trachuk[1, 2]
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Abstract

This study focuses on analysing the decision-making processes of Russian small and medium-sized enterprises (SMEs) when entering international markets. Key aspects of internationalisation are examined, including market selection, entry strategies and the factors that influence these decisions. Particular attention is paid to the characteristics of SMEs, such as resource constraints and limited opportunities, which affect their behaviour in international markets. Concepts of internationalisation of new international ventures (INVs) are explored, including different types of start-ups and the concept of 'born globals'. The role of entrepreneurial dynamism, flexibility, and motivation in overcoming competitive disadvantages against large corporations is discussed. Issues related to the impact of operating in foreign markets on knowledge accumulation and improved business efficiency, particularly under conditions and restricted access to resources, are also addressed.

An analysis of 421 Russian SMEs revealed that the choice of internationalisation strategy is significantly influenced by factors such as the effectiveness of innovation activities and the industrial sector of the company. Despite successes in international operations, the current situation poses challenges that are leading to reduced investment in innovation. Geopolitical risks increase costs and discourage companies with a horizon-expanding strategy from exploring new markets. Decisions about external market choices are based on personal and inter-firm networks. Long-term experience in foreign markets facilitates the transition to developed country markets and promotes innovation. It is common for Russian SMEs to establish subsidiaries and branches abroad without a step-by-step approach.

Keywords: internationalisation strategy, small and medium enterprises, internationalisation models, external market selection, entering foreign markets.

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俄罗斯中小企业进入国外市场的决策

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简介
本研究分析了俄罗斯中小企业在进入国际市场时的决策过程。研究探讨了国际化的主要方面，包括市场选择、进入战略和影响这些决策的因素。 特别关注中小企业的特点，如资源和能力限制，这些因素影响着它们在国际市场上的行为。还探讨了新兴国际企业（包括不同类型的初创企业）的国际化概念，以及 "天生全球主义者 "的概念。讨论了中小企业的创业活力、灵活性和积极性在克服大公司竞争优势方面的作用。报告还谈到了在外国市场开展业务对创造知识和提高公司效率的影响，特别是在受到制裁和资源有限的情况下。
根据对 421 家俄罗斯中小企业的分析发现，创新绩效因素和行业归属对国际化战略的选择起着重要作用。尽管在国际活动中取得了成功，但目前的形势造成了困难，导致创新投资减少。 地缘政治风险增加了成本，阻碍了追求扩大视野战略的公司寻找新市场。选择国外市场的决定是在人际关系和公司间合作的基础上做出的。在国外市场的长期经验会刺激企业向发达国家市场过渡，并增加创新活动。俄罗斯中小型企业的特点是在国外市场建立子公司和分支机构，不需要逐步干预。
关键词： 国际化战略、中小企业、国际化模式、外部市场选择、进入外部市场。

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Introduction

Internationalisation decision-making processes are complex [Andersson, 2011] and involve many different decisions [Santos-Alvarez, García-Merino, 2010; Vlacic et al., 2023]: market selection, choice of internationalisation strategy, choice of entry model for a new market analysis and factors influencing the choice of this model [London, 2010; Buckley, Casson, 2019]. At the same time, the authors [Crick, Spence, 2005] suggest that none of the existing theories of internationalisation can fully explain decision-making in the internationalisation process.

The purpose of this study is to analyse various decisions on entering foreign markets and factors influencing these decisions by Russian small and medium-sized enterprises (hereinafter referred to as SMEs).

Research on the internationalisation of small, internationally competitive firms from the early years of their existence began in the late 1980s and gave rise to the concept of internationalisation of new international ventures (INVs). First of all, this concept distinguishes between different types of new international enterprises that differ in their internationalisation strategy. The following were distinguished: export-import start-ups, transnational trading companies, geographically oriented start-ups and global start-ups. Recent studies have described another type of new international firm, the 'born globalist' (BG), which differs from the previous types mainly in the speed of internationalisation [Leis, 2024], since this type of firm is conceived as an international firm from the moment of its creation, as well as in its high innovative activity.

It should be noted that small and medium-sized enterprises differ from large firms in their specific characteristics, which may influence their decisions to enter international markets [Fernandes et al., 2023]. Such specific characteristics include: limited access to financial capital, structural constraints, management and skills constraints, and financial and human resource constraints [Johanson, Vahlne, 2003; Crick et al., 2020].

However, other researchers, such as [Paul et al., 2017], have shown that SMEs can be competitive despite their limitations due to their behavioural strengths. For example, SMEs tend to be characterised by entrepreneurial dynamism, flexibility and higher motivation, while large firms benefit from economies of scale and the availability of financial and technological resources. The works [Zacharakis, 1997; Paul et al., 2017] show that large firms are more effective in overcoming barriers associated with internationalisation because they have greater resources, competencies and capabilities than small firms.

In addition, the studies discuss quite extensively the extent to which firms' activities in various external markets affect the efficiency of their activities. The discussion relates to the extent to which firms' activities in external markets contribute to the accumulation of knowledge about how to improve product quality, improve management skills,

use new technologies, build relationships with partners and apply this knowledge to improve their activities. Does accumulated knowledge influence the internationalisation strategy? What characteristics should a company have in order to use the acquired knowledge and skills to improve its performance? These issues are particularly interesting in the context of small and medium-sized enterprises, as they have to operate with limited resources, the acquisition of which in the Russian market depends not only on the amount of free cash in the SME company and access to financial capital, but also on sanctions restrictions, including access to technology and equipment. Therefore, an entrepreneur deciding to enter foreign markets is faced not only with the question of designing the internationalisation strategy itself, but also with the question of contextual factors that can influence the success of doing business in foreign markets.

For SMEs, internationalisation for business expansion is a serious step that requires analysing a complex external environment, finding an optimal balance in resource allocation, and strategically aligning external and internal environmental determinants to make a profit in different foreign markets [Fernandes et al., 2023].

The article is structured as follows. The first part presents studies of factors influencing decisions on entering foreign markets - decisions on internationalisation, choice of internationalisation strategy, choice of market and possibility of cooperation. The second part of the article is devoted to an empirical study of the influence of factors on the decision-making of Russian SMEs. The final part contains the main findings.

1. Theoretical review of the literature

1.1. Decision to internationalise

Currently, there are several classic theories explaining the decision to internationalise: the Uppsala model of internationalisation [Johanson, Vahlne, 1977], the resource-based approach [Barney, 1991], the network approach to internationalisation [Coviello, Munro, 1997] and Dunning's eclectic paradigm [Dunning, 1988].

Thus, the Uppsala model of internationalisation is that a company starts international expansion gradually, using the accumulated experience and knowledge from the domestic market and adapting it to new conditions in foreign markets. In the initial stage, the company starts its international activities by exporting goods to countries that are similar to the domestic market, where risks and uncertainties are lower. The company then increases its presence in foreign markets, deepening its involvement through the opening of representative offices, the creation of joint ventures and, finally, through foreign direct investment (FDI). At the same time, international expansion is based on the experience and knowledge acquired by the company in its home market. The transition to a new market requires the adaptation of this knowledge and skills to local conditions.

According to J. Barney's resource-based view (RBV), the source of a company's competitive advantage is unique resources and capabilities that are difficult for other organisations to copy or imitate. The resource-based approach explains why some companies successfully enter international markets while others fail. A company with unique resources seeks to transfer them to international markets to increase profits and expand its influence. If a company has rare and valuable resources, such as brands, technology, or management talent, it can take advantage of global opportunities.

The network-based view of internationalisation, proposed by D. Coviello and A. Munro in 1997, focuses on the importance of social networks and inter-firm relationships for the successful development of international markets [Coviello, Munro, 1997]. Within this approach, internalisation is seen as the result of interactions between different market actors, such as customers, suppliers, partners and government agencies.

Dunning's eclectic paradigm was proposed by M. Dunning in the 1980s and combines several approaches to explain internationalisation. It includes four main components: ownership advantages, market opportunities, investment availability and managerial preferences [Dunning, 1988]. Ownership of proprietary assets suggests that firms with unique technologies, brands or other internal resources are better able to enter international markets; the presence of market opportunities suggests that firms seek markets with the greatest potential for demand and expansion; the availability of investment and the ability to raise capital determine a firm's ability to conduct international operations; and managerial preferences signal that decisions to enter international markets are made by managers based on their assessment of all of the above factors.

However, an increasing number of studies show that internationalisation decisions are influenced by internal and external factors, such as the strategic orientation of the firm making the decision [Kollmann, Christofor, 2014], the foreign language skills of the decision-maker [Cannone, Ughetto, 2014], and the existence of contacts, relationships and cooperation with firms from other countries [Xie, Amine, 2009; Castellacci, 2014]. For example, a quantitative study of 871 Dutch SMEs [Hessels, Terjesen, 2010] showed that the decision maker's perception of the increasing international presence of its network partners (competitors, customers and suppliers) explains the decision to internationalise.

Among the external factors, the influence of the national and institutional context is highlighted. The studies [Meyer, Nguyen, 2020; Meyer et al., 2023], which are devoted to institutional environmental factors that influence the success of business in foreign markets, show the important role of business conditions in developed and developing countries. The work of M. Peng [Peng, 2003] shows that all countries with developing economies differ from each other in terms of institutional rules and the rate of change of the external environment.

Studies of the institutional environment identify three main aspects that influence business behaviour and development: (1) government regulation of business, (2) the knowledge and skills of the country's population, (3) the value system shared by society. These three aspects are

referred to as direct influencing factors (in some studies the microenvironment of the firm) and political, economic, social and cultural factors are referred to as indirect influencing factors (or the macroenvironment of the firm).

In summary, an institutional approach to corporate analysis has emerged in the literature, reflecting the study of the strategy and behaviour of firms as a result of the interaction between institutions and firms.

In addition, a number of studies examine the influence of industry factors on the success of firms in foreign markets. For example, [Chang, 2011] points out that the success of a company in foreign markets depends on the specifics of the industry. Industry factors help to better understand the process of internationalisation [Belso-Martínez, 2006], but the most important factor at the industry level is the level of competition.

1.2. Choosing an internationalisation strategy

The choice of internationalisation strategy plays a key role in determining the future success of an SME's international operations. There are different approaches to classify such strategies. For example, the authors of [Barlett, Goshal, 2000] proposed a classification of strategies according to the level of analysis of local conditions and integration into the international market into: (1) a replication strategy, which does not require special measures to adapt to local market conditions; (2) a multilocal strategy, in which each subsidiary operates autonomously and adapts its products as much as possible to the preferences of consumers in foreign markets, and also focuses on product innovation and marketing; (3) a global strategy, which involves the release of standardised products in each foreign country of presence and the absence of product adaptation to the needs of local markets; (4) a transnational strategy, which involves integration when entering foreign markets and the transfer of competencies from the parent company to the subsidiaries for their most effective use.

In [Jeannet, Hennesey, 2003], a classification of strategies is presented based on the EPRG model [Wind et al., 1973], which identifies the market strategy of adapting products to the needs of foreign markets. This model identifies an ethnocentric (intranational) approach, which does not involve the adaptation of manufactured products; a polycentric (multinational) approach - with a high degree of product adaptation; a region-centric (megaregional) approach - using uniform marketing approaches in similar countries; and a geocentric (global) approach.

The authors [Rugman, Verbeke, 2 004] offer their own classification of foreign economic strategies based on the geography of coverage. They focus on the choice between a regional strategy (within a region), a strategy to develop two regions, a strategy to develop distant regions and a global strategy.

In [Finkelstein et al., 2007], a classification is developed that takes into account the level of risk involved in foreign operations. According to the authors, each strategy can be applied in both established and new markets, increasing the number of possible combinations. For example, the strategy of 'expanding horizons' implies a rapid expansion of the company by entering new geographical markets with proven products and ideas. The 'reshaping' strategy represents a transition to new business opportunities that change the very nature of the company. The 'follower to leader' strategy involves moving to a leadership position under new management and renewing the strategy after a long period of stability. Finally, the 'storming' strategy describes the rapid growth of a young company that quickly achieves a significant position in the market.

The authors of the study [Kotler et al., 2015] consider a classification of internationalisation strategies based on the substantive aspects of a company's behaviour in the market. It includes the management of a portfolio of activities ("focused portfolio", reduction of vertical integration, market presence, consolidation through mergers and acquisitions, network strategies, partnerships and virtualisation) as well as competitive tactics (creation of new rules of the game, innovation and brand strategies).

A careful analysis of the internationalisation process allows us to differentiate between companies according to the type of internationalisation process they undergo. This distinction has been introduced and generalised in [Knight, Liesch, 2016]: some companies enter foreign markets gradually, while others are initially 'born globalists'. The latter is closely related to the choice of internationalisation model.

1.3. Choosing an internationalisation model

Another important decision is the choice of the internationalisation model, which is described in [Pinho, 2007; Nabi et al., 2024] as one of the most critical decisions in the internationalisation process. The study [Root, 1994] dedicated to internationalisation describes models such as selling goods for export, technology transfer, forming strategic alliances, subcontracting, investing, creating joint ventures, opening a branch abroad.

The purpose of this article is not to describe these strategies in detail, but to identify those used by Russian SMEs and to understand the factors that influence the choice of solution.

Among the factors that have a positive impact on the initial decisions about the entry model into a foreign market for small and medium-sized enterprises, the entrepreneurial orientation of the decision maker as well as his ability to establish contacts are indicated [Ibeh, Kasem, 2011; Kaur, Sandhu, 2013; Heydari et al., 2023], and subsequent entries into foreign markets are explained by the factor of accumulated knowledge and experience [Peng et al., 2011]. The study [Hessels, Terjesen, 2010] also shows that the decision maker's perception of favourable conditions for access to knowledge, technology, financial capital and production costs in the domestic market explains the choice of entry model into foreign markets (in line with resource dependence theory). In addition, the work [Liesch, Welch, 2024] shows that the choice of internationalisation model is linked to the desire of firms to find the best (more productive) use of the firm's resources, which requires deep knowledge

of the firm's technological base and access to resources provided by network partners. This knowledge cannot be acquired from outside, as it is unique to each specific firm. That is, experience helps to understand which internationalisation model allows the best use of the firm's resources, including combinations with the resources of foreign partners.

According to the view presented in [Kaur, Sandhu, 2013], decisions on the choice of entry model depend on the nature and state of the industry in which the firm operates.

1.4. Choosing a foreign market

Another important decision considered in internationalisation studies is the choice of the foreign market in which the SME intends to operate [Ojala, Tyrväinen, 2008; Francioni et al., 2013].

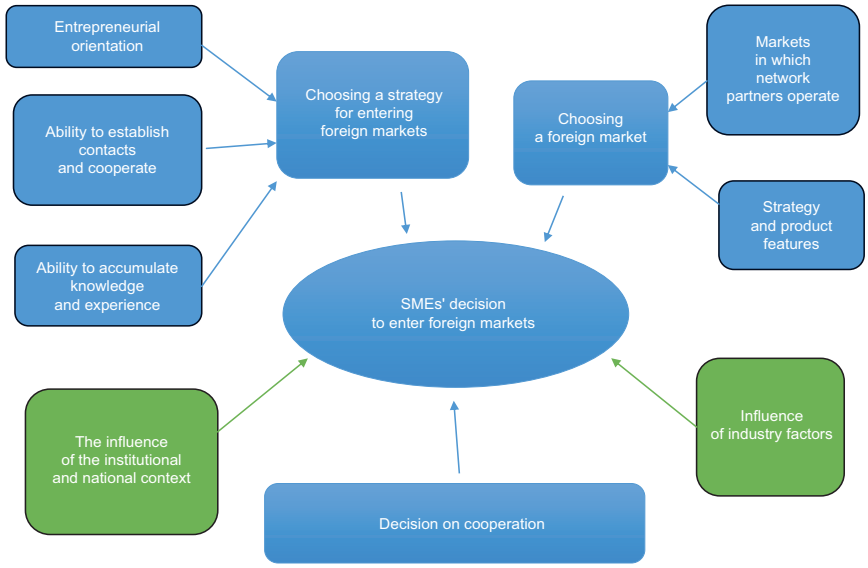
[Appiah, 2023] shows the importance of factors influencing market choice decisions, such as social and business connections, as well as the markets in which network partners operate. However, the authors [Ojala, Tyrväinen, 2008] also describe an exception: the decision of Finnish software SMEs to enter the Japanese market, which was based on strategic factors and not simply on network relationships with partners. The company explains this choice by saying that its products are niche and that there are many IT-based manufacturing companies in Japan, so there are many target customers.

1.5. Decisions on cooperation

Research describes two types of decisions regarding collaboration and engagement. According to [Spence et al., 2008], firms decide on collaboration and its forms depending on their objectives and the position of the partners in the value chain. The author of the article [Castellacci, 2014] found that SMEs decide to collaborate to support their activities in a foreign market or when they lack the necessary resources. [Camuffo et al., 2007] shows that collaboration places greater obligations on SMEs to maintain international activities and that such firms tend to devote more resources to achieving success in a foreign market.

The conceptual model of this study is shown in Figure 1.

Fig. 1. Conceptual model of the study



2. Methodology and findings of the study

The empirical analysis is based on panel data of Russian small and medium-sized enterprises from three industries: IT, manufacturing and retail - from 2019 to 2023. The sample includes data from 409 observations of firms with 8 to 417 employees. A limitation of the sample is its bias towards companies located in Moscow and the Moscow region, St. Petersburg and the Leningrad region, due to better accessibility of respondents. The characteristics of the enterprises are shown in Table 1.

During the research, we analysed the following characteristics of SME export activities:

- presence of export activities (export of products);
- volume of export activity (share of exports in total turnover);
- presence of a foreign affiliate (subsidiary, etc.);
- participation in different forms of cooperation in foreign markets;
- the market in which the SME operates (developed or developing markets).

Since we assume that the decision to enter foreign markets is influenced by the accumulation of knowledge and experience, which is reflected in the duration of work in foreign markets, we analyse the company data over 5 years - from 2019 to 2023.

In order to analyse the decisions on the choice of the internationalisation strategy, we divided the studied SMEs into four groups - according to the use of one of the internationalisation strategies (Exp_strat):

- Group 1 includes companies with an 'expanding horizons' strategy - these are companies that have demonstrated rapid expansion into new geographic markets based on existing products that have proven effective in foreign markets (Exp_strat1);
- Group 2 includes companies that have adopted a transformation strategy, i.e. they have transformed their enterprise to operate successfully in foreign markets (Exp_strat2);
- Group 3 includes companies with a 'from laggards to leaders' strategy, where a company that has been operating without change for a long time reaches high positions thanks to leadership in a new strategy (Exp_strat3);
- Group 4 includes companies using the 'storming' strategy, i.e. those that have demonstrated a quick and successful start to their activities (Exp_strat4).

Table 1
Statistics of SME respondents (%)

Company characteristics	2019	2023	Panel study
By sector			
IT	14	14	14
Industry	32	32	32
Retail	54	54	54
Total	100	100	100
By average number of employees			
Up to 15 people	5	3	4
16–49 people	9	7	8
50–99 people	14	16	15
100–149 people	44	49	47
150–299 people	16	14	15
300 people and more	12	11	12
Total	100	100	100
By export activities			
Share of exporters that only sell goods	35	38	37
Share of exporters with a foreign affiliate	17	34	25

As factors influencing the choice of internationalisation strategy, we use factors of the internal environment: strategic orientation of SMEs, indicators of innovation activity, the presence of a foreign branch/subsidiary dependent companies (hereafter referred to as SDCs), the presence of cooperation agreements with foreign companies.

Table 2 shows the characteristics of SMEs in the context of the groups formed.

The Pearson chi-square test and the Kruskal-Wallis test for comparing means were used to assess the significance of differences.

It should be noted that most of the enterprises using these strategies have reduced their R&D expenditure, but at the same time they have started to introduce more new products to the market, focusing on the needs of the local market. This trend can be explained by the increased competitive pressure in the market, with SMEs more involved in imitation than in in-house development.

To analyse the influence of factors on the choice of market, the following variables were added: the industry in which the enterprise operates and the direction of the export markets (developed countries or developing countries (Exp_market)) (Table 3):

- Exp_market1 – companies that do not export during the period analysed;

Table 2
Descriptive characteristics of enterprises surveyed by export groups

Company characteristics		1st group	2nd group	3rd group	4th group	Statistical significance of differences
Average number of employees	2019	106	124	62	38	0.000
	2023	179	97	38	34	
Participate in different forms of cooperation with foreign enterprises (%)	2019	15	22	11	9	0.000
	2023	42	36	7	12	
Have a foreign branch (%)	2019	89	63	0.0	0.0	0.005
	2023	92	87	0.0	0.0	
Implement process innovations (%)	2019	15	34	28	6	0.002
	2023	22	39	31	11	
Implement product innovations (%)	2019	6	9	11	8	0.002
	2023	18	22	24	12	
Engage in marketing innovation and creating better value for customers (%)	2019	35	24	18	19	0.002
	2023	52	39	31	29	
Engage in research and development (%)	2019	0	0	0	0	0.021
	2023	0	12	0	0	
IT companies (%)	2019	4	1.3	0	4	0.000
	2023	12	36	3.9	2	
Industrial companies (%)	2019	23	29	17	38	0.001
	2023	28	36	13	31	
Retail companies (%)	2019	48	27	25	76	0.000
	2023	54	42	4	74	
Number of observations		49	111	136	113	

- Exp_market2 – companies that exported only to developing countries throughout the period;
- Exp_market3 – companies that only exported to developed country markets throughout the period analysed;
- Exp_market4 – companies that exported to both developing and developed countries throughout the period analysed.

The Pearson Chi-square test was used to assess the significance of differences.

It should be noted that all groups of enterprises exporting to developed markets or to developed and developing markets differ significantly from enterprises exporting only to developing markets in terms of their involvement in product and process innovation. In both 2019 and 2023, exporters operating in developed markets were more likely to be involved in all types of innovation activities than exporters operating only in developing markets.

In addition, the industry affiliation factor is statistically significant at a level of less than 0.001, indicating its importance for all groups of exporting enterprises.

In order to analyse the influence of factors on the choice of internationalisation model, the variables of the internationalisation model (Regim) were added:

- Regim1 – companies that only export goods or technologies;
- Regim2 – companies that form/are part of a group of companies in a strategic alliance abroad;
- Regim3 – companies that have made foreign investments;
- Regim4 – companies working on a subcontracting basis with foreign firms;
- Regim5 – companies that create joint ventures in foreign markets or open their own divisions, branches, and subsidiaries.

As a general approach to the empirical assessment of factors and their influence on the decision to internationalise, we use models of the form:

$$Y_i^t = \alpha_1 + \sum_{j=1}^{4} \alpha_{j+1} \text{Exp\_status}_j + \alpha_5 \text{Size}^{t-1} + \alpha_6 \text{Foreing}^{t-1} + \\ + \sum_{k=1}^{3} \alpha_{k+6} \text{age}_k + \sum_{l=1}^{3} \alpha_{l+3} \text{sector}_l \cdot \quad (1)$$

We use the following indicators as dependent variables to characterise the influence of the export strategy and other factors on internationalisation decisions: the number of foreign markets in which the company operates, the introduction of a new product to the market and/or the introduction of a new technology, an increase in the share of exports, and the opening of its own branch/subsidiary/associate abroad. To estimate the dependent variables, which take discrete values from 0 to 1, we use a standard probit regression of the dependence of the corresponding indicator in 2023 on the value of this indicator in the previous observation period - 2019,

Table 3
Percentage of companies in groups with different decisions regarding the choice of markets for internationalisation, 2019–2023 (%)

Company characteristics		Export to emerging markets only	Export to developed markets only	Exports to both developed and emerging markets	Statistical significance of differences
Have a foreign branch	2019	46	23	29	0.001
	2023	49	12	15	0.013
Participate in various forms of cooperation with foreign companies	2019	15	22	11	0.000
	2023	42	36	7	
Implement marketing innovations and create better value for customers	2019	35	24	18	0.002
	2023	52	41	29	
Implement process innovations	2019	56	62	36	0.000
	2023	64	73	15	0.004
Implement product innovations	2019	34	73	65	0.027
	2023	58	76	72	0.004
Engage in research and development	2019	45	63	69	0.001
	2023	51	66	64	0.000
IT companies	2019	47	59	57	0.003
	2023	45	53	52	0.002
Industrial companies	2019	64	63	64	0.082
	2023	68	71	64	0.024
Retail companies	2019	24	46	42	0.000
	2023	37	51	48	0.001

the export strategy and other characteristics of the enterprise.

Table 5 presents the results of the analysis of the influence of factors on the decision to internationalise of SMEs.

When analysing the data obtained, it can be seen that some factors influencing the decision to internationalise have a low explanatory power (*R*-square is less than 0.2), which means that other factors that also have a significant impact on this decision are not included in the model.

The choice of internationalisation strategy by SMEs is significantly influenced by the performance of innovation activities as well as by the industry in which the SME operates. For example, firms that chose the 'expanding horizons' strategy (Exp_strat_1) were more likely to use product and marketing innovations; firms that chose the 'changing form' strategy (Exp_strat_2) were more likely to use organisational and managerial innovations as well as the introduction of new technologies; the 'from laggard to leader' strategy (Exp_strat_3) and the 'taking by storm' strategy (Exp_strat_4) are characterised by the introduction of new products to the market and an increase in the share of exports.

It can therefore be concluded that SMEs that have decided to enter foreign markets are committed to a strategy of innovation and development of their own internal resources and capabilities. The choice of internationalisation strategy depends on which innovations and competences are predominant in the company.

However, the survey data show that, despite the successful experience of international activity (SMEs with productivity growth between 2019 and 2023), companies are experiencing certain difficulties in the current climate, with many reducing their investment in innovation. In addition, the unfavourable geopolitical situation leads to additional costs for firms implementing the 'expanding horizons' strategy (Exp_strat_1) and forces them to abandon new foreign markets,

Table 4
Variables of the study

Model	Dependent variable designation	Description of the dependent variable and predictors
Y_1	R&D	The existence of a knowledge management system in the enterprise (takes values 1 or 0 for each period)
Y_2	R&D_ cost	Availability of R&D expenditure (takes values 1 or 0 for each period)
Y_3	NewProduct	Introduction of a new product (takes values 1 or 0 for each period)
Y_4	NewTechnology	Introduction of a new technology (takes values 1 or 0 for each period)
Y_5	Exp	Increase in the share of exports (takes the value 1 if the share of exports increases or 0 if it decreases for each period)
Y_6	Market_innov	Presence of marketing innovations (takes values 1 or 0 for each period)
Y_7	Org_innov	Presence of organisational and management innovations (takes values 1 or 0 for each period)
Y_8	patents	Presence of patents (takes values 1 or 0 for each period)
Y_9	performance	Labour productivity growth (takes values 1 or 0 for each period)
		Predictors
—	Exp_strat	Choosing a solution to implement one of the internationalisation strategies: 1 - companies following the 'expanding horizons' strategy 2 - companies following the 'changing shape' strategy 3 - companies implementing the 'from laggard to leader' strategy 4 - companies following the 'taking by storm' strategy
—	Exp_market	Decisions on the choice of market for internationalisation: 1 - companies that exported only to developing countries throughout the period analysed. 2 - companies that exported to developed markets only during the whole period analysed 3 - companies that exported to both developing and developed markets during the entire period analysed
	Regim	Decisions on the internationalisation model 1 - companies that only export goods or technology 2 - companies that form/are part of a group of companies in a strategic alliance abroad 3 - companies that have made foreign investments 4 - companies working with foreign companies on a subcontracting basis 5 - companies setting up joint ventures in foreign markets or opening their own divisions, branches, subsidiaries and affiliates
	Foreign Inter-firm relations	Existence of inter-company relations in the enterprise (yes - 1; no - 0)
	Size	Enterprise size (logarithm of number of persons employed)

Table 5
Results of the regression analysis of the factors influencing the decision to internationalise

Indicators	У1	У2	У3	У4	У5	У6	У7	У8	У9
У_01	1.0013***	0.9972**	0.1782**	0.528*	0.492***	0.913**	0.1442***	0.2251**	0.3418**
Exp_strat_1	0.672***	0.638**	0.736***	0.3342**	0.344**	0.3552**	0.4472***	0.3389***	0.4541***
Exp_strat_2	0.4522***	0.331**	0.125***	0.134**	0.4711**	0.4861**	0.2231***	0.1872**	0.3781**
Exp_strat_3	0.321***	- 0.218**	- 0.288***	0.3712**	0.539**	0.4791**	0.2792***	- 0.2931***	0.377**
Exp_strat_4	0.277***	0.296**	0.306***	0.299**	0.4801**	0.3972**	0.1479***	0.3651**	0.4211***
Foreign Inter-firm relations	0.235**	0.141**	0.382**	0.273*	0.527**	0.342***	0.225**	0.131***	0.259**
Size	0.4013**	0.255**	0.198***	0.214**	0.1599**	0.1415***	0.325**	0.118**	0.257**
Exp_market 1	0.15	0.224	0.206	–0.721	0.274	0.341	0.551	0.194	0.237
Exp_market 2	0.617	- 0.544	dropped	0.311	0.416	0.233	0.182	0.429	0.371
Exp_market 3	dropped	0.439**	–0.399	0.512	–0.992	–0.337	0.551	0.547**	0.662
Regim1	0.262***	0.428**	0.436***	0.412**	0.514**	0.452**	0.372***	0.299***	0.317**
Regim2	0.245**	0.341**	0.472**	0.474*	0.517**	0.359***	0.415**	0.261**	0.382***
Regim3	0.212**	0.205**	0.218***	0.214**	0.292**	0.215***	0.220**	0.227**	0.231**
Regim4	0.145**	0.141**	0.172**	0.174*	0.117**	0.151***	0.125**	0.161**	0.182***
Regim5	0.112**	0.107**	0.118***	0.114**	0.130**	0.115***	0.135**	0.127**	0.111**
cons	0.132**	–0.237**	0.437**	0.0027***	–1.639**	–1.087**	–2.12***	0.324**	0.227***
N obs	311	305	302	311	307	311	311	311	311
R-square	0.345	0.277	0.201	0.203	0.181	0.194	0.293	0.316	0.428

Note: * – significance $p < 0.10$; ** – significance $p < 0.05$; *** – significance $p < 0.01$.

i.e. sanctions reduce the number of firms implementing the 'expanding horizons' strategy (Exp_strat_1).

Enterprises implementing the internationalisation strategy of 'change of form' (Exp_status_2) have a negative value of the coefficient, indicating a decrease in their willingness to invest in innovation, launch new products and implement technologies. The main business transformation of such enterprises is the entry into foreign online trading platforms and the marketing promotion of existing products.

When deciding which foreign markets to enter, SMEs use personal and inter-firm relationships to identify the benefits of a foreign market and to gain support for entering it. It is also worth noting the significant influence of the 'export learning' factor: the longer a company operates in foreign markets, the more often it decides to enter the markets of developed countries. Most Russian SMEs start the internationalisation process by choosing geographically close markets in developing countries (Exp_market 1). However, the longer the companies operate in foreign markets, i.e. the longer the 'training' lasts, the more noticeable is the change in their innovative behaviour, which is expressed in changes in the company's business processes, renewal of employees, their creativity and changes in the business model. Changes in the innovative behaviour of SMEs in turn influence the decision to choose markets in developed countries (Exp_market 2).

The decision on the internationalisation model for Russian SMEs is characterised by direct entry into the foreign market through the establishment of subsidiaries, branches or representative offices (Regim5), i.e. without a step-by-step internationalisation strategy. However, such decisions are typical for 2023. In 2019, most SMEs tended to export their products (Regim1) or subcontract work to foreign companies (Regim4). This can be explained by the characteristics of the introduction of sanctions and the willingness of companies to act on behalf of foreign organisations. However, the presence of a foreign branch/subsidiary/affiliate does not have a significant impact on the firm's choice of internationalisation strategy and innovation activity. Moreover, SMEs usually choose developing country markets to establish subsidiaries, branches or representative offices (Regim5).

It should be noted that internationalisation models such as joining a group of companies in a strategic alliance abroad (Regim2) and making foreign investments (Regim3) are not very attractive for SMEs.

Conclusions

The current conditions for the internationalisation of Russian SMEs are characterised by a high degree of uncertainty associated with not only economic but also political conditions. However, the development of SMEs is inextricably linked to the realisation of their export potential.

Our analysis shows that Russian SMEs tend to favour simple models and less risky internationalisation strategies. However, the choice of internationalisation strategy is strongly influenced by the effectiveness of innovation activities.

The choice of foreign markets is influenced by the existence of personal and inter-firm links, as well as the 'learning by exporting' factor.

The decision-making process regarding the internationalisation model for Russian SMEs is characterised by direct entry into the foreign market through the establishment of subsidiaries, branches or representative offices, i.e. outside the logic of a step-by-step internationalisation strategy, which is explained by the sanctions regime introduced.

Despite the generally unfavourable situation of foreign trade, SMEs manage to exploit their competitive advantages based on innovation.

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Transport system of the digital society: Problems and solutions

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Abstract

In a transition economy, the issues of reforming the transport system and overcoming the exacerbating problems of industry management become relevant. It seems that technological progress and the digital transformation of business processes should simplify the algorithm of action in management matters. However, as practice shows, during this period new conditions for the functioning of the industry arise (the emergence of new modes of transport or their modification) and elements of the transport system undergo changes. A more serious problem, according to the authors, is the unpredictability of foreign partners' behaviour in relation to exclusive rights to software (SW) used by companies in the transport and logistics sector. The purpose of the study is to develop a model for assessing the cost of the risk of a company's sudden transition to domestic software and test it on the materials of companies in the transport and logistics industry of Altai Krai. The study was conducted in the context of trends in the digital transformation of the transport system, identifying factors and types of risk, and assessing their impact on the information technology landscape (IT landscape) of transport companies in the context of sanctions. The results confirm the need to prepare industry participants homegrown software and to minimise potential risks. A sudden software replacement is more likely to cause serious financial loss to organisation than planned actions that do not disrupt business processes and communications with partners and government agencies. The practical significance of the proposed risk assessment model lies in the possibility of its application when making management decisions on the digitalisation of business processes and the transition to domestic software, regardless of the industry and size of the company.

Keywords: transport system, digital society, logistics, risk, software, IT landscape.

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数字社会的运输系统：问题与解决方案

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简介

在经济转型期，改革运输系统和克服日益严重的行业管理问题成为当务之急。技术进步和业务流程的数字化转型似乎可以简化管理问题的行动算法。　　但是，实践证明，在这一时期，行业运行会出现新的条件（出现新的运输方式或对其进行改造），运输系统的要素也会发生变化。作者认为，外国合作伙伴在运输和物流业公司所使用软件的专有权方面的行动的不可预测性是一个更为严重的问题。本研究的目的是开发一个模型，用于评估公司突然过渡到国产软件的风险成本，并在阿尔泰边疆区运输和物流业公司的材料上进行测试。这项研究是在运输系统数字化转型趋势的背景下进行的，确定了风险因素和类型，并评估了它们在制裁限制背景下对运输公司信息技术状况的影响。研究结果证实，行业参与者应为过渡到国产软件做好准备，并将潜在风险降至最低。与不干扰业务流程以及与合作伙伴和政府机构沟通的系统性行动相比，突然更换软件更有可能给公司造成严重的经济损失。所建议的风险评估模型的实际意义在于，可以不受行业限制和公司经营规模的限制，将其应用于业务流程数字化和向国产软件过渡的管理决策中。

关键词: 运输系统、数字社会、物流、风险、软件、IT 环境。

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1. Transport system in the context of digital transformation: relevance and issues

The development of society is not possible without transport, which, like any other economic activity, uses advanced scientific achievements and technologies and consumes various types of resources, including labour, energy and natural resources. In turn, transport, as a resource for a separate business entity, is at the same time one of the structural elements of the 'organised whole' - the transport system, because its high-quality use requires additional resources and an infrastructure that ensures interaction.

The spatial development and progress of any territory presupposes its transport accessibility for economic entities to resource potential and sales markets. The transport system contributes to the development of economic processes both within a separate territorial entity and in the country as a whole, as it acts as a locomotive for the redistribution of labour resources between production areas, provides access to natural resources and is an integral part of the strategy for the socio-economic development of territories.

The importance of the transport system for socio-economic development is determined by its level of development, quality and potential. If the world transport system is an element of the world economy, the national transport system unites the transport complexes of a single country, then the regional transport system plays one of the main roles in regional economic integration. Separate economic areas created for transport services form a zonal transport system. At the level of a single economic entity it is a corporate transport system. Separate types of transport can form their own transport systems [Chernysheva, 2020].

Transport systems and infrastructure of regional importance have become the subject of research [Jakimavičius, Burinskienė, 2007; Almetova, 2012; Almetova, Larin, 2014; Glaeser, Kohlhase, 2014; Voronina, 2017; Chen, Vickerman, 2017; Guzman et al., 2017;] and others. The problems of functioning and development of transport infrastructure are studied in articles [Krylov, 2017; Macheret, Ledney, 2018].

Digital transformation of transport system elements is considered in works [Erofeev, 2017; Lapidus, 2018; Berdysheva, Zharkova, 2019; Mikhalchuk, 2019; Pomortsev, 2019; Mashkina, Veliev, 2020; Akbarova, Shonazarova, 2023] and others, but the issue of risks of switching to domestic software (SW) is not covered in sufficient depth.

Today's transport system is a combination of all modes of transport (car, rail, urban surface and underground electric transport, air, water, etc.). Its functionality is determined not only by transport vehicles and means of transport (motorways, railways and waterways, air routes, etc.), but also by the companies that ensure uninterrupted transport processes, management and logistics structures.

The globalisation of a significant part of economic processes and restrictive measures introduced as a result of political disagreements for participants in the global market space have identified one of the main problems in the development of the transport system - a change in the composition of players in the global market and the

architecture of logistics systems, on the one hand, and the complexity of software for the system elements, on the other. A natural and predictable consequence of the development of the current situation was the growth of transaction costs in the construction of new routes for the movement of values for participants in market exchange and additional investment in the development, implementation and replication of the practice of using modern domestic software.

The solution to this problem has been entrusted to the Industrial Competence Centres (ICC) created by the decision of the Government of the Russian Federation, which operate on the principle of consortia and take into account the interests of customers of digital products for representatives of various sectors of the economy. For transport, one of the key sectors of the economy, four ICC have been created and are managed by transport companies: JSC Russian Railways, PJSC Aeroflot, JSC Sheremetyevo International Airport and FSUE Rosmorport (Fig. 1). ICC play the role of curator of projects for the import substitution of 'industrial software, hardware and software systems as well as system and application software'[1]. Participants in the ICC 'Railway Transport and Logistics' included Russian Railways, Moscow Metro, St Petersburg Metro, Mostransavto, Avtodor, GLONASS, Rusatom Cargo, Research Institute of Automobile Transport, Russian Post, Sberbank and SberTroika.

The strategy of digital transformation of JSC Russian Railways until 2025 defines the course of development of railway transport in the range of 10-15 years, and its vector is directed towards the digital space. Priority has been given to technologies that can apply predictive analytics, provide real-time information on the condition of vehicles and the transport process, and respond quickly to emerging failures.

According to a number of researchers, the solution to the transport industry's problems lies in digital transformation and a consistent move towards paperless document management, intelligent transport systems and unmanned transport.

Considering the situation in which the Russian transport system and related industries find themselves, the modern digital technologies planned for implementation should contribute to the creation of a trustworthy environment in freight transport, and all participants in the transport process should solve one of the main tasks: switching to the use of domestic IT solutions in the optimal timeframe.

The results of the work (products) of the ICP 'Railway Transport and Logistics', which can be in demand by both transport companies and business partners, are presented in the form of universal IT products. Some of them are already in use, work on others should be completed in 2024 (Table 1).

2. Transport system transformation vector

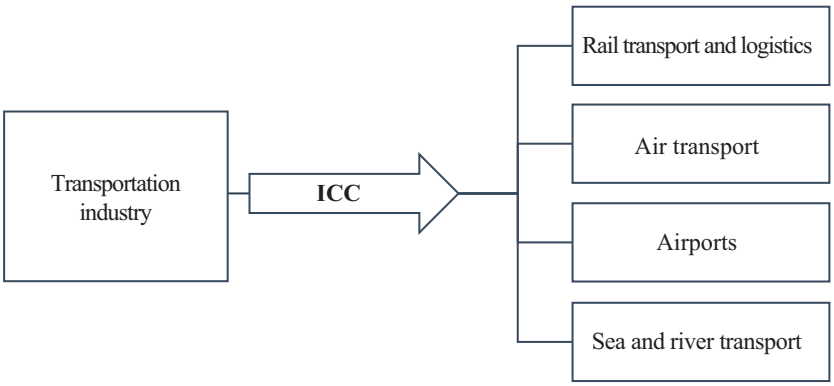
The development of the Russian transport system directly depends on the results of the implementation of the digital transformation strategy of JSC Russian Railways, at least as far as rail transport is concerned. As the main investor in the development of innovative digital solutions, JSC Russian Railways is ultimately interested in spreading the practice of their application to the entire infrastructure.

In the Strategy for the Digital Transformation of Russian Economic Sectors, the section on 'Transport and Logistics' envisages the improvement of the transport system, technologies for managing vehicles and flows through the creation of intelligent transport systems. The transformation of the industry is based on modern information and telecommunications technologies and the GLONASS global navigation system. Multimodal transport must be developed for passenger transport within the country and beyond its borders.

At present, the registration of shipping documents is partly done in electronic form; the complete conversion of documents to digital form will not only speed up registration and processing, but also organise a higher quality and more efficient control of the movement of goods.

Intelligent Transport Systems are the unity and effective interaction of all their elements: the road surface, all types of vehicles, road management systems and infrastructure facilities, including traffic lights, video cameras and lighting systems. The introduction of artificial intelligence technologies in an ideal development scenario should ensure the emergence of intelligent roads, facilitating the spread of digital technologies in road user communication processes, road infrastructure and unmanned transport. One of the main obstacles may be the lack of 5G technology on transport routes, which provides high-speed internet as a necessary condition for the functioning of intelligent roads, unmanned transport and the information and communication infrastructure of all participants in the transport system, including the control system.

Fig. 1. Centres of industrial excellence in the transport system



Source: compiled by the authors based on Russian Railways data: https://rzddigital.ru/upload/iblock/d33/0lwx5pswqxi94yczn2ss3wicjaydp34u.pdf.

[1] Industrial Competence Centers (ICC) (2024). TADVISER: State. Business. Technologies. https://clck.ru/3ASegU.

Table 1
Products of the PPI 'Rail transport and logistics'

Product	Characteristic	Result	Foreign equivalent
Consistent Data Model of the Transport Process - import-independent automated system for operational management of transportation	A single data model for managing and optimising transport processes	More than 100,000 users of automated production systems have been trained to work with the data of the Consistent Data Model of the Transport Process Over 80 automated production systems interact with the Consistent Data model of the Transport Process	IBM
Electronic Consignment Note Automated System - automated system for centralised preparation and execution of shipping documents on an import-independent platform	Full technological cycle of registration of transport documents in the electronic document management system	Connected: 3846 structural units and 28,439 users of Russian Railways; 15,847 organisations and 29,991 clients	Oracle
ACS 'Express' of the new generation - a system for railway ticket sales and passenger complex management	Information and reference services for passengers, organisation of baggage and mail transport, management of the operation and repair of passenger vehicles, reporting.	More than 1,500 JSC Federal Passenger Company's checkouts converted to use of ACS Express system More than 1,000 active users	No
Unified numbering system for new generation locomotives - import independent unified locomotive numbering system	Accounting for rolling stock, equipment and small mechanised equipment	The development of the basic functionality of Unified numbering system is carried out on the basis of x86/64 architecture. Audit of the current integration interactions of Unified numbering system with the automated systems of Russian Railways, design of a new system.	SAP
Automated system for managing freight car repairs - automated system for managing freight car repairs based on economic criteria in operating and repair depots	Automation of business processes of operational and repair wagon depots with regard to the execution of current and planned types of repairs of freight wagons and parts	A business process survey was carried out, core design work began, an architectural solution was prepared, 14 modules were created, consisting of more than 70 different functions, covering the main processes of the current uncoupling repair system and the wagon management system based on economic criteria.	SAP
Import-independent infrastructure management system	Improving the efficiency of the production processes of the Central Infrastructure Directorate	The following will be created: A unified model of transport process data, a new generation electronic consignment note	–
'Passenger Flows' v^2 - software package for modelling and forecasting passenger flows	Taking into account various demand factors when forecasting passenger flows, including: ● economic and demographic forecasts ● the impact of other transport modes	An architectural scheme for interaction between Russian Railways systems and systems of external participants in the transport process for exchanging data on the transport behaviour of the population was approved. A methodology for modelling and forecasting passenger flows was developed and approved, taking into account the distribution of intercity passenger flows on the territory of agglomerations and transport hubs.	PTV, VISUM, AIMSUM, TransCAD

Source: compiled by the author based on Russian Railways data: https://rzddigital.ru/upload/iblock/d33/0lwx5pswqxi94yczn2ss3wicjaydp34u.pdf.

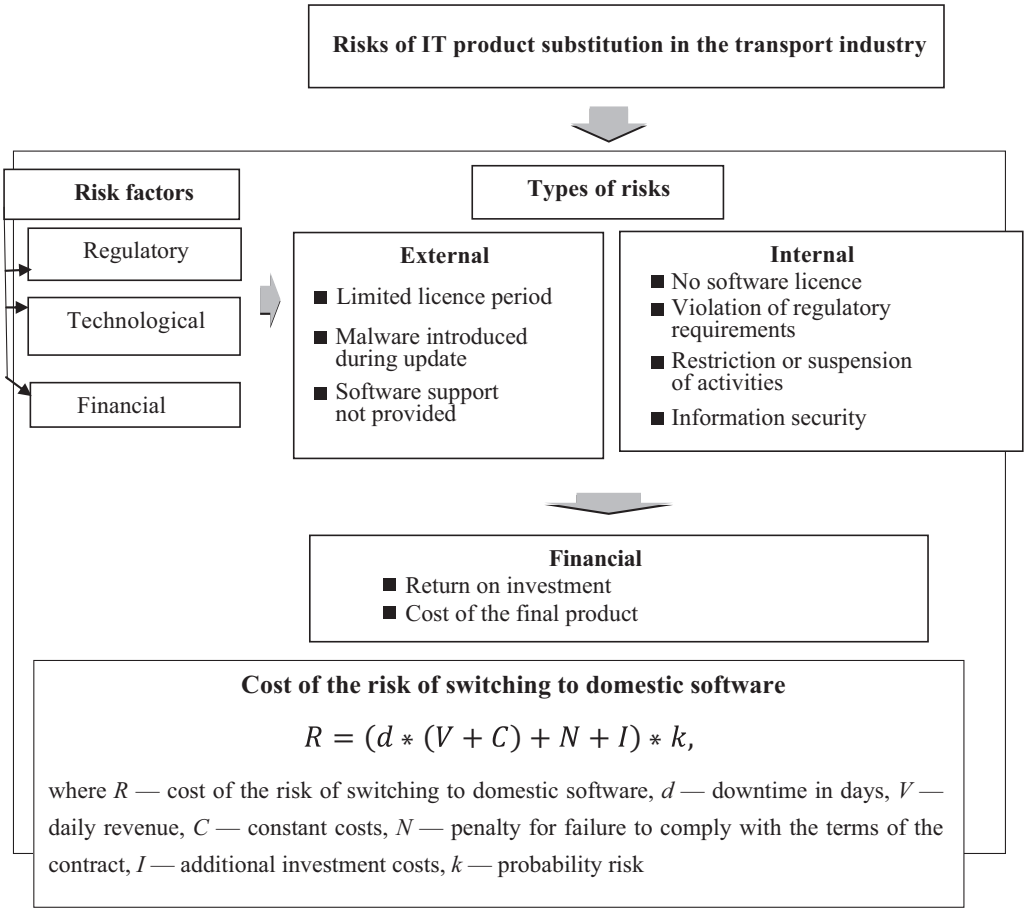
The deployment of 5G technology in the transport sector as part of the implementation of Russia's digital development agenda is a task that requires a collective solution from stakeholders, investors, IT industry specialists, mobile operators, interested parties (for example, the leadership of a territorial entity) and participants in the transport system interacting in the process of its operation. Such a large project is essentially a combination of several projects, the products of which will ensure the construction of a modern, efficient transport system for the territory. The financial component deserves special attention in solving the problem. Since we are talking about a series of projects, the financing can be collective and include the participation of budgets at different levels (when we are talking about federal, regional and local roads) and private investment.

3. IT landscape of a transport company in the context of digital transformation and sanction restrictions

Today, almost every business entity uses Internet resources in its activities to organise communication with partners and government institutions, to build business processes, and to perform analytical and accounting work. A set of tools to support business processes, enabling the management of financial, human and material resources, sales activities, appears to the user as a set of information systems, services, products and is called an IT landscape or IT architecture. The number of IT architecture components is determined by the social or commercial focus of the organisation, the size of the business, the geographical location of structural elements, involvement in virtual space, financial capabilities and the use of monolithic or microservice principles.

The IT landscape is a flexible system that can change to ensure business security when the opportunity or need for change arises. Due to the need to maintain technological independence and security of the critical information infrastructure of the Russian Federation in the context of sanctions restrictions, the Decree of the President of the Russian Federation of 30 March 2022 No. 166[2] establishes the requirement for transition to domestic IT solutions for companies with state participation before the beginning of 2025. Despite the fact that, according to the document, the obligation to migrate applies to government agencies and organisations with government participation, it should be remembered that for other companies this will not be

Fig. 2. Factors and risks of IT product substitution in the transport industry



[2] Decree of the President of the Russian Federation dated 30.03.2022 N 166 'On Measures to Ensure the Technological Independence and Security of the Critical Information Infrastructure of the Russian Federation'. http://www.kremlin.ru/acts/bank/47688.

Table 2
Revenue of transport and logistics companies in the Altai Territory by type of activity for 2022 (RUB mln)

Type of activity	Revenue		
	Vav	Vmin	Vmax
Automotive and freight transport	371	101	1 872
Freight transport by road and transport services	162	100	341
Wired telecommunications activities	301	154	566
Inland water transport	112	104	120
Supporting and auxiliary transport activities	–	–	692
Other supporting transport activities	517	102	2958
Rail transport: Freight transport	761	129	3620
Railway infrastructure	–	–	182
Other computer and related activities not included in other groups	–	–	138
Computer consultancy and related activities	–	–	202
Courier activities	142	110	164
Passenger air transport	–	–	143
Warehousing and storage	508	436	580
Creation and use of databases and information resources	131	119	143
Operation of roads and motorways	1583	547	2261
Other land passenger transport activities not included in other groups	–	–	114
Land passenger transport activities: urban and suburban passenger transport	145	106	167
Other computer and related activities	230	116	481
Newspaper publishing	271	102	440
Freight transport by non-specialised vehicles	215	105	405
Freight transport by specialised vehicles	449	122	1013
Suburban passenger rail transport	–	–	595
Provision of transport services	221	103	332
Computer software development	162	103	331
Urban and suburban regular passenger bus services	166	149	375
Urban and suburban regular passenger bus services	0	0	0
Urban and suburban regular passenger services by trolley bus	118	101	134
Urban and suburban regular passenger rail services	0	0	0
Storage and handling of grain	–	–	273

Source: compiled by the authors based on SPARK data: https://spark-interfax.ru/.

an obligation in the near future, but an urgent necessity, due to the high probability of restrictions on the use and maintenance of foreign software.

IT landscapes can be categorised by end user (internal and external with access by company employees and external users), functional use, architectural separation, type of ownership or creation. Given that the IT landscape belongs to a certain classification group and the principles of its construction for a specific user (monolith or microservices), it is recommended that the transport organisation make or postpone a decision on replacing foreign IT products with domestic software, taking into account the calculation of the cost of its update and comparison with the cost of the potential risk. The process of replacing IT products is associated with risks of various types (Fig. 2).

In order to calculate the cost of the risk of IT product substitution, the authors used data on the revenues of transport companies in the Altai Territory, examined them

Table 3
Revenues and additional costs for companies that suddenly switch to domestic software (RUB mln)

Вид деятельности	Daily revenue			Transitional revenue (d = 14)			Fixed costs during the transition period (d = 14, C = 0.4)			Penalty for 14 days (N = 0.3)		
	V_{av}	V_{min}	V_{max}	dV_{av}	dV_{min}	dV_{max}	C_{Vav}	C_{Vmin}	C_{Vmax}	N_{Vav}	N_{Vmin}	N_{Vmax}
	2	3	4	5	6	7	8	9	10	11	12	13
Road freight transport	30.9	0.3	5.1	432.7	3.9	71.8	2423.0	21.6	402.2	2855.6	25.4	474.0
Freight transport by road and transport services	0.4	0.3	0.9	6.2	3.8	13.1	34.7	21.5	73.2	40.9	25.3	86.3
Wired telecommunications activities	0.8	0.4	1.5	11.5	5.9	21.7	64.6	33.1	121.4	76.1	39.0	143.1
Inland water transport	0.3	0.3	0.3	4.3	4.0	4.6	24.1	22.3	25.9	28.4	26.2	30.5
Supporting and auxiliary transport activities	—	—	1.9	—	—	26.7	—	—	149.4	—	—	176.0
Other supporting transport activities	1.4	0.3	8.1	19.8	3.9	113.5	111.1	21.9	635.4	130.9	25.8	748.8
Rail transport: Freight transport	2.1	0.4	9.9	29.2	4.9	138.8	163.5	27.6	777.5	192.7	32.5	916.3
Railway infrastructure	—	—	0.5	—	—	7.0	—	—	39.1	—	—	46.1
Other computer and related activities not included in other groups	—	—	0.4	—	—	5.3	—	—	29.6	—	—	34.8
Computer consultancy and related activities	—	—	0.6	—	—	7.8	—	—	43.4	—	—	51.2
Courier activities	0.4	0.3	0.5	5.4	4.2	6.3	30.5	23.7	35.4	35.9	27.9	41.7
Passenger air transport	—	—	0.4	—	—	5.5	—	—	30.8	—	—	36.3
Warehousing and storage	1.4	1.2	1.6	19.5	16.7	22.2	109.1	93.6	124.6	128.5	110.3	146.8
Creation and use of databases and information resources	0.4	0.3	0.4	5.0	4.6	5.5	28.2	25.6	30.8	33.3	30.2	36.3
Operation of roads and motorways	4.3	1.5	6.2	60.7	21.0	86.7	340.0	117.4	485.7	400.7	138.4	572.4
Other land passenger transport activities not included in other groups	—	—	0.3	—	—	4.4	—	—	24.4	—	—	28.7
Land passenger transport activities: urban and suburban passenger transport	0.4	0.3	0.5	5.6	4.1	6.4	31.1	22.8	35.9	36.7	26.9	42.3
Other computer and related activities	0.6	0.3	1.3	8.8	4.4	18.5	49.3	24.9	103.3	58.1	29.3	121.8
Newspaper publishing	0.7	0.3	1.2	10.4	3.9	16.9	58.3	22.0	94.6	68.7	25.9	111.5
Freight transport by non-specialised motor vehicles	0.6	0.3	1.1	8.2	4.0	15.6	46.2	22.6	87.1	54.4	26.6	102.7
Freight transport by specialised motor vehicles	1.2	0.3	2.8	17.2	4.7	38.9	96.4	26.2	217.7	113.7	30.9	256.6
Urban passenger transport by rail	—	—	1.6	—	—	22.8	—	—	127.7	—	—	150.5
Land transport	0.6	0.3	0.9	8.5	4.0	12.7	47.4	22.2	71.3	55.8	26.1	84.1
Computer software development	0.4	0.3	0.9	6.2	3.9	12.7	34.7	22.1	71.0	40.9	26.1	83.7
Urban and suburban regular passenger bus services	0.5	0.4	1.0	6.4	5.7	14.4	35.7	32.1	80.5	42.0	37.8	94.9
Urban and suburban regular passenger bus services	0.3	0.3	0.4	4.5	3.9	5.2	25.3	21.7	28.9	29.8	25.6	34.0
Regular urban and suburban passenger transport by trolleybuses	—	—	0.7	—	—	10.5	—	—	58.6	—	—	69.0
Urban and suburban regular passenger tram services	2.0	0.8	3.1	27.3	10.8	43.8	152.9	60.3	245.4	180.2	71.1	289.2
Storage and handling of grain	0.5	0.3	1.6	7.5	4.0	22.0	42.3	22.2	123.1	49.8	26.1	145.1

Source: compiled by the authors based on SPARK data: https://spark-interfax.ru/.

Table 4
Cost of the risk of sudden replacement of IT products for transport and logistics companies in the Altai Territory (RUB mln)

Type of activity	Cost of risk for 14 days (k = 1)			Cost of risk for 14 days (k = 0.1)			Cost of risk for 14 days (k = 0.5)			Cost of risk for 14 days (k = 0.8)		
	V_{av}	V_{min}	V_{max}	V_{av}	V_{min}	V_{max}	V_{av}	V_{min}	V_{max}	V_{av}	V_{min}	V_{max}
	1	2	3	4	5	6	7	8	9	10	11	12
Road freight transport	5711.4	51.0	948.2	571.1	5.1	94.8	2855.7	25.5	758.6	4569.2	40.8	758.6
Freight transport by road and transport services	82.1	50.8	172.8	8.2	5.1	17.3	41.0	25.4	138.2	65.7	40.7	138.2
Wired telecommunications activities	152.5	78.2	286.5	15.2	7.8	28.6	76.2	39.1	229.2	122.0	62.5	229.2
Inland water transport	56.9	52.7	61.2	5.7	5.3	6.1	28.5	26.3	48.9	45.5	42.1	48.9
Supporting and auxiliary transport activities	0.2	0.2	352.2	0.0	0.0	35.2	0.1	0.1	281.8	0.2	0.2	281.8
Other supporting transport activities	262.1	51.8	1497.8	26.2	5.2	149.8	131.0	25.9	1198.3	209.6	41.4	1198.3
Rail transport: Freight transport	385.7	65.2	1832.9	38.6	6.5	183.3	192.8	32.6	1466.3	308.6	52.2	1466.3
Railway infrastructure	0.2	0.2	92.4	0.2	0.2	9.2	0.2	0.2	73.9	0.2	0.2	73.9
Other information service activities not included in other groups	0.2	0.2	69.9	0.2	0.2	7.0	0.2	0.2	55.9	0.2	0.2	55.9
Computer consultancy and related activities	0.2	0.2	102.6	0.2	0.2	10.3	0.2	0.2	82.1	0.2	0.2	82.1
Courier activities	72.1	56.0	83.5	7.2	5.6	8.4	36.0	28.0	66.8	57.7	44.8	66.8
Passenger air transport	0.2	0.2	72.8	0.0	0.0	7.3	0.1	0.1	58.3	0.2	0.2	58.3
Warehousing and storage	257.3	220.9	293.8	25.7	22.1	29.4	128.6	110.4	235.1	205.8	176.7	235.1
Activities related to the creation and use of databases and information resources	66.7	60.6	72.8	6.7	6.1	7.3	33.4	30.3	58.3	53.4	48.5	58.3
Operation of roads and motorways	801.7	277.0	1145.0	80.2	27.7	114.5	400.8	138.5	916.0	641.3	221.6	916.0
Other land passenger transport activities not included in other groups	0.2	0.2	57.7	0.2	0.2	5.8	0.2	0.2	46.1	0.2	0.2	46.1
Land passenger transport activities: urban and suburban passenger transport	73.6	54.0	84.8	7.4	5.4	8.5	36.8	27.0	67.9	58.9	43.2	67.9
Computer and related activities, other	116.4	58.8	243.8	11.6	5.9	24.4	58.2	29.4	195.0	93.2	47.0	195.0
Publishing of newspapers and periodicals	137.5	51.9	223.3	13.8	5.2	22.3	68.8	26.0	178.6	110.0	41.6	178.6
Freight transport by non-specialised vehicles	109.0	53.4	205.5	10.9	5.3	20.6	54.5	26.7	164.4	87.2	42.7	164.4
Freight transport by specialised vehicles	227.5	61.9	513.4	22.8	6.2	51.3	113.8	31.0	410.7	182.0	49.5	410.7
Urban passenger rail transport	0.2	0.2	301.2	0.2	0.2	30.1	0.2	0.2	241.0	0.2	0.2	241.0
Land transport	111.8	52.5	168.4	11.2	5.2	16.8	55.9	26.2	134.7	89.5	42.0	134.7
Computer software development	82.1	52.3	167.6	8.2	5.2	16.8	41.0	26.2	134.1	65.7	41.9	134.1
Urban and suburban regular passenger bus services	84.3	75.8	190.0	8.4	7.6	19.0	42.1	37.9	152.0	67.4	60.6	152.0
Regular interurban bus services	59.9	51.4	68.2	6.0	5.1	6.8	29.9	25.7	54.6	47.9	41.1	54.6
Urban and suburban regular carriage of passengers by trolley bus	0.2	0.2	138.2	0.2	0.2	13.8	0.2	0.2	110.6	0.2	0.2	110.6
Urban and suburban regular passenger rail services	360.6	142.3	578.6	36.1	14.2	57.9	180.3	71.2	462.9	288.4	113.8	462.9
Storage and handling of grain	99.8	52.5	290.3	10.0	5.2	29.0	49.9	26.2	232.3	79.8	42.0	232.3

Source: compiled by the authors based on SPARK data: https://spark-interfax.ru/.

in terms of types of activity and divided them into three categories: revenues calculated using the simple average method (V_{av}), maximum revenues (V_{max}) and minimum revenues (V_{min}) (Table. 2).

The transition period to domestic software may vary (number of days $d > 1$) depending on the readiness of the enterprise to switch to domestic IT products (availability of the right to use the IT product, personnel skills for data translation, technical capabilities of the enterprise and organisational characteristics). The amount of fixed costs (C) can be determined based on the planned value in the unit cost structure of the service or the actual value for the month per day. The penalty (N) for breach of the terms of the contract is determined in accordance with paragraph 5 of Article 28 of the Law on Protection of Consumer Rights[3] in the amount of 3% of the price of the work (service) performed in case of breach of the terms for performance of the work (service) established in the contract per day. Additional investment costs (I) will depend on the needs of the business and will be determined by the parameters of the desired IT landscape and the principle of its construction (monolithic or microservices).

At the time of writing, the IT products market offered Russian programmes for the automation of motor transport companies, transport companies, logistics, cargo and passenger transport: SHEDEX, Smart logistics, Maxoptra, CyberLog, Zavgar.Online, CARGO. RUN, Megalogist, AutoTransport, TIS Online, 1C:TMS Logistics, 4logist, BIT:Autotransport, AutoPlan, Advantum TMS, 1C:Motor Transport Management, GdeMoi, Logista Tools 24, Trans-Manager, TransTrade, Cargo Transport, G-Soft, BIA Logistics Assistant, Expedit, PROLOGISTA, Vehicle Control and Accounting, Kargobar, Novator CRM, AutoGRAPH GPS, Gruzoplan, AB:CARGO, Kors Avtopredpriyatiye[4]. These are cloud programs, online services, online systems, FMS systems, digital logistics platforms, programs on the 1C platform, offering services for the organisation of the activities of companies in the transport and logistics industry, automation of business processes in digital and cloud implementation. The cost of using the proposed software for one microservice starts from 33 thousand roubles, and programs for automating individual functions from 90 thousand roubles. The total cost of building a CT landscape based on homegrown software depends on the number of microservices or complex programs required by the company.

The probability of risk (k) is determined by expert judgement, involving specialists with expertise in assessing the situation in the IT product markets, geopolitical trends, sanctions pressure and their impact on internal economic processes.

To calculate the cost of the risk of substitution of IT products of companies in the Transport and Logistics industry of the Altai Territory, the necessary parameters were set: investment costs (I) - 200 thousand rubles; transition period (d) - 14 days; level of fixed costs (C) in revenue - 40%; probabilities of risk occurrence - 10, 50, 80 and 100%, or (k) = 0.1, 0.5, 0,8 and 1.0.

The results of the calculations of the volume of lost sales during the transition period, the amount of fixed costs, the amount of penalties for non-compliance with the terms of contracts in the event of forced replacement of software due to the sudden cessation of operation of foreign analogues are presented in Table 3, the costs of the risk of a sudden transition with various degrees of probability of the event occurring are presented in Table 4.

The results of the research support the conclusion that sudden software replacement is more likely to result in significant financial losses for companies in the transport and logistics industry than the cost of planned and parallel actions that do not disrupt business processes and relationships with partners and government institutions. The results of the research support the conclusion that sudden software replacement is more likely to result in significant financial losses for companies in the transport and logistics industry than the cost of planned and parallel actions that do not disrupt business processes and relationships with partners and government institutions. We share the managers' concerns about the need for additional organisational measures, the financial costs of preparing staff for change, the costs of purchasing the necessary software and possibly revising the IT architecture that already supports business processes. We should not forget, firstly, that the suddenness and inevitability of such actions will cost much more (this is confirmed by the presented calculations), secondly, the process of transition to domestic software is irreversible, because even under favourable conditions in terms of the use of foreign software by commercial companies and the obligatory transition to domestic software by 01.01.2025 of companies with state participation, it will be necessary, at best, to search for options of compatibility of IT products used by participants in economic interaction.

4. Digital twin as one of the solutions

The current level of IT technology development allows transport logistics management to optimise operational and management processes using the proposed new technological solutions: Digital Twin - a computer program that combines information, an object and a process and builds an algorithm for their interaction. According to the developers, a digital twin is a virtual model that can be updated when there is a need or requirement to change the physical analogue, and is essentially a modular logistics platform designed to automate key supply chain management processes and account for logistics costs.

The concept of a digital twin is an opportunity to identify weaknesses in the construction of a logistics chain based on the results of a virtual copy of expected events and the developed strategy. The trajectory of the cargo movement can be adjusted if an unsatisfactory result is obtained; a course of action can be selected based on a comparison and evaluation of several alternative scenarios. In logistics, the

[3] Law of the Russian Federation dated 07.02.1992 No. 2300-1 'On Protection of Consumer Rights'. https://rg.ru/documents/2008/12/01/pravapotr-dok.html.
[4] Top 10: Software for transport companies (for Russia) (2024). Livebusiness. 12 August. https://www.livebusiness.ru/tools/transport/.

capabilities of a digital twin can be used to minimise the cost of transporting and storing cargo by determining its most advantageous location. One of the main advantages and capabilities of a digital twin is its independence from related processes, given a large number of scenarios, and achieving a predictable result after processing a large number of parameters in a minimum amount of time. The designated capabilities for managing logistics activities are provided by a digital twin of the supply chain based on the AXELOT SCM platform. The AXELOT SCM platform is being developed with the support of the Russian Foundation for the Development of Information Technologies, which acts as an operator of measures to support projects for the implementation of domestic products, services and platform solutions created on the basis of end-to-end digital technologies.

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Are human factor risks in the activities of scientific design organisations subject to reliable measurement?

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Abstract

The article considers the problem of measuring risks and threats created by the nature and charac-teristics of the human factor and affecting the efficiency and safety of activities at the micro level of the economy, in particular, in the environment of scientific and design organisations during the development of restoration projects at immovable cultural heritage sites located in St. Petersburg and the Leningrad Region. A literature review of sources covering the problem under study is carried out. The objective of the study is formulated, which consists in attempting to measure the impact of human factor risks on the efficiency of scientific and design work, and the tasks are outlined, the solution of which will allow the objective to be achieved. The study focuses on the assessment of complex damage and indirect losses, and the subject is defined as the methods for measuring the impact of these risks. The methods and tools of the planned study are defined. A number of intermediate author's results are obtained, clarifying the nature of the human factor, the conceptual apparatus of the topic, the classification of risks, threats and dangers that can cause significant damage to an economic entity, market activity, business reputation and brand value. Partial results were discussed and five-stage conclusions were drawn. Promising directions for further joint research have been identified by the authors of the article, which can be considered as the starting point and the beginning of the path in the systematic study of the problem of human factor hazard metrics.

Keywords: human potential, risk, treatment, error, event, entity, phenomenon, innovation stress, immovable cultural heritage, restoration and construction works.

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研发机构活动中的人为因素风险是否可以可靠地衡量？

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简介

文章探讨了如何衡量自然和人为因素造成的风险和威胁，以及这些风险和威胁对经济微观层面活动效率和安全的影响，特别是在圣彼得堡和列宁格勒地区不可移动文化遗产修复项目开发过程中科学和设计组织的风险和威胁。　对涉及所研究问题的资料来源进行了审查。制定了研究目标，其中包括尝试测量人为因素造成的风险对科学和设计工作效率的影响，并概述了为实现目标而需要解决的任务。该课题的研究对象是复杂损害和间接损失的评估，并确定了测量上述风险影响的程序。确定了计划研究的方法和工具。已经取得了一些中间成果，澄清了人为因素的性质、这一主题的概念装置、风险、威胁和危险的分类，这些风险、威胁和危险可能对经济实体造成明显损害，损害其市场活动，损害其商业声誉和品牌价值。对部分结果进行了讨论，并得出了五个阶段性结论。确定了文章作者进一步共同研究的方向，可将其视为从人为因素出发系统研究威胁度量问题的起点。

关键词： 人的潜能、风险、威胁、错误、事件、本质、现象、创新压力、不可移动文化遗产、修复和建设工程。

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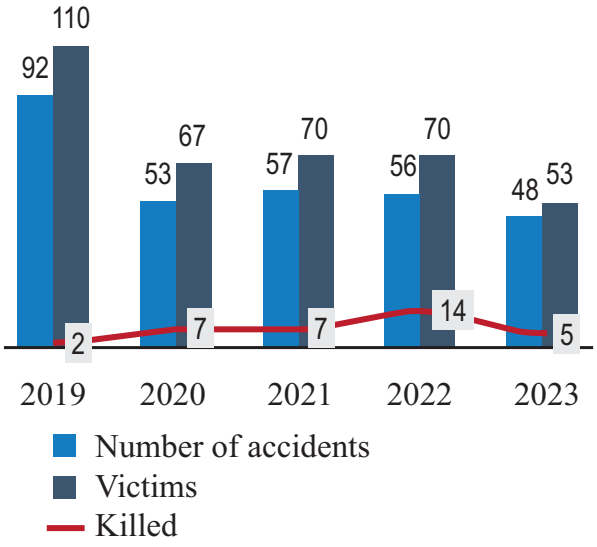
Introduction

A serious approach to various epistemological kinds of risks and taking them into account has long been an integral part of the productive, economic, financial and other activities of any organisation. The principles and forms of managing some risks are even included in local documents, including in the development strategies of these organisations of different legal forms of ownership. This is mostly related to known circumstances that should not only be mentioned, but also clearly disclosed:

Firstly, the ability to generate real benefits that are fully commensurate with the risks taken into account; secondly, the ability of the organisation to absorb potential damage, losses and claims arising from a range of all types of risks and those associated with its core activities; and thirdly, the risk of finding itself in situations of insolvency and bankruptcy, which are common in a turbulent economy. However, it is extremely rare to find organisations that have thoroughly studied and practically adopted recommendations on the currently highly relevant category of risks directly related to the influence of the so-called human factor (hereafter referred to as HF). It is here that we cannot help but take a look back at the actual history of this phenomenon.

The first comprehensive surveys of all types of accidents that occurred in various sectors of our economy did not include accidents caused by human error - man-made incidents, so to speak. However, in the early 1930s, human error began to be considered as an independent cause of accidents [Tumani-shvili, 1932]. However, a long time has elapsed between the inclusion of every cause of an incident (from a routine fire to a major man-made disaster) in a separate cadastre of 'human error' and the systematic application of every effective means of combating human error.

Fig. 1. Information from Gazprom Mezhregiongad Group on the number of accidents and victims in 2019–2023



Source: compiled by the authors.

Table 1
Analysis of accidents in the Gazprom Mezhregiongaz Group
for 2019–2023

Ranking	Main types of accidents with victims	Main causes of accidents
1	Road traffic accidents	Failure to take personal safety measures
2	Damage caused by workers falling	Traffic violations by third parties
3	Damage caused by contact with plants and animals	Illegal actions by third parties
4	Damage caused by the illegal actions of third parties	Attacks by dogs and wild animals
5	Damage caused by high-risk work	Poor work organisation
6	Damage due to collision with objects/parts/mechanisms	Violations of work, production discipline, requirements of regulatory documents
7	—	documents

Source: compiled by the authors.

Nevertheless, this time was usefully spent in collecting reliable statistics on incidents by industry and sector of the economy, and in preliminary - essentially desk-based - analysis by multidisciplinary specialists. Thus, according to national statistics, about 70% of accidents/crashes are due to the HF fault and 45% of them are due to the behaviour of the identified / guilty individual in critical situations. The remaining 30% of incidents can occur completely independently of the quality of production management practised and/or adopted by the organisation[1].

In those industries where there is a systematic, ongoing statistical monitoring of the types of incidents with victims and a proper accounting of the causes of accidents, emergencies and incidents, a favourable dynamic of both can be found. An example of the organisation's successful activity in this regard is the analysis of incidents in the Gazprom Mezhregiongaz Group for 2019-2023 (Figs. 1, 2, Table 1), which shows a convincing reduction in alarming indicators of safety, insecurity and well-being of the economic entity: by 81.35% in terms of accidents and by 46.79% in terms of incidents.

The transition to a fundamentally new qualitative level of solving the key socio-economic problems facing the Russian state in the third decade of the 21st century required the use of different analytical methods and modern instruments of socio-economic measurement. The main objective of such changes is to gradually move from factual registration at the end of a significant event to a comprehensive measurement of social, public and other risks associated with the impact of the HF on a significant event, forecasting the behaviour of risks over a given horizon and their timely prevention, without bringing either their predetermined nature or real, highly probable activity to the actual occurrence of an unfavourable event.

The best option for risk prevention seems to be the search for opportunities for extremely careful and sensitive management, since the overwhelming majority of organisations, in their current professional activities, encounter risks generated by the factor of human nature.

[1] https://srg-eco.ru/article/bezopasnost-rabotnika-na-predpriyatii-i-chelovecheskij-faktor/.

Moreover, due to the organic unreliability of individual employees, companies suffer losses that are much greater than those caused by occasional political and economic reasons, usually of external origin, and by circumstances of so-called force majeure (although, from the point of view of the interpretation of the current legislation of the Russian Federation, it is more correct to use the terms 'force majeure' or 'force majeure circumstances' instead of the term 'force majeure'[2]).

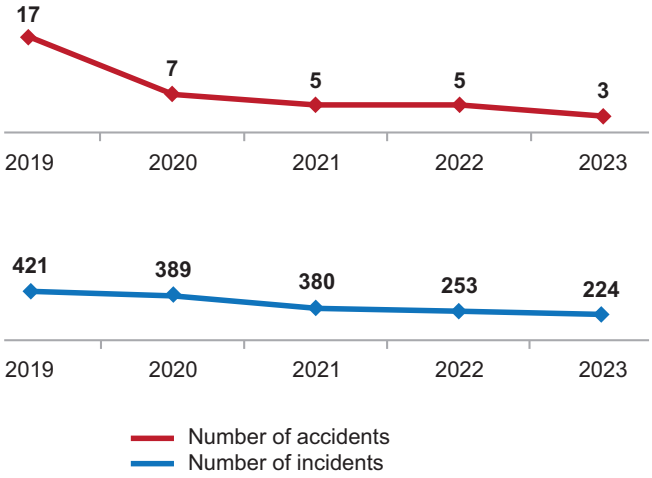
The authors of the article believe that risks of an obvious and implicit nature determined by the impact of the black field, act as the most significant threats to economic entities (hereinafter referred to as EE) that use live labour in their core business, i.e. have a purposefully selected temporary creative team and/or a permanent staff of industrial and production personnel, including engineering, technical and scientific workers.

Meanwhile, the continuous and dynamic development of the knowledge economy suggests that truly innovative organisations are faced with the most important but difficult task of recruiting appropriately qualified, preferably not only full-time, but also narrowly specialised freelancers to perform analytical, logical, intellectual, project-creative, expert, etc. work. Here, the significance of the presence of the risk of HF in the normal course of intellectual processes begins to noticeably exceed the role of the risks directly associated with the processes of physical labour in the conditions of automation, robotization, in the broadest sense of production processes in the conditions of using unmanned technologies of an achievable high level.

The role of living labour in developed market economies has relatively decreased, and the overall labour intensity of the production of an economic entity has decreased with the growth of labour productivity [Kolganov, Buzgalin, p. 265]. At the same time, with the increase in the complexity and impressive variety of available production technologies, the role of highly skilled labour has increased, and the quality of labour reproduction in accordance with the modern requirements of the labour market has improved, which in fact ensures the innovative and progressive development of any economy, and for the Russian economic system - the transition to a post-industrial society.

Such processes and phenomena as the transformation of science and the innovative economy into the main productive force of society, the increasing role of R&D, the widespread and large-scale introduction of the latest basic and advanced technologies, combined with the large-scale digitalisation of the main national economic processes, statistically indicate an increase in the share of purely creative activity in the creation of the final science-intensive product and, accordingly, in the level of added value.

Fig. 2. Statistics of accidents and incidents in dangerous production facilities of gas distribution organisations for the years 2019 to 2023



Source: compiled by the authors.

Accordingly, the demand for specialists with a high and the highest level of personal education and qualification increases, which, of course, requires the attraction of very significant target costs, which can be compensated to the global investor in the future both by directly increased returns from the application of the results of their labour in the sectors of the real economy [Ilyinskaya, 2010], and by contributions in other various aspects in the mode of an economic multiplier. It is precisely this phenomenon in its sequence of algorithms and operations that was reflected in the development of the concept of human potential formation, which was reincarnated in the list of categories of innovative production as human capital.

1.Clarification of the problem and the purpose of the research

This article examines the concepts of risk and uncertainty, their definitions, refined classifications of human risk, problems of risk comparison, methods of informational description of possible scales and metrics of hazards, predictive outcomes in statistics and dynamics, and, finally, approaches to the development of a system for measuring the risk of the human factor itself.

At the same time, the authors of the article propose the further development of a methodology for minimising the risk of the black field by selecting tools based on probabilistic assessments in relation to the conditions of those threats that create dangers for the harmonious balance of forces and actions usually included in the material complex of human behaviour. This or that content of the complex appears and is taken into account when justifying and making a final management decision in unclear situations that develop in conditions of

[2] Civil Code of the Russian Federation, Article 401. https://www.consultant.ru/document/cons_doc_LAW_5142/.

environmental uncertainty. In the most general form, uncertainty is understood as incomplete knowledge of the actual state of the studied, for example, socio-economic process, since analysts never have access to all the necessary information about the environment of the occurrence of the phenomenon and/or the course of the process.

According to the established opinion in the statistical community, the most consistent approach to the problem of accounting for uncertainty in solving optimisation problems is the probabilistic one - based on the frequency concept of the existing objective probability. The concept of objective mathematical probability in the axiomatics of Academician A.N. Kolmogorov, as a non-negative, σ-additive, normalised measure, is widely used in the construction of optimisation models that take into account uncertainty in relation to the predominant number of cases from the class of mass processes. However, the probabilistic properties of models can be successfully determined in non-mass cases, for which either methods of expert assessment or some inductive rules are used, operating both with the principles of entropy and with the principle of invariance. The already assessed uncertainty of the environment is subject to its proportionate reduction by reducing it to the original conditions of emergence and existence of risks, in particular from the group of black-field risks [Tsatsulin, Bykov, 2023, p. 127]. After all, if we analyse the environmental factors, both external and internal, it will quickly become clear that the behaviour of a certain person is explained by the state of the environment and/or the legal field, regulations, certain rules, which sometimes it is completely or partially impossible to convey information to this person [Hunt, Krivoshapka, 2020]. Therefore, it is necessary and important to create universal and specialised information bases and databases, which will allow, in particular, the so-called information diversification (see [Kordovich, 2008]) of factual and separate factorological arrays.

The clarification of such conditions of the environment of the existence of risks of personal characteristics and attempts to create methods of estimation of the effects of their impact on the activity of a certain organisation formed independent directions in many studies. Individual achievements allowed to improve the system of management of personal characteristics, i.e. personal characteristics themselves, in certain branches of the national economy, in certain enterprises. For example, the Russian consulting company SRG-ECO tried to develop an original method for measuring the human factor - Human Aspect in Labour Protection (HALP), known in the Russian version as the Diagnostic and Preventive System for Assessing the Human Factor[3]. The methodology has already been tested by experts in domestic companies and has received positive reviews on social networks and in the professional community.

However, in the comparatively narrow, limited and extremely specific field of the design of restoration and recovery works on immovable cultural heritage (ICH) objects, the authors of the article did not find any such specific studies. Nevertheless, the standards of behaviour in the organisation, the cultural and professional aspects of its core activities, undoubtedly affect the activity of the HF in the production of scientific and design works, which determined the purpose of this study, which is reduced to measuring the impact of HF risks on the efficiency of the analysed type of activity. Here, the authors understand HF as a structural component of the anthropogenic factor, influencing the modification not only of the environment, but also of the habitat of the person himself.

The article studies the assessment of complex damages and indirect losses, including a decrease in market activity and loss of business reputation of a specialised design organisation due to the negative impact of HF in the whole spectrum of its constituent elements on the results of professional, mainly creative activity. The subject of the study is the existing procedures and tools for measuring the impact of these risks in a multi-factor statistical analysis and modelling of business processes based on reliable baseline information.

Although the relevant specialists (statisticians, economists, sociologists, risk managers) recognise the usefulness of the above-mentioned diversification of information in research and, in essence, the intersection of various characteristics-factors in their sets, there are no clear indications in the literature reviews of the requirements and conditions of use under which the selected instruments reduce risks/threats and, consequently, the damage incurred. However, there are interesting sensational developments in the field. For example, analysts from the St. Petersburg administration calculated that the city's annual losses due to the implementation of climate risks amount to almost 786 billion roubles, and the number of independent risks of global climate change by type of detailed classification turned out to be no more and no less than seventeen[4].

There are also no universal, sufficiently reliable and convincing methods for measuring the impact of prescribed or recommended tools for reducing the probability of adverse outcomes based on the results of the organisation's project activities and/or analytical understanding of the depth of the risk situation, as well as risk sensitivity analysis and global risk analysis of the Black Sea Fleet during the final acceptance of the completed ONCH restoration project by the direct customer.

[3] https://srgroup.ru/.
[4] https://78.ru/news/2024-05-28/usherb-peterburgu-ot-izmeneniya-klimata-ocenivayut-v-780-mlrd-rublei-v-god.

2. Scientific elaboration of the research problem

In order to achieve the research objective and related tasks, it is necessary to identify the essence, to discover the sources, elements and properties that form the basis of concepts such as risk and uncertainty, since both the abundant scientific developments and materials, as well as the enviable wealth of pedagogical and methodological literature on risk management, contain interpretations of these terms and concepts that are characterised by their unfortunate ambiguity. Modern researchers of a topic that has been raised for quite some time, rather vaguely assume that risk is considered to be the flip side of freedom of choice, and the absence of a selectable alternative essentially also means the absence of any significant or even noticeable risk/threat of an unfavourable event occurring under conditions of environmental uncertainty that have not been fully clarified [Semerkova, 2005].

At the same time, in order to formulate a strategy for a particular choice in controversial conditions of uncertainty and as a basis for a management decision, the research literature traditionally recommends the use of probabilistic criteria by A. Wald, A. Hurwitz, L. Savage and others.[5] However, with regard to the uncertainty associated with HF and the predictability of human behaviour in a specific production situation, it should be understood that the most advanced corporate culture adopted by an organisation, based on correctly understood principles of freedom and responsibility, is of little value if employees do not bear personal, regulated responsibility for their erroneous actions for freedom, which has a certain price [Frantz, Rhoades, 1993]. It is here, in the opinion of the authors of this article, that the methodological sources of HF risk management can be found, particularly in a typical design and survey organisation.

The concept of risk is directly linked to measurable uncertainty and potential loss in the event of one or another economic, legal, social or other unfavourable outcome of an event. And if the category of 'event' is understood as a quantifiable result and sensory evidence of a specific test, then an event as a philosophical content reflects the category of 'the essence of the object/subject of scientific research' through the external forms of its existence. Under the quantitative result of the tests in general at different times and in different spaces of the general set of events (more precisely, its exhaustive set), dialectical logic and Marxist dialectics perceive and consider the canonical unity of the category 'essence' with another philosophical content called 'phenomenon' [Marx, Engels, 1962, p. 384]. It is fully consistent with the conceptual apparatus of epistemology [Lenin, 1974, p. 227] and does not contradict the philosophical approach to understanding the sources and postulates of the theory of knowledge of the postmodern era [Badiou, 2007].

Usually, the result of the realisation of risks for any phenomenon is an increase or decrease in some specific welfare, security and satisfaction of the owners or other economic agents who take these risks [Batanova, 2008, p. 127]. Thus, despite the fact that risk is a rather multifaceted entity and, of course, a multidimensional concept, something common to the definitions of various authors is the uncertainty in relation to one or another type of properly registered property from the point of view of legal and technical registration [Bulochnikov, Vinogradov, 2008, p. 146].

As a result, in view of the multifaceted and multidimensional nature of the risk of the HF, its final implementation comes down to the damage caused to the owner. Its scope covers the areas of activity on the production of goods, provision of services, consultations, implementation of socio-economic and scientific-technical developments and projects, design and engineering, forecasting, expert work on financial intermediation and commodity-money transactions [Bogatyrev, Tsatsulin, 2024, p. 174-193]. By taking risks, the owner or the hired manager (in any case, the person making the management decision, hereinafter referred to as the PMMD) still expects to make enough profit to receive the expected benefit. When investing in a project, the PM strives to obtain the benefit that covers the costs incurred/invested directly in the project [Tsatsulin, Bykov, 2023, p. 135].

In the search for means of safe operation of organisations, the so-called ALAPA principle (As Low As Practicably Achievable) was even formulated, according to which it is necessary to strive for the maximum theoretically possible safety, regardless of the cost. However, it turned out that such an approach, despite its attractiveness, is not scientific, since its consistent implementation leads directly to an increase in threats/dangers/risks with absolutely ineffective spending of target resources [Tretyakov, 1993, p. 17].

In fact, in addition to the direct risk that the measures themselves aim to reduce, there is a group of indirect risks caused by the specific characteristics of the ONCH and the restoration and construction works, as well as the equipment and materials available to the contractor and

[5] The Wald criterion (the so-called maximum, most cautious) is used by the decision maker when he chooses the option of an extremely pessimistic solution, without taking into account the risks; the strategy that guarantees the maximum profit under the worst conditions is accepted as optimal, which orients the statistics towards the most unfavourable conditions. The decision maker using the Savage criterion, in one way or another, takes into account the presence of a perfectly understandable risk, is guided by a more favourable development of the situation compared to its initial worst state, and chooses the strategy that provides for the prevention of excessive losses, which it can lead to. The Hurwitz criterion is used as a basis for the choice of the option in the most uncertain environment in the presence of all the risks considered in the preliminary analysis, for which a linear function of the pessimistic and optimistic outcome of the studied steady-state dynamic event is constructed [Kuznetsov et al., 1980; Savage, 1981, p. 432]. In any case, it is recommended to use several criteria, including the so-called combined Bayes-Laplace, Hodge-Lehmann, etc. criteria [Gorsky, Labsker, 2020].

the client, their operational characteristics, technologies, etc. Thus, the recognition that in a number of cases it is impossible or even inappropriate to achieve 'zero risk' (according to the ALAPA principle) has raised the problem of defining an acceptable level of risk or, in other words, of establishing a certain level of safety in the performance of design and survey work.

A number of suggestions were made, some of which were based on a comparison of the risks involved in implementing innovative technologies with the existing risks of technologies that were already updated at the time of implementation. The risk is considered acceptable if the innovation leads to a reduction in the overall risk. Other proposals have been reduced to a procedure for optimising safety costs, where the criterion of optimum is the minimum of total risk. This principle of ensuring the safety of activities is called ALARA (As Low As Reasonably Achievable), i.e. setting the level of safety of the organisation's operations as low as it can reasonably be achieved.

In recent years, a new direction in risk management has emerged, which is understood as a set of measures aimed at reducing the level of overall composite risk, i.e. the potential but always present material losses and other negative consequences of an incident in the broadest sense. The central concept in the risk management methodology is an incident/accident/error, which is recognised as inevitable and requires the development of protection systems to reduce its occurrence.

Accordingly, the subject of risk is the loss of various resources: mainly financial, labour, material, information, as well as the loss of business reputation, a threat to the image of the ES in the form of reputational risk, a decrease in the value of its brand and a decrease in its market activity. Thus, the amount of total losses can be correlated in one way or another with the measure of risk, which accordingly helps to determine its magnitude [Kas'yanenko, 2008, p. 184].

It is here, in this article (the first on the subject), that the authors believe it is necessary to quickly identify and adapt the tools that allow a proportionate reduction in the risks identified; in this case, the main tools for calculating the risk measure are sections of probability theory and mathematical statistics. Probabilities themselves, according to renowned experts in the field of artificial intelligence, 'are a way of accounting for the uncertainty that arises from economy of effort and lack of knowledge' [Russell, Norvig, 2006, p. 624]. In this case, it will be possible to express plausible judgments about the occurrence of a particular event with an established level of confidence/reliability and acceptable reliability.

The new institutional economic theory uses the term 'subjective risk', which is closest in meaning to the term 'human risk', as the tendency of individuals to behave opportunistically in the theory of modelling the mechanism of a commercial contract. Subjective risk is understood as the possibility that the insured will not take appropriate measures to reduce the probability of the insured event occurring within the term of the contract and will not be ready to take responsibility for the possible and various negative consequences of the mistakes made [Kashina, 2004].

At this point, we should avoid the fallacy of looking for the causes of the disease of irresponsibility exclusively in the character flaws of the organisation's employees, even though the term 'responsibility' itself has an understandable connotation of responsible behaviour. This leads to the realisation that any responsibility is represented by a certain behaviour in the form of specific actions that can be monitored and controlled. External control of an employee's feelings, thoughts, loyalty to the organisation, etc. is still fundamentally impossible. And if the head of an organisation really wants to create real responsibility among his employees, he must formulate the necessary and clear requirements for their behaviour [Smirnov, 2002].

3. Research methods and information base

The theoretical and methodological basis of the study was formed by the works of Russian and foreign scientists and specialists, who dealt with the issues of designing repair, construction and restoration works at the ONCH sites, and the associated risks related to HF. In order to obtain information on the parameters/indicators of risk accounting systems in Russian design and survey organisations, information banks and databases of data of interest were used, as well as reports from specialised related organisations engaged in the design of relevant work.

To solve the problems posed in this study, methods of materialistic dialectics, methods of inductive (probabilistic) logic, computational techniques of economic statistics, continuous and selective observation, methods of scenario approach, decision making, expert assessments, methods of financial and economic analysis and multifactor statistical modelling are used.

4. Research findings

The specific meaning of risky behaviour of an employee, a specialist of a design organisation in a given situation, and separately in the case of restoration works on the ONCH, is acquired by the execution of a contract concluded as a result of a tender for the performance of design and survey and restoration works of a construction and restoration nature, including the preparation of a feasibility study (hereinafter referred to as FES) of the project, project management, engineering services, etc. The need to use methods and tools that help take into account the risks and uncertainties associated

with decisions, which in most cases are significant [Kardanskaya, 2017], is increasing, especially in large organisations, where the principle of separating creative labour functions (not to be confused with the banal reduction of labour in mass, serial production) and creative operations in the process of making informed management decisions is widely applied.

Decision-making in a creative environment, i.e. any project work in an organisation with the ever-present so-called project risk, generally appears to be a holistic process, starting with the phase of recording the initial state of the analysed situation. This situation should always be perceived by the decision-makers as a significant deviation from the desired target state of the search environment, where the solution should be updated in accordance with the formulated goal setting, for example, in the performance of scientific and design work for the restoration and adaptation to modern use of immovable historical and cultural monuments of various levels of significance in the territory of St. Petersburg, the Leningrad region and the North-West region of Russia as a whole.

The specificity of the risks associated with the manifestation of HF, i.e. the usual behaviour of a person and the unusual actions of certain people acting as independent biological beings endowed with will and consciousness[6], is characterised by extreme diversity and natural complexity. Specificity includes first and foremost the biological characteristics of the human body, namely: susceptibility to disease, injury, age-related changes and old age, disability, dependence on outside help and other limitations of the individual. Such HF risks arise as an individual passes through the stages of his or her own life cycle, a sort of transient earthly valley of life, and can theoretically include a wide variety of phenomena associated with human life.

Thus, from a social engineering point of view, an individual's actions can be interpreted very broadly and include not only meaningful actions, but also physical reactions, body characteristics, involuntary actions, etc. Errors made by workers are to a large extent caused by psychophysiological limitations, such as reduced ability to perceive and process information, errors in management decisions, susceptibility to stress, fatigue, belonging to a risk group, including gambling addiction, which has recently taken on threatening proportions, emergent effects of actions, etc.[7]

The uncertainty that underlies the risks of cystic fibrosis is associated with the uncontrolled and sometimes aberrant behaviour of a particular individual in a particular, sometimes critical situation, where both the physical and mental components of the behaviour are simultaneously present and manifest. In the mental component, the so-called spiritual, conscious and unconscious processes usually occur. Depending on which of the above-mentioned components the sources of uncertainty in the environment in which the risks of HF are studied belong to, the latter can be classified as follows: physiological, behavioural, socio-public.

Physiological risks of cystic fibrosis are generated by causes, the implementation of which forms physiological reactions and properties of the organism of a specific individual, and these include such causes of dangerous events as poor vision, i.e. the inability of the eye to adapt to the instinctive physiological act of seeing[8], myopathy and myasthenia (muscle weakness), various diseases and health disorders, and finally, the cessation of all physiological processes in the body, i.e. death, the completion of the life cycle of an individual.

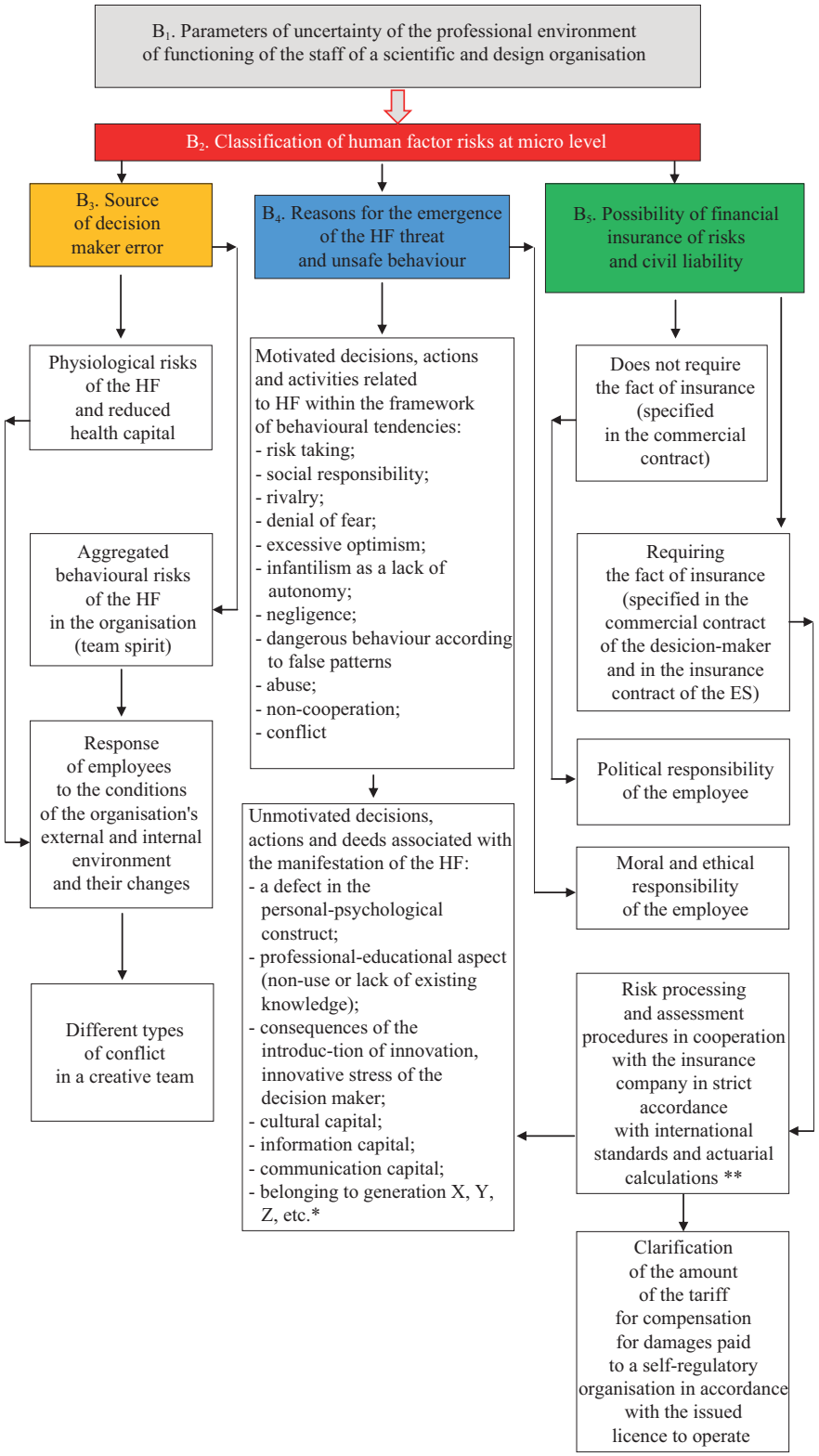
Behavioural risks of the HF, on the other hand, are the causes embodied in the decisions and actions of certain employees acting as independent decision-makers. Depending on the presence of will and awareness of consequences in the actions of employees, the subgroup of behavioural risks distinguishes decisions and actions as motivated, which can be established in the course of legal and technical procedures, and unmotivated, when the desicion maker performs actions that have undesirable consequences, including for the person himself. In this case, it is generally accepted that what happens is random in nature, has some stochastic distributions, and typical representatives of a certain group/category of causes (taking into account signs-factors acting as an independent variable) can be absent-mindedness, all kinds of miscalculations, errors and omissions of various kinds in work.

In addition to the biological characteristics of the behaviour of a particular desicion maker, it is necessary to separately identify a group of so-called socio-public risks directly associated with HF, which include the conditions of the functioning of the economic environment in the period under consideration, namely the general level of family income, the level of wages and the tax burden, the state of the labour market, the quality of the health care and social protection system, restrictions on access to socially accepted social standards, and even belonging to a certain age group of the population according to the Strauss-Howe generation theory [Howe, Strauss, 2008], recognised/accepted for Russian realities[9].

Most often, the risk category is defined as a potential danger or threat. However, the composition of the risk of HF, which is essentially socio-psychological in nature,

[6] https://allinsurance.kz/training-center/2012-06-28-04-04-26/upravlenie-riskom-risk-menedzh-ment/risk-menedzh-ment/1773-232-riski-svyazannye-s-chelovecheskim-faktorom.
[7] Identified consequences that the parties involved did not consciously seek in their actions.
[8] If normal vision is called proportionate or emmetropic, then the main types of human vision impairment are colour blindness, nearsightedness (myopia), farsightedness (hyperopia), astigmatism and some others.
[9] https://www.mirapolis.ru/blog/bumery-millenialy-i-zumery/.

Fig. 3. Classification of the risks associated with the impact of the Black Sea Fleet on the efficiency of the design and survey activities of a specialised organisation in the field of restoration works



* [Howe, Strauss, 2008].
** International standard ISO/IEC 27102:2019: Information security management – Guidelines for cyber-insurance ('Information Security Management: A Guide to Cyber Insurance'). http://rusrim.blogspot.com/2019/11/isoiec-271022019.html.

Source: compiled by the author.

includes several of its aspects. On the one hand, there is the risk of losses associated with the occurrence of unfavourable events in a person's life and, in our case, a desicion-maker as the first component. At the same time, the personal losses incurred by the desicion-makers and the organisation in which he or she works cannot always be compensated for by his or her income and, moreover, can be considered as missed opportunities for the comprehensive development of the desicion-maker's personality. On the other hand, the possibility of receiving any free transfer for persons who have a formal right to it, but which does not correspond to the true state of the recipient, becomes extremely illusory and is reduced to the second component.

The third component is the guarantee of the maximum set of social services necessary for the development of the individual and provided by the state, which contributes to the normal and safe functioning of society. The risk of not receiving/under-receiving the minimum set of social standards is accompanied by a limitation of opportunities for the full development of the individual. For example, lack of computer and financial literacy, systemic digitalisation skills, etc. limit access to information flows, which can be seen as a specific missed opportunity for individual development. At the same time, such risks may threaten not only the full development of a specific individual as a form of human capital, but also the security of the society and/or the economic unit at the micro level where this individual is employed - a specific unreliable employee, so to speak, belonging to a risk group. It is there that the requirements for the quality of human capital are assumed to be the highest.

The fourth component of the social and public risk of the HF is connected with the population's access to the reform of the system of social institutions functioning in society, a kind of natural selection and improvement of the best creative initiatives. This component is also related to the level of professional competences achieved by the population employed in the national economy, which is formed as a result of the education received at different times, the acquisition of specialised knowledge, skills, abilities and skills during retraining, further training, etc., as well as the previous presence of the individual in a specific social environment and his/her background.

The taxonomy of HF risk itself should be understood as the distribution of risk into specific classification groups according to certain characteristics and factors for the detailed formulation and achievement of the goals set. The main thing here is to maintain the purity and stability of the classification feature-factor with previously adopted criteria for conducting typological statistical grouping. When constructing possible classifications of human risks, the block principle can be applied, which assumes the distribution of human risk components by categories, types and subtypes, groups, subgroups, families and other levels.

The classification can be built on different principles and bases, for example: general (unified) and specific (block), according to industrial and regional criteria, with or without the use of any summary characteristics in the form of an index, indicator, etc., but necessarily with the parameterisation of the habitat of the analysed micro-level organisation, as shown in block B_1 in Figure 3. The process of detailing the classification of risks according to the block principle from the human factors point of view is shown rather schematically in the figure, and the synthesis and/or detailing of blocks, if necessary, will not be difficult at any stage of a detailed study of the nature of human factors risks.

In the activities of specialised design and survey organisations, the analysis of the issue of sources and causes (signs-factors) determining the existence of human capital risk is of the greatest practical importance. Personal and psychological factors of HF risk, indicated in block B_4 for the group of unmotivated actions and deeds in Fig. 3, which also determine the market competitiveness of HF on the labour market, play an increasingly important role at the micro level of the economy in modern production-economic and financial-sales activities of the ES.

Personality traits such as discipline, energy, businesslike attitude, as well as sociability, ability to respond to external influences and other characteristics of an individual act as an important aggregate factor in the efficiency of the use of human capital, especially in knowledge-intensive industries of the real sector of the economy and in the service sector. At the same time, the theoretical significance of the results of statistical analysis of related sectors of the array of factorological material is in no way diminished.

Contact with rapidly changing and constantly updated conditions of the external and internal environment, which the decision maker often does not have time to foresee and is not ready to understand, forces him to make decisions on new situations and tasks under time pressure. It leads him to a serious psychological problem in the form of phobias - fear of any change and fear of making a wrong decision. Phobias, in turn, greatly reduce not only the capacity of personal memory, but also the operational and technical level of the individual's intellect as a whole.

In the decoding of the positions of block B_4 in Figure 3, there is also a factor of imputed innovativeness, which requires due comment, since the modern vision of the concept of psychological stress allows us to consider innovative moments as one of the factors of neurosis. In addition, any novelty can be interpreted as stress, which suggests the formation of one or another neurosis, since there are at least two isolated sign factors involved - the

reaction of the individual at the mental level and the reaction of the body LPUR at the physiological level.

Depending on the strength and duration of the innovative influences, the combination of the individual's reaction to the decision maker and the development of compensatory mechanisms of its adaptation, stress as a product of the influence of the innovative factor can acquire either a mobilising or a destructive and painful character. The latter type is known in psychological literature as stress/distress [Cheprasov, 2011, p. 50], which requires the detection and identification of such a threat, the vulnerability of the decision maker and the implementation of appropriate measures in block B_5 in Fig. 3.

One of the main approaches in the theory of innovative neuroses is to consider innovative stress (social and public conflicts, changes in the external and internal environment, crisis phenomena, etc.) as a phenomenon leading to the emergence of various types of psychological conflict [Shcherbatykh, 2012]. For a decision maker, the introduction of new equipment, innovative technologies (especially basic ones), materials and services usually means the need to abandon the state of habitual perception, the 'good old' meme, a change in long-established but somewhat outdated public and social ideas, established professional relationships and a clip of communicated contacts.

Innovations imposed 'from above' often provoke overt or covert resistance, sometimes even a hostile reaction from the professional environment to the somewhile aggressive onslaught of innovation. Even in the case of consensus, its implementation is accompanied by latent conflict as it forces staff to adapt to mandatory and regulatory changes. Consequently, conflict can also be considered as an objective source of the emergence of HF risk and as an independent sign factor that necessarily accompanies innovation processes.

Personal-psychological and communicative factors of human risk are directly related to social-production relations and conflicts of interest between people. They find their solution in the form of overcoming the conflict according to the established canons of classical conflictology, with the emergence of new conflicts of interest and new social and industrial relations, manifested in such a quality of human nature as self-reflection. In other words, the analysis of an individual's responsible behaviour and inner world is carried out in order to resolve deep inner problems, torment and to find ways of further self-development. This specific quality of HF, as noted, for example, in [Ushanov, 2011], turns out to be the basis that serves as a foundation for the development of a complex of relations between the subject and object of management with the aim of adapting the latter to the challenges of external and internal changes.

The phobia of making a wrong, erroneous decision due to time constraints, i.e. strict design deadlines, coexists in block B_4 in Fig. 3 with the information overload of the decision maker, which implies a lack of understanding of the responsibility that a key employee of an organisation performing scientific and design work imposes on himself, according to the positions of professional and functional instructions, as well as the departmental methodological recommendations[10].

Those who cannot cope with the increased speed of decision making begin to show symptoms of fear of the manifestation of unknown direct, indirect and associated risks, and the actual fear of action forces them to slow down the process of making a particular management, engineering or technical decision. In such a psychosomatic context, tendencies towards persistent resistance to more or less significant changes begin to manifest themselves. Such behaviour of an individual on the Internet and in the perception of information is currently being seriously studied by specialists in the field of risk management.

The targeted collection of information necessary for the study of risks of various kinds requires the solution of a whole range of methodological problems and issues in the creation of an information system for measuring, comparing, analysing and forecasting social and public risks at various levels of management. All this is possible within the framework of departmental statistics, provided that there is a regular interdepartmental exchange of information. The lack of a theoretical basis and an established, generally accepted system of technical, economic and other indicators not only complicates the formation of both, but also hinders interdepartmental analysis in the mode of the above-mentioned diversification of information.

The integrated, interconnected use of information from different departments opens up favourable prospects for thorough, comprehensive and, above all, justified measurement using a single methodology and interdepartmental comparisons of the HF risk system, for example during design and survey work, where significant risk tensions are observed. Only then will there be a prospect of developing and subsequently implementing some kind of integrated risk management system.

There are three possible approaches to the integration of interdepartmental information, which are implemented on the basis of:

– an individual approach to the analysis of the activities of a specific scientific and design organisation, i.e. the identification of employees with low indicators in the broad sense of reliability;

[10] RNiP-4.05.01-93. Methodological recommendations for estimation of costs of scientific and design works for restoration of historical and cultural monuments. Moscow, 1992.

– study of the composition of restoration, construction and other works carried out by the scientific and design organisation;
– the results of the analysis of the personal skills and human capital of performers in specific jobs, which will allow us to identify areas for the development of personal characteristics in the areas of communication, emotional intelligence, stress resistance and other individual qualities.

5. Discussion

An error prevention system is more effective if it focuses not so much on quality control of products and/or services, but on quality control of production processes and/or delivery of integrated services, business processes and their prioritisation. Accumulated statistics show that despite constant efforts to improve the security of, for example, large and small companies, the majority of incidents are due to the functional unreliability of a person. Therefore, today the main emphasis in prevention and protection against HF risks should be placed on the protection of employees from mistakes, according to some researchers [Olinovich, 2010], and the authors of this article agree with this opinion.

From the conceptual positions of social engineering, methodological and instrumental tasks of threat analysis, socio-public risk is understood as the probability of the occurrence of events that threaten the normal reproduction of human capital, the physiological and socio-economic life of an individual and belonging to a generation of a specific age group of the population. Thus, according to Rosstat, the X generation (born 1967-1984) makes up 28.7% of the country's total population, the Y generation (or millennials, born 1984-2000) - 20.5%, and the Z generation (or zoomers, born 2000-2015) - 16.3%[11]. It is these three groups, out of six that have emerged and that sociologists have observed, that make up the majority of applicants for a particular position in the organisation.

The differences in the worldviews and backgrounds of the X, Y and Z generations, which are the source of the threats (see B_4 in Fig. 3), can be extremely useful both in the search for new non-trivial solutions to routine problems and in the implementation of fundamental innovations in an organisation. It has been shown that in game and practical Brain Storming situations, the participation of representatives of all three generations in a single team leads to a higher quality management decision and produces a better result than a mono-team with representatives of only one generation. An employer who recognises the benefits of age diversity in his workforce may find himself in an advantageous position.

General criteria of social and public risk usually include the following: probability - frequency (f - frequency), frequence (φ - RF, frequence) - of occurrence of a risk situation; duration of a risk situation, i.e. the period between its occurrence and transition to normal, usual conditions of life of an individual, economic entity, other object of study; level of social guarantees in case of occurrence of a risk situation; level of material security before occurrence of a risk situation; amount of personal contribution to creation and realisation of a risk situation; amount of personal contribution to creation of insurance funds and reimbursement of full or partial damage from the position of the insurer[12].

Moreover, paradoxical as it may seem, the desire to completely eliminate the risk of a normal, rational, logical and reasonable person making a mistake for various reasons seems to be an unjustified whim in certain areas of creative and intellectual activity. And here one cannot but agree with the statement from the famous work: 'A wise man is not a man who does not make mistakes. Such people do not exist and cannot exist. A clever person is one who makes mistakes, not very important ones, and who can and knows how to correct them easily and quickly'. [Lenin, 1981, p. 86].

However, the human brain, as a unique information neural network, is so complex, and the algorithms of human behaviour, as a product of a progressive thought process, so unpredictable, that an individual's actions can often turn out to be simply irrational, so it is not only possible to correct mistakes, but one should definitely learn from them.

The representatives of the philosophical school of the cynics have left us with the humorous maxim that one's own experience helps to avoid repeating mistakes for the seventh time. In the concepts of innovation policy that are currently being implemented everywhere, the so-called trial-and-error method is one of the key aspects. The best practices of domestic and foreign IT companies and the successful experience of transforming their market business in highly competitive conditions show that in truly innovative environments, which require the presence of the highest creative potential, each individual is allowed to make mistakes of a certain severity.

Conclusions

On the basis of the material in this article, five rather brief interim conclusions can be drawn about research.

1. In everyday scientific, design, engineering, etc. activities, the decision maker, when making all sorts of decisions in an insufficiently defined production

[11] https://www.mirapolis.ru/blog/bumery-millenialy-i-zumery/.
[12] Yukaeva V.S., Zubareva E.V., Chuvikova V.V. (2016). Making Management Decisions: Textbook. Moscow: Dashkov i K, 216.

environment, may also be confronted with the uncertainty of the consequences of its sometimes erroneous actions in the mode of already occurred risks. A meaningful explanation of the multidimensional matrix of such uncertainty, the study of unknown state spaces, their essential content and a reliable measurement of the multiplicity of risks, as the authors of the article believe, will be possible if the methodology of inductive logic is always applied. The latter has adopted the modern form of probabilistic logic, supported by qualitative measurement tools such as Instrumental Variables (IV) and other statistical techniques and methods.

2. Correction of changes in the behaviour of the decision maker in a design and survey organisation in the field of design of restoration and construction works is possible if a number of requirements are met, in particular, reduction of direct mistakes and errors, the proportion of which, even in a regulated stable management system, reaches 5-10%. Given the absolute impossibility of completely eliminating them in the daily activities of the creative industries, a reduction in the level of errors is possible by moving to controlled/supervised regulations for the automated development of projects and technologies, with strict adherence to a risk-centred approach aimed at minimising the foreseeable direct and indirect types of damage. The latter must necessarily entail a proportionate reduction in the level of tariffs transferred to the industry's self-regulatory organisation.

3. It is impossible to develop an integrated system for measuring HF risks and the technology for managing them in a research and design organisation without a deep and fundamental understanding of the causes of human behaviour and a comprehensive assessment of the seriousness of any erroneous actions of the decision maker, an adequate assessment of the perception of the essence of these risks. Otherwise, each ES will involuntarily form its own additional risks of a professional nature, assortment and nomenclature characteristics and related features of the ES's presence in the industrial market environment.

4. Special attention should be paid to the possibility of preventing the occurrence of erroneous decisions in scientific design works, the implementation of which will, in one way or another, be connected with the expansion of the scope of application of artificial intelligence and robotics technologies from the realm of creative design possibilities. In this case, it is unproductive to shy away from the accumulated foreign experience in solving the identified problems, and the ES must focus on transforming the research and design organisation into a platform for advanced development and, accordingly, qualified solution based on verified statistics of the threat-metric complex of narrow professional problems of the ES operating in the restoration works market of the ONCH.

5. Finally, the authors of the article strongly recommend that developers of advanced innovative and digital technologies pay particular attention to the supposedly risk-free behavioural algorithms of robotic performers, which are being created everywhere with the help of artificial intelligence. Such essentially neural network algorithms can, of course, in most cases turn out to be congruent with basic anthropomorphism, which suffers from vulnerability, insecurity and a tendency to misbehave. These concerns are justified in the context of the reports that have appeared about the successes of some domestic scientific centres in creating models of neuromorphic microelectronics, in which basic integrated circuits and neuromorphic processes replicate the structures of the human brain and in some ways coincide with it. And although the seemingly controversial achievements of neuromorphic engineering have long been known, the mysteries of the human brain have not yet been fully unravelled, and therefore the HF errors cannot be eradicated.

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Qualitative assessment of climate risks for companies in the Russian fuel and energy complex

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Abstract

This paper presents the existing methodological recommendations for assessing the climate change risks of fuel and energy companies. The classification of climate risks is presented in accordance with the most authoritative methodological recommendations for assessing climate risks - the recommendations of the Task Force on Climate-Related Financial Disclosure (TCFD). Climate risks are divided into two categories: risks associated with the effects of climate change (physical risks) and risks associated with the transition to a low greenhouse gas economy (transition risks). Physical and transition risks are described, as well as the possible consequences associated with the occurrence of the risk. Climate risks of three Russian companies representing the Fuel and Energy Complex (FEC) are considered. For each company, a description is given of the risks, both physical and transient, identified by the companies as a result of climate change and the mitigation or adaptation measures developed by the companies. Conclusions are drawn on the need to assess climate risks and take them into account when implementing the business process of managing greenhouse gas emissions in order to reduce future costs arising from the onset of climate change.

Keywords: climate risks, climate change, sustainable development, fuel and energy companies.

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对俄罗斯燃料和能源行业公司气候风险的定性评估

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简介
本文总结了评估燃料和能源综合体企业与气候变化相关风险的现有方法建议。本文根据最权威的气候风险评估方法建议--TCFD 气候相关财务披露工作组的建议，对气候风险进行了分类。 介绍了有形风险和瞬时风险，以及与风险发生相关的可能后果。对燃料和能源行业的三家俄罗斯公司的气候风险进行了研究。 每家公司都说明了已确定的气候变化风险，既包括有形风险--飓风、洪水等急性风险，也包括可能导致海平面上升或干旱的长期气候条件变化所带来的慢性风险，还包括与向低碳经济过渡有关的过渡性风险。 介绍了各公司制定的缓解和适应措施。得出的结论是，有必要评估气候风险，并在实施温室气体排放管理的业务流程时将其考虑在内，以降低未来因气候变化而产生的成本。
关键词: 气候风险、气候变化、可持续发展、燃料和能源公司。

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Introduction

Climate change and environmental degradation are serious challenges facing the global community. At the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP28) in Dubai in 2023, Parties recognised the need to reduce greenhouse gas emissions, taking into account different national circumstances, pathways and approaches. The final joint statement includes measures to reduce greenhouse gas emissions: tripling the capacity of renewable energy sources (hereafter referred to as RES) by 2030, gradually reducing the share of coal-fired power generation without carbon capture, gradually phasing out fossil fuels in energy systems 'in a fair, orderly and equitable manner', accelerating measures to achieve carbon neutrality by 2050 in accordance with scientific data, etc.[1] The National Action Plan for the Second Stage of Adaptation to Climate Change for the period up to 2025 shows that the average annual surface air temperature on the territory of the Russian Federation is currently increasing on average 2.8 times faster than the average global air temperature[2].

IIn order to reduce the risks caused by climate change, Russia has adopted the Climate Doctrine[3], which is based on background and applied scientific knowledge in the field of climate and related areas, including a retrospective current analysis of the climate system, the influence of various factors on the climate, the forecast of climate change and its consequences for all sectors of the country's economy, as well as an assessment of the possibility of mitigating the impact on the climate.

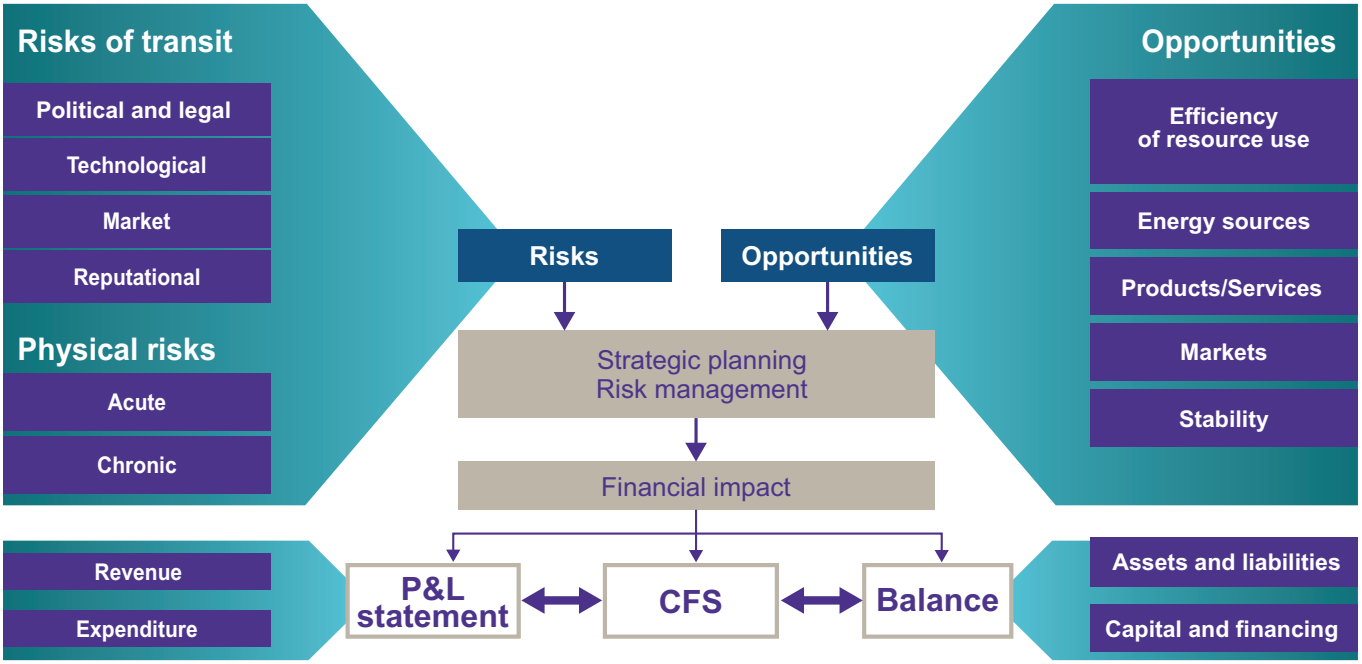
Russia's Fuel and Energy Complex (FEC) is the basic sector of the country's economy, ensuring energy independence and the progressive development of the country's entire industry. Fuel and energy companies, especially those involved in the extraction and combustion of hydrocarbons, are major sources of greenhouse gas emissions, as the technological processes of hydrocarbon and coal extraction are inextricably linked to greenhouse gas emissions (carbon dioxide, methane and nitrogen dioxide). Reducing these emissions is therefore an increasingly urgent task for fuel and energy companies.

1. Climate risk assessment methods

There are several approaches to assessing climate risks. The most authoritative are the recommendations of the Task Force on Climate-Related Financial Disclosure (TCFD), established by the Financial Stability Board (FSB) in 2015 to develop approaches to climate-related disclosure to inform

[1] First global stocktake. Conference of the Parties serving as the meeting of the Parties to the Paris Agreement Fifth session United Arab Emirates. 2023. https://unfccc.int/sites/default/files/resource/cma2023_L17_adv.pdf.
[2] National Action Plan for the Second Stage of Adaptation to Climate Change for the Period to 2025. Decree of the Government of the Russian Federation of 11.03.2023 No. 559-r. 2023. http://publication.pravo.gov.ru/Document/View/0001202303130019.
[3] Decree of the President of the Russian Federation dated 26.10.2023 N 812 'On Approval of the Climate Doctrine of the Russian Federation'. 2023. http://publication.pravo.gov.ru/document/0001202310260009.

Fig. Risks, opportunities, and financial implications of climate change



Source: Climate risks in the reporting of insurance companies. Report and Letter of the Bank of Russia dated 12.01.2021 No. IN-015-53/1 'On Accounting for Climate Risks'. FBK Grant Thornton. https://www.fbk.ru/upload/press-center/Климатические%20риски%20для%20СК_final.pdf.

investment, credit and insurance policies, understand the concentration of carbon-related financial assets, and assess the exposure of the financial system to climate-related risks. The TCFD recommendations apply to the following aspects: corporate governance, corporate development strategy, risk management system, corporate objectives and metrics[4]. The TCFD methodology divides climate risks into two categories: physical risks associated with the impacts of climate change, and transition risks associated with the transition to a low-carbon economy.

Physical risks represent a significant financial cost to organisations.

Physical risks include:

– acute risks: hurricanes, floods;
– chronic risks: driven by long-term changes in climate conditions that can cause sea level rise or drought.

Transition risks associated with the transition to a low-carbon economy include:

– political and legal risks: organisational mechanisms for reducing greenhouse gas emissions (emissions trading schemes, carbon tax) [Nagaytsev, 2022];
– technological risks: the transition to a low-carbon economy has a significant impact on the existing global energy balance in favour of less carbon-intensive production and renewable energy sources;
– market risks: changes in demand for goods and services in favour of less carbon-intensive ones create risks and opportunities;
– reputational risks: companies' activities will be judged by society according to their contribution to the climate agenda.

In addition to the risks, there are a number of opportunities associated with climate change, as highlighted by the TCFD:

– efficient use of resources;
– transition to low-carbon and renewable energy sources;
– products and services with a low carbon footprint;
– access to new sales markets;
– sustainability.

The figure shows the climate-related risks, opportunities and financial implications of the TCFD.

The financial impact of climate-related risks on an organisation is determined by specific consequences. To reduce the likelihood of climate-related risks occurring, organisations need to manage these risks by implementing appropriate management and technology business processes.

In Russia, methodological recommendations and indicators on climate change adaptation issues have been developed and adopted for assessing climate risks[5]. The methodological recommendations introduce the concept of climate risk: 'a common characteristic of the probability

[4] Recommendations of the task force on climate-related financial disclosures. 2017. https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf.
[5] Order of the Ministry of Economic Development of Russia of 13.05.2021 No. 267 'On Approval of Methodological Recommendations and Indicators of Adaptation to Climate Change'. https://www.economy.gov.ru/material/file/b3cc582c24e7367170b5605f1199c6a9/267_13052021.pdf.

of dangerous manifestations of a climatic factor and its impact on the object of this impact, which is expressed in the amount of damage characteristic of the repeatability of the specified values of a dangerous climatic factor'. The recommendations include:

- general approaches to climate risk assessment;
- assessment of climate risks to territories;
- assessment of climate risks of economic and other activities;
- climate risk assessment of economic sectors;
- recommended information sources for climate risk assessment;
- examples of climate factors and their relationship to climate risks and vulnerability;
- other applications intended for assessment of climate risks, ranking of adaptation measures, preparation of plans for adaptation to climate change at the level of sectors, regions, enterprises;
- Indicators of achievement of climate change adaptation objectives.

Corporate governance disclosure under the TCFD involves communicating the extent to which management is engaged in managing the risks and opportunities associated with global climate change. The TCFD recommends communicating to senior management the actions taken to manage climate-related changes in production processes, including their monitoring and prompt response. In order to comply with the climate risk assessment recommendations, companies need to implement management business processes for managing risks associated with climate change.

The company's climate risk management business processes include the following management functions:

- determining the planning horizon over which climate-related risks and opportunities are analysed and identified [Sitnik, 2022];
- analysing the company's activities and identify processes that are vulnerable to the effects of climate change;
- identifying assets that are vulnerable to the effects of climate change;
- identifying climate-related risk factors and ways to prevent them.

The outcome of these functions is to determine the impact of climate-related risks and opportunities on the business plan, strategy and financial indicators. Based on the results obtained, a scenario and an action plan are developed for the company to ensure its sustainable operation under different conditions of global climate change development and related climate agenda trends.

Table 1
Transitional and physical risks of Lukoil

Types of risks	Description	Activities
Transitional risks		
Political and legal risks	Transitional risks associated with the tightening of greenhouse gas regulations in the countries in which the company operates.	Transitional risks associated with the tightening of greenhouse gas regulations in the countries in which the company operates.
Technological risks	Risks associated with the development and diffusion of low-carbon technologies	Monitoring and developing our own solutions to reduce greenhouse gas emissions
Market risks	Risks associated with consumer switching to less carbon-intensive products	Using a scenario approach to forecast economic indicators based on different climate scenarios
Reputational risks	Risks associated with the perception of the company's climate activities by key stakeholders	Disclosure of information related to the company's actions in the area of climate impact
Physical risks		
Acute risks, chronic risks	Risks associated with climate change affecting the company's operations, including natural disasters and melting permafrost	Assessing climate change in the design of investment projects in the most vulnerable areas. Monitoring climate change

Source: Annual report of PJSC Lukoil for 2022. https://lukoil.ru/FileSystem/9/621041.pdf.

Table 2
Transitional and physical risks of Novatek

Types of risks	Description	Activities
Transitional risks		
Political and legal риски	Increased costs associated with the introduction of carbon regulation	The company analyses global and Russian practices in the field of climate regulation.
Technological risks	Increased costs of adapting production processes to the effects of climate change	The company develops and implements decarbonisation technologies.
Market risks	Decline in demand for the company's products	Monitoring and transformation of products taking into account market demand
Reputational risks	Reducing the company's investment attractiveness as climate policy evolves	Considering the market situation and developing scenarios and plans in the light of climate policy developments
Physical risks		
Acute risks, chronic risks	Climate change, extreme weather events causing damage	Implementation of various measures to mitigate and adapt to climate risks

Source: Annual report of PJSC Novatek. 2022. https://www.novatek.ru/common/upload/doc/RUS_NOVATEK_AR22.pdf.

Table 3
Transitional and physical risks of Evraz

Types of risks	Description	Activities
Transitional risks		
Political and legal risks	Carbon pricing, other regulatory risks: More jurisdictions likely to introduce carbon pricing mechanisms. The World Bank predicts that by 2025, about half of all greenhouse gas emissions will be controlled through government and intergovernmental regulation. The forms of regulation are direct taxes on emissions, trading schemes, and an increase in the average global price of carbon in the context of rising current prices in the ETS. In 2018, only 15% of global emissions were covered to any degree by these forms of regulation. In addition, the changes are justified by new requirements to disclose information on activities that may have an impact on climate change.	Assessment of potential new regulations related to carbon regulation, etc.
Technological risks and market risks	Transition to a less carbon-intensive global economy. Failure to respond to these trends creates risks for companies that do not develop and implement clean technologies. However, there is no guarantee that investment in R&D to develop low-carbon projects will be successful.	Monitoring the spread of new low-carbon technologies.
Reputational risks	Climate change is a major challenge for the steel industry. As more financial institutions and regulators adopt ESG criteria, industrial companies are being asked to take a more responsible approach to sustainability issues, including following the recommendations of the TCFD.	Public disclosure of climate-related risks and opportunities in line with TCFD recommendations.
Physical risks		
Acute risks, chronic risks	Climate change, extreme weather events causing damage	The company constantly monitors changes in weather conditions and implements various measures to mitigate and adapt to climate risks, including the use of a closed water supply cycle in the plants, monitoring the condition of equipment, etc.

Source: Our approach to climate change. Evraz. 2020. https://www.evraz.com/upload/iblock/5b4/5b4632992a737d9dc83693b375ce3f16.pdf.

2. Results of climate risk assessment by fuel and energy companies

Some Russian energy companies have already conducted climate change risk assessments based on the TCFD recommendations, identifying key physical and transition risks and developing adaptation and mitigation measures.

Below are the climate risks of three Russian fuel and energy companies representing the oil, gas and coal industries: Lukoil, Novatek and Evraz (including the coal segment).

Lukoil. The company's business model includes oil and gas exploration, production, gas and oil refining, petrochemicals, product sales and power generation, including renewable energy. The company pays great attention to monitoring and preventing climate risks and implements a wide range of measures to manage them and identify opportunities[6] (Table 1).

From the information provided, it can be concluded that the company has identified key risks to itself and developed mitigation and adaptation measures, and has also identified climate-related opportunities: energy conservation, natural gas, renewables, CO_2 capture and storage, and advanced biofuels.

Novatek. The majority of the company's assets are located in the Yamalo-Nenets Autonomous Okrug with total proven reserves of 17.6 billion barrels of oil equivalent (as of the end of 2022). The Company analyses and considers the impact of climate risks and opportunities on its activities in accordance with the recommendations of the TCFD[7].

Climate risks at Novatek are taken into account in the development and implementation of strategic and financial plans. The risk criticality indicator is used to assess the impact of the risk, taking into account the probability of the risk occurring and a quantitative assessment of the consequence[8]. The transition and physical risks identified by Novatek are presented in Table 2.

Analysing the data in the table, we can conclude that the company has assessed the potential impact of each risk on its activities and has developed measures that contribute to mitigating and adapting to the risks described above.

Evraz. In 2020, the company published a climate change report to provide stakeholders with additional information on the principles that guide its approach to climate change and an understanding of the potential long-term risks associated with climate change[9]. The report has been prepared in accordance with the recommendations of the TCFD. The company's structure includes the Coal Division, which supplies coal raw materials not only to the Group's steel mills in Russia, but also to other major domestic coke and steel producers, and exports its products abroad. The company's transition and physical risks are shown in Table 3.

Climate change challenges the company to adapt to new demands and conditions, and dynamic action will lead to new opportunities. Evraz has identified the following opportunities related to climate change:

– resource efficiency: increasing the use of scrap metal, improving the efficiency of water resource management (closed water systems), increasing the use of coke oven gas produced by the company's own operations, reducing natural gas consumption;

Table 4
Typical transition and physical risks for Russian fuel and energy companies

Types of risks	Description	Activities
Transitional risks		
Political and legal risks	Risks of tightening carbon regulation around the world, risks of introducing carbon regulation in Russia	Monitoring global carbon regulation and climate policy implementation in Russia
Technological risks	Accelerated development and deployment of low-carbon technologies. Transition to a less carbon-intensive global economy	Development and implementation of technologies to reduce carbon footprint, investment in R&D, research, development and production, and use of alternative energy sources
Market risks	Risks associated with changing consumer preferences towards less carbon intensive products	Monitoring market preferences and taking into account consumer demands, increasing the company's competitiveness by implementing technological solutions to reduce the carbon footprint, using alternative energy sources

[6] Lukoil Group Sustainable Development Report 2022. file:///C:/Users/79609/Downloads/Отчет%20об%20устойчивом%20развитии%20Группы%20«ЛУКОЙЛ»%202022%20(1).pdf.
[7] Our approach to climate change. Evraz. 2022. https://www.novatek.ru/common/upload/doc/RUS_NOVATEK_AR22.pdf.
[8] Id.
[9] Наш подход к изменению климата. Евраз. 2020. https://www.evraz.com/upload/iblock/5b4/5b4632992a737d9dc83693b375ce3f16.pdf.

Table 4 – *remainder*

Types of risks	Description	Activities
Reputational risks	Risks arising from stakeholders' desire to buy products that have a minimal carbon footprint during production	Disclosure of climate-related information, including: greenhouse gas emissions, climate risk assessment, application of internal carbon price, etc.
Physical risks		
Acute risks, chronic risks	Single events (hurricanes, floods, cyclones) and chronic risks (long-term changes in climate conditions) that can affect the operational efficiency of the business and the supply chain.	Implementing systems to monitor the impact of climatic conditions on the company's production activities, as well as considering likely climatic changes in the design of the company's facilities

Source: compiled by the authors.

– energy resources: gradual transition to less carbon-intensive and more efficient energy resources, gradual increase in the share of renewable energy sources in the energy balance;
– markets and products: identifying opportunities in new markets and new products related to the transition to a low-carbon economy and climate change adaptation and mitigation[10].

3. Discussion

The above assessment of physical and transition risks gives an idea of the most prominent climate risks faced by Russian fuel and energy companies. Table 4 shows the typical climate risks of Russian fuel and energy companies.

Analysing the data in Table 4, we can conclude that the activities of Russian fuel and energy companies are subject to the influence of climate risks. The possibility of occurrence of one or another risk may affect the investment and operational efficiency of the company or its customers. For stable and effective work, it is necessary to take into account the possible consequences of climate change when developing and implementing long-term strategies.

Conclusion

Fuel and energy companies involved in the extraction, processing and transportation of energy resources face a number of climate risks. These include extreme weather events such as hurricanes, floods, droughts and wildfires, which can lead to production disruptions, losses and even fatalities. The risk classification is based on the TCFD guidelines for climate risk assessment and is based on the division of risks into two categories: risks arising from the consequences of climate change (physical risks) and risks arising from the transition to a low greenhouse gas economy (transition risks).

To reduce the pressure of climate risks on the efficiency of fuel and energy companies' operations, it is necessary to develop appropriate projects. In the process of developing mitigation or adaptation measures, Russian fuel and energy companies need to introduce new technological processes, as well as expand the sphere of influence on the production technology of existing or emerging business processes for managing greenhouse gas emissions for a comprehensive approach to issues related to carbon regulation and climate policy in general. These include improving infrastructure, developing adaptive technologies, introducing weather monitoring and forecasting systems, and training personnel. It is therefore necessary to implement individual measures and large-scale projects to reduce the impact of the fuel and energy complex on the climate.

At the same time, large companies have the opportunity to implement adaptation projects and even offset the impact of climate change on the performance of activities that are reduced due to climate change and the need to adapt. Despite the complexity of the task, there are positive examples of fuel and energy companies successfully adapting to climate change. Many companies are actively implementing energy-efficient technologies and developing and implementing projects to reduce greenhouse gas emissions, thereby contributing to a reduction in the rate of climate change.

In conclusion, climate risks pose a serious threat to fuel and energy companies, but with the right approach and implementation of the necessary projects, it is possible to reduce and minimise the negative impact of fuel and energy companies on climate change.

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Integrated approach to analysing the relationship between factors, working conditions, and performance indicators in the foreign market entry of Russian SMEs

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Abstract

The article discusses the decision-making strategies of Russian small and medium-sized enterprises (SMEs) when entering foreign markets entry and analyses the factors and conditions that influence the effectiveness of their export activities. It focuses primarily on the analysis of internal and external factors, including sanctions restrictions, access to financial resources, production capacity, marketing skills, digital technologies, and others. Different approaches to factor and condition analysis are discussed, such as the rapid start model, the traditional market entry model, and capture and expansion strategies. It also examines methods for assessing export efficiency, both quantitative and qualitative. The result is a landscape of quality models linking factors and working conditions to the performance of Russian export-oriented SMEs, comprising four primary models, is created.

Keywords: internationalisation, foreign market entry, quick start model, expansion, capturing territory strategy, small and medium business, SMEs' operational efficiency.

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俄罗斯中小企业进入外国市场：分析因素和条件与绩效参数之间关系的综合方法

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简介

文章介绍了俄罗斯中小企业在进入国外市场时的决策战略，分析了影响其出口活动效率的因素和条件。文章的重点是分析内部和外部因素，包括制裁限制、获得财政资源、生产能力、营销能力、数字技术等因素。讨论了各种分析因素和条件的方法，包括快速启动模式、传统退出模式以及前沿捕捉和扩张战略。还审查了评估出口绩效的方法，特别是定量和定性方法。因此，形成了俄罗斯出口导向中小型企业的因素和条件与业绩之间关系的定性模型，包括四个主要模型。

关键词: 国际化、进入外国市场、快速启动模式、扩张、前沿占领战略、中小企业、中小企业绩效。

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Introduction

The modern world requires small and medium-sized enterprises (hereinafter referred to as SMEs) to participate actively in the global economy, which implies entering foreign markets. However, success in this endeavour depends on many factors and conditions, ranging from the internal organisation of the company to external economic and political realities.

The article presents a literature review on the topic of SME foreign market entry, with the aim of identifying the characteristics of the strategy and decision-making mechanisms of Russian SMEs when entering foreign markets, and analysing the influence of various factors and conditions on the effectiveness of their export activities. The analysis was conducted on the basis of publications in leading international management and business journals in the period from 2000 to 2023.

The scientific novelty of the study lies primarily in the generalisation and systematisation of knowledge on the influence of internal resources of SMEs, such as innovative products, entrepreneurial spirit and unique resources and competences, and external conditions, including sanctions restrictions and the development of digital technologies, on the efficiency of SMEs in foreign markets. As a result of the literature review, the main approaches to analysing factors and conditions were identified, including fast-start models, the traditional entry model, and frontier capture and expansion strategies. The comparison of the methodological features of the works devoted to the study of the entry of SMEs into foreign markets helped to formulate general recommendations on the internationalisation concept development, as well as to outline the landscape of qualitative models of the relationship between the

factors and conditions of work and the efficiency of Russian export-oriented SMEs, including four main models. The results obtained are of practical relevance to researchers whose attention is drawn both to the study of the internationalisation of SMEs and to useful tools for improving the strategic planning and decision-making of SMEs when entering foreign markets, thus helping to increase their competitiveness and sustainability in the global economy. Methods for assessing the effectiveness of export activities, particularly in quantitative and qualitative terms, are also discussed.

1. Comparative study of approaches to analysing the factors and conditions influencing SME export activity

The efficiency of SMEs in foreign markets is influenced by both external and internal factors. The internal environment of SMEs plays a key role in the efficiency of their export activities. For example, the works [Budkova, 2015; Volkova, Karachev, 2016; Bodyagin, Balanova, 2019; Bereza, Bereza, 2022] describe such factors of the internal environment as:

- unique products and technologies - SMEs with unique products or technologies may have a competitive advantage in foreign markets. These can be innovative products, patents or other forms of intellectual property;
- staff skills - highly skilled staff, especially those with experience of international markets, can significantly increase an SME's chances of export success. This can include knowledge of foreign languages, cultural specifics and international standards and regulations;
- production capacity - having modern production infrastructure and equipment can facilitate the production of high quality goods, which is important for successful exports;
- marketing and logistics processes - well-organised marketing and logistics processes can contribute to the efficient delivery of goods to foreign markets and the establishment of mutually beneficial relationships with customers and partners.

These internal environmental factors are closely linked and together form the basis for successful SME export activities.

The external environment also has a significant impact on the efficiency of SMEs' export activities. For example, the following external environmental factors are considered in the works [Mazilov, 2015; Malysheva, 2019; Ivanov, 2023; Koroleva, 2023; Voskresensky, 2024; Repnikova, Dmitrieva, 2024]:

- government support for SMEs and exports - Government policies to support SMEs and exports can provide additional resources and incentives to enter foreign markets. This can include financing, tax incentives, assistance in establishing contacts with foreign partners and other support measures;
- development of digital technologies and platforms - Digital technologies and platforms can significantly simplify and speed up export processes, including e-procurement systems, online sales, participation in global value chains and business ecosystems;
- Favourable economic and political situation in partner countries - A stable economic and political situation in partner countries can help improve export conditions and reduce risks.

Today, one of the key factors influencing exports of Russian companies, including SMEs, is the introduction of sanctions restrictions. According to a survey conducted by the National Research University Higher School of Economics, among representatives of small and medium-sized enterprises [Adaptation of Russian industrial companies..., 2023] the main negative consequences of sanctions were difficulties in importing raw materials and supplies, an increase in their cost, a decrease in domestic demand, disruption of supply chains, difficulties with payments, disruption of transactions and the termination of business relations with foreign partners. Similar findings, with an emphasis on the problems associated with the substitution of software and telecommunications equipment, have been reported in other studies. However, it is worth noting that sanctions can have a dual effect on SMEs, acting both as an obstacle and a catalyst for their development [Spartak, 2023]. Some studies show that sanctions have provided SMEs with the opportunity to develop new niches, expand their product range and find new markets. With many foreign companies leaving the Russian market, SMEs have an opportunity to attract qualified staff. Some SMEs are adapting to the domestic market, while others are adopting a strategy of entering markets in friendly countries.

The analysis of foreign sources [Imran et al., 2017; Jean, Kim, 2020; Knight et al., 2020; Haddoud et al., 2021; Kalinic, Brouthers, 2022; Kasema, 2023; Higón, Bonvin, 2024; Obadia, Vida, 2024] complements and extends the factors considered by Russian researchers. Factors influencing the efficiency of SME export activities include human capital skills and management skills, innovation and technology, marketing skills, general experience of SMEs in international markets, knowledge of foreign markets and networking. It is also shown that the export performance of SMEs is influenced by organisational, entrepreneurial, production and market factors. The efficiency of activities is achieved through a combination of these factors.

Internal determinants that determine the results of export activities include the resources and capabilities of the firm, including experience and diversification of export activities, management characteristics with emphasis on export orientation, customers, innovation and technology, as well as an export marketing strategy that includes the adaptation of products and services to the characteristics of the foreign market, the development of pricing policies and advertising campaigns, and the choice of distribution channels [Sukhikh, Katz, 2015]. There is a strong relationship between export performance and the use of export channels, as well as the entrepreneurial orientation of the firm. In addition, the presence of a Total Quality Management (TQM) system in SMEs is an important factor influencing the competitiveness of products in international markets [Calheiros-Lobo et al., 2023; Elsharnouby et al., 2024].

Key factors for increasing the export efficiency of modern SMEs include access to networks and the availability of employees with networking skills, effective supply chain management, external market analysis and monitoring, product diversification and the use of digital technologies. However, a strategy of specialisation or differentiation can carry high risks in a global high-tech environment, so decisions on the feasibility and direction of diversification for SMEs require careful analysis and assessment.

With the growing instability of the macroeconomic situation, it is necessary to increase the attention and the range of external factors analysed. In recent years, special attention has also been paid to factors related to the development of digital technologies, which allow for the expansion of network cooperation, increased opportunities for obtaining information about foreign markets and the use of online formats in export activities.

2. Research on the relationship between external market factors and conditions and the results of SME export activities

The following are identified as trends in the development of research in the area of the relationship between factors and conditions with the outcomes of SME export activities:

- noticeable and growing interest in knowledge management in SMEs. This is determined by the expansion of opportunities and the increasing role of network interactions and network cooperation [Sukhikh, Katz, 2015; Malysheva, 2019; Faruk, Subudhi, 2019]. The ability to create new knowledge increases the attractiveness of SMEs as potential partners. Well-established knowledge transfer processes ensure the effectiveness of network interactions. The issues of knowledge preservation and protection, on the one hand, and

Fig. 1. Landscape of qualitative models of the relationship between factors and working conditions and the efficiency of Russian export-oriented SMEs

<table>
<tr><td rowspan="2">Internationalisation strategy</td><td>Quick</td><td>Quick (M1)</td><td>Taking the objective (M3)</td></tr>
<tr><td>Gradual</td><td>Traditional model (M2)</td><td>Expansion (M4)</td></tr>
<tr><td colspan="2" rowspan="2"></td><td>Entering the foreign market</td><td>Successful activity</td></tr>
<tr><td colspan="2">Internationalisation stage</td></tr>
</table>

Source: compiled by the author.

Fig. 2. Generalised framework for the development of qualitative models of the relationship between factors and working conditions and the efficiency of Russian export-oriented SMEs

<table>
<tr><td>Internal resources (RS)</td><td>Managed processes (PR)</td><td rowspan="2">Results:
- final (RZ1);
- leading (RZ2)</td></tr>
<tr><td colspan="2">External factors and conditions (uncontrollable):
- positive (VS);
- negative – risks (RK)</td></tr>
</table>

Source: compiled by the author.

Fig. 3. The 'Quick start' model framework (M1)

Internal resources (RS): - innovative products (RS1); - entrepreneurial spirit (RS2); - unique resources and skills (RS3); - geographical location (RS4); - limited resources and opportunities (RS5)	**Managed processes (PR):** - search for foreign markets (PR1); - gathering information on markets (PR2); - choosing the export strategy (PR3); - finding partners (PR4); - entering a new market (PR5)	**Results** ***Final (RZ1):*** - growth in export sales volume (RZ1-1) ***Leading (RZ2):*** - access to strategic resources (RZ2-1); - leadership experience - knowledge of advanced technologies and business models (RZ2-2); - network collaboration (RZ2-3); - online distribution (RZ2-4); - diversification of risks (RZ2-5)
External positive factors and conditions (VS): government support for SMEs (VS1); government support for exports (VS2); digital technologies and platforms (VS3) External risks (RK): sanctions (RK1), other risks (RK)		

Source: compiled by the author.

its joint creation, on the other, largely determine the competitiveness of SMEs in domestic and foreign markets [Faruk, Subudhi, 2019; Jean, Kim, 2020; Calheiros-Lobo et al., 2023];

- increasing attention to the human capital aspects of SMEs. A high level of human capital is recognised by many researchers and practitioners as a primary factor in the effective internationalisation of SMEs. The components of human capital related to the foreign economic activity of SMEs are considered to be the export and entrepreneurial orientation of managers and employees, the motivation to work in foreign markets, the availability of the necessary knowledge and competencies in various areas: unique knowledge and technologies as a basis for creating and protecting the competitiveness of products and services promoted in international markets,

Fig. 4. A model of the relationship between factors and working conditions and the efficiency of Russian export-oriented SMEs 'Quick start' (M1)

Source: составлено автором.

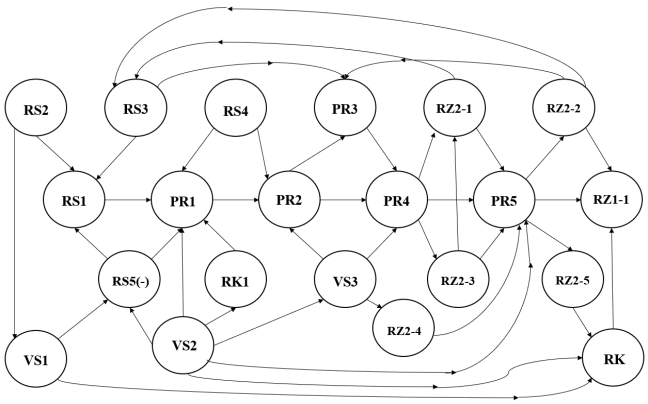
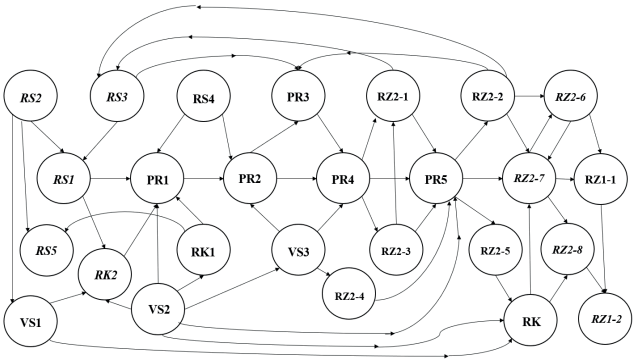


Fig. 5. The framework of the traditional model (M2)

Internal resources (RS): - competitive products (RS1); - human resources and management experience (RS2); - production capabilities (RS3); - geographical location (RS4); - marketing and logistics (RS5)	**Managed processes (PR):** - search for foreign markets (PR1); - gathering information on markets (PR2); - choosing the export strategy (PR3); - finding partners (PR4); - entering a new market (PR5)	**Results** ***Final (RZ1):*** - growth in export sales volume (RZ1-1); - growth in export profitability (RZ1-2) ***Leading (RZ2):*** - access to strategic resources (RZ2-1); - leadership experience - knowledge of advanced technologies and business models (RZ2-2); - network collaboration (RZ2-3); - online distribution (RZ2-4); - risk diversification (RZ2-5); - strengthening image (RZ2-6); - expanding the customer base (RZ2-7); - cost reduction (RZ2-8)
External positive factors and conditions (VS): government support for SMEs (FS1); government support for exports (FS2); digital technologies and platforms (FS3) External risks (RK): sanctions (RK1), limited domestic market (RK2); other risks (RK)		

Source: compiled by the author.

Fig. 6. The traditional model of the relationship between factors and working conditions and the efficiency of Russian export-oriented SMEs at the stage of entering the foreign market (M2)



Source: compiled by the author.

developed digital competencies, knowledge and understanding of the characteristics of promising foreign markets, etc. [Imran et al., 2017; Dabić, 2020; Elsharnouby et al., 2024];

- expanding the opportunities and formats of export activities based on the use of digital technologies [Denicolai et al., 2021; assessing the integration processes of the EAEU.., 2023; Rosyidah et al., 2023];
- redirecting geographical attention. This aspect is particularly important for Russian SMEs in the context of sanctions restrictions [Dolgov et al., 2023; Spartak, 2023; Repnikova, Dmitrieva, 2024].

The approaches presented consider both the internationalisation process as a whole and export activity as one of its components from different angles, i.e. they are mutually complementary. The essence of this complementarity lies not only in the diversity of factors, but also in the fact that they are not static and isolated. Therefore, the model of the impact of factors and working conditions of Russian SMEs on the efficiency of their export activities should be dynamic in nature and take into account the interrelations and interaction of various groups of factors.

3. Development of qualitative models of the relationship between factors and conditions of work and the efficiency (effectiveness) of the activities of Russian export-oriented SMEs

The analysis conducted showed that the strength and nature of the impact of certain factors on the efficiency of SME export activities depends, firstly, on the stage of internationalisation (entering a foreign market or continuing successful activity in it) and, secondly, on the strategy of entering a foreign market (gradual, according to the Uppsala model [Boguslavskaya, 2023], or a strategy of rapid internationalisation) (Fig. 1).

Since the number of different factors and conditions influencing the effectiveness of SME export activities is quite large, before constructing the models we will group them according to the logical chain 'resources - processes - results'. In this case, a distinction is made between internal (controllable) and external (uncontrollable) factors, as well as between two levels of results: final or lagging (mainly financial), and leading or results-generating factors (increased customer satisfaction, creation of network relationships, strengthening of the company's

Fig. 7. The framework of models for consolidating and operating in the foreign market (M3, M4)

<table>
<tr><td>External resources (RS):
- competitive products (RS1);
- human resources and management experience, including in foreign markets (RS2);
- production capabilities (RS3);
- marketing and logistics (RS4)</td><td>Managed processes (PR):
- monitoring market conditions (PR1);
- strengthening relationships with key clients and partners (PR2);
- product development (PR3);
- improving production efficiency (PR4);
- risk management (PR5);
- diversification of international activities (PR6) – for the M4 model</td><td rowspan="2">Results
Final (RZ1):
- growth in export sales, including online sales (RZ1-1);
- growth in export profitability (RZ1-2).
Leading (RZ2):
- network cooperation (RZ2-1);
- image strengthening (RZ2-2);
- customer base growth (RZ2-3);
- cost reduction (RZ2-4)</td></tr>
<tr><td colspan="2">External positive factors and conditions (VS): rgovernment support for SMEs and exports (VS1); development of digital technologies and platforms (VS2)
External risks (RK): risks of changes in legislation, sanctions and customs regulations and conditions, currency risks, cybersecurity threats, etc.</td></tr>
</table>

Source: compiled by the author.

image, etc.). A generalised framework for developing high-quality models of the relationship between factors and operating conditions and the efficiency (effectiveness) of Russian export-oriented SMEs is presented in Fig. 2.

The theoretical and methodological basis for the development of models are cognitive maps, which allow a visual representation of the multiple (usually indirect) relationships between factors and outcomes, as well as taking into account the mutual influence between the factors themselves. The approach to the construction of cognitive maps and their use as a basis for the subsequent development of simulation models and quantitative analysis of the processes under study is presented in the article [Katalevsky, 2015]. It is recommended to use causal and factor analysis [Glebkova, Kachanova, 2015; Kochemasova, 2018], as well as statistical methods of data processing [Burtseva, 2021] as methods for identifying and evaluating relationships.

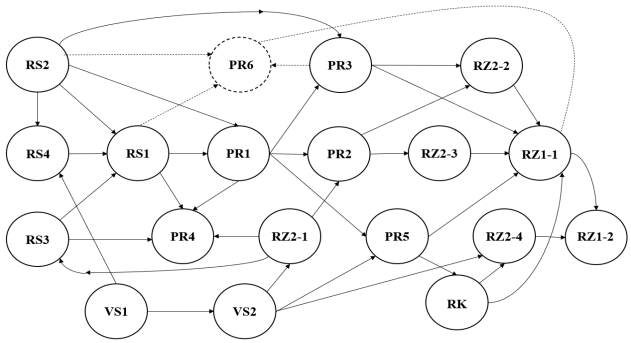
In accordance with the adopted framework, the factors and conditions influencing the effectiveness of export activities at the stage of entering a foreign market for Russian SMEs using a rapid internationalisation strategy are presented in Fig. 3. Figure 4 shows a qualitative model of the relationship between the factors and conditions of work and the efficiency of such SMEs, corresponding to these conditions, in the form of a cognitive map - model M1 'Quick Start' (see Fig. 1).

Figures 5 and 6 present a framework and model for the situation of foreign market entry of Russian SMEs using a gradual entry strategy (traditional model - M2).

The main stages and external factors in the M1 and M2 models are virtually identical, the differences being mainly in the availability of internal resources and capabilities (for the quick start model these are an innovative product, entrepreneurial spirit and unique resources and competencies; for the traditional or gradual model these are competitive products, human resources and management experience, existing production capabilities, well-established marketing and logistics) as well as the expected results. The names of the elements of the M2 model, which differ in content from the M1 model presented earlier, are highlighted in italics in Fig. 6.

The analysis of specific factors and the adoption of specific decisions in export activities are mainly associated with the stage of entering the foreign market [Zhang, 2024]. At the stage of consolidation in the market and ensuring successful activities, it is necessary to carry out more general actions: continuous monitoring of the market situation, improving the quality of products (services) and production efficiency, product development, strengthening relations with key customers and partners, including in a network format. Particular attention should be paid to the analysis and management of external risks, including the risks of changes in legislation, sanctions and customs regimes and conditions, currency risks and cybersecurity threats. Therefore, the models of the relationship between the factors and conditions of work and the efficiency of the activities of Russian export-oriented SMEs at the stage of ensuring successful activity (M3 and M4) do not have many differences. They concern, on the one hand, quantitative characteristics in terms of the availability of certain resources and opportunities and the breadth of market coverage, which are not reflected in the qualitative models. Second, at this stage, SMEs that started their activities by establishing themselves on the domestic market and are developing according to the model of gradual internationalisation (M4) can consider issues of further diversifying their activities and entering new foreign markets. Therefore, for the M4 model, an additional process (PR6) will appear in comparison with M3. The framework of the models of consolidation and activity in the foreign market (M3, M4) is shown in Fig. 7, the corresponding cognitive model in Fig. 8.

Fig. 8. A model of the relationship between factors and working conditions and the efficiency of Russian export-oriented SMEs at the stage of activity in the foreign market (M3, M4)



Source: compiled by the author.

An additional opportunity for the M4 model to diversify international activities is indicated by a dotted line in Fig. 8.

Conclusion

Entering foreign markets offers Russian SMEs great opportunities for development. However, their limited resources mean that decisions must be carefully justified. Within the framework of this work, two tasks of such justification were solved: identification of factors and conditions influencing the efficiency of export-oriented Russian SMEs, and a model study of the relationship between such factors and export efficiency indicators.

Within the framework of this work, two tasks of such justification were solved: identification of factors and conditions influencing the efficiency of export-oriented Russian SMEs, and a model study of the relationship between such factors and export efficiency indicators. The increasing role of human capital skills and related organisational factors such as entrepreneurial spirit,

digital literacy and networking experience of managers and employees is noted. The main external conditions that determine the export opportunities of Russian SMEs are sanctions restrictions and digital technologies that open new formats of foreign economic activity for SMEs (electronic procurement systems and the development of online sales, participation in global value chains and business ecosystems, as well as a significant expansion of opportunities to obtain up-to-date information about new markets). Under these conditions, more and more companies are beginning to adopt a rapid internationalisation strategy to enter foreign markets.

The sets of factors and conditions associated with the strategies of traditional (gradual) and rapid internationalisation have certain differences. Taking this into account, as well as the differences in the tasks solved at the stages of entering a foreign market and subsequently ensuring successful activity on it, a landscape of high-quality models of the relationship between the factors and conditions of work and the efficiency of Russian export-oriented SMEs has been formed, combining four basic models which include a quick start, a traditional entry model, capturing borders and expansion.

Taking into account the existence of cross-links between different factors, their direct and indirect influence on the efficiency of SME export activities, cognitive maps were chosen as a method for constructing qualitative models. The developed models systematise the composition and visualise the mechanism of influence of key external and internal factors and conditions on the results of export activities. Such a presentation is the basis for obtaining quantitative estimates and increasing the validity of decisions of Russian export-oriented SMEs to enter foreign markets.

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Technological features of creating IT products within the framework of implementing IT projects

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Abstract
The article examines the characteristics of ECM programs, such as incrementalism and high technology, as well as the technological features IT project management that create similar characteristics. The purpose of the article is to analyse the technological features of IT project management that arise during the creation of ECM programs. The study found that waterfall and flexible approaches, fourteen techniques and four lifecycle models are used to create ECMr programs. In addition, it was found that every IT project implemented according to the waterfall life cycle model, regardless of its size, complexity, duration, type, management methods and number of team members, goes through the six phases, such as starting an IT project, determining the requirements for the created ECM program, planning, coding, testing and closing the IT project. From the results obtained, it could be concluded that the concepts and techniques for creating ECM programs, as well as lifecycle models, are necessary knowledge competencies that all participants in IT projects must possess. Inadequate possession or lack of these skills jeopardises the ability to achieve the planned project objectives, to produce a working program code and also to fulfil the obligations of the transaction.
Keywords: IT project, Project Management, Waterfall, Agile, Scrum.

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在IT项目实施框架内创建IT产品的技术特点

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简介

本文讨论了计算机软件的特性，如增量和高可制造性，以及 IT 项目管理的技术特点。 本文旨在分析在 IT 项目过程中创建计算机程序的技术特点。研究发现，级联和敏捷概念（Waterfall和Agile）、约14种技术（XP、RUP、AUP、RAD、DSDM、Scrum、DAD、Kanban、Lean SD、FDD、MDD、DevOps、MSF 和 Oracle CDM）和4种生命周期模型（V 模型、Boehm 生命周期模型、迭代和级联生命周期模型）用于创建计算机软件。 此外，研究还发现，任何采用级联生命周期模式的信息技术项目，无论其规模、复杂程度、持续时间、类型、管理方法和团队成员数量如何，都要经历六个阶段：信息技术项目的开始、确定要创建的计算机程序的要求、规划、编码、测试和信息技术项目的结束。 研究结果使我们得出结论，计算机软件制作的概念和技术以及生命周期模型是信息技术项目的所有参与者都必须掌握的必要知识能力。如果不具备这些能力或缺乏这些能力，就有可能无法实现计划的项目目标，无法获得可行的软件代码，也无法履行交易契约。

关键词: IT 项目、项目管理、Waterfall, Agile, Scrum.

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The analysis of the works of O'Connell (2005), Chernikov, Dashitsyrenov (2017), Marchenko et al. (2020) and Bazarova, Rochev (2022) has enabled us to conclude that the main technological properties of computer programs are incrementality and high technological efficiency.

Incrementality of computer programs is defined as the possibility of adding new data and commands to the program code in order to expand functionality and rectify software bugs. A case in point is the computer game Cyberpunk 20777[1], which was released at the end of 2020. Despite the game's relatively long release cycle, CD Projekt RED has consistently released updates to improve technical specifications, fix bugs and add new content. For instance, in September 2022, the developer released patch 1.6, which added content from the Cyberpunk: Edgerunners series, which premiered on Netflix in autumn 2022.

The concept of incrementality allows for the decomposition of a desired computer program into discrete user stories, which can then be delivered to stakeholders in a piecemeal fashion. As Vigers and Beatty observe in their work, stakeholders frequently present a multitude of conflicting user, functional, and business requirements. Incrementalism offers a straightforward method for eliminating these inconsistencies. In particular, it helps us to first create user stories that fulfil the requirements of all parties and then, with each update, to incrementally resolve critical contradictions [Vigers and Beatty, 2022].

It is important to highlight that the defining characteristic of incrementality sets computer programs apart from the outputs of more traditional project types, such as construction or education. In particular, if separate parts of a computer program can be developed in parallel, in classical projects the desired result is only obtained when a certain sequence of actions is performed.

Another property of computer programs is their high manufacturability. This implies that only those specialists who have the necessary professional competences can be involved in creating the program code. For instance, a programmer[2] should possess a minimum level of professional qualification, whereas a testing specialist[3], a database

[1] https://www.cyberpunk.net/ru/ru/.
[2] Professional standard 06.001 'Programmer'. https://clck.ru/PaFBJ.
[3] Professional Standard 06.004 'Information Technology Testing Specialist'. https://clck.ru/PaFa5.

Table 1
The main advantages and disadvantages of the cascade approach to programming for ECM

Advantages/Disadvantages	Comments
The main advantages of the cascade approach to programming for ECM	
Differentiation of the phases of computer software development	Clear boundaries of the phases make it possible to determine their exact start and end dates, which not only increases customer loyalty, but is also one of the essential conditions for concluding contracts (Article 432 of the Civil Code of the RF[a])
Fixed Price	Determining a fixed price increases the loyalty of customers of computer programs and the competitiveness of organisations involved in their creation
Quality of project documentation	As a rule, different workers take part in the process of creating computer programs, so high-quality project documentation is necessary for their coordinated and synchronous work
Harmonious integration of new participants into the IT project team	Each phase ends with the production of a set of design documents sufficient for another team to continue development
The main disadvantages of the cascade approach to programming for ECM	
Difficulty in changing previously approved user, functional and business requirements	As a general rule, changes to requirements can only be made once a specific IT result has been produced.
Duration of creation of a computer program	The development of computer software is a lengthy process, which increases the probability of such risks as changes in legislation, transformation of the business structure and customer interests, departure of key employees, etc.
Deviation from planned timelines	Computer software creation rarely meets the planned deadlines. In particular, The CHAOS Manifesto analytical reports state that the average deviation from the planned terms in IT projects is 89%[b]

[a] Civil Code of the Russian Federation of 30.11.1994 No. 51-FZ. https://clck.ru/MsKTf.
[b] The Standish Group International. https://clck.ru/3Div55.

administrator[4] and a system analyst[5] should have completed secondary specialised education. A specialist in graphic user interface design[6] should have undertaken up to one year of professional training, while an IT[7] project manager should have obtained a higher education qualification at the bachelor's degree level.

The work emphasises that the success of IT projects is dependent on the professional competences and experience of programmers (Chernikov & Dashitsyrenov, 2017). Failure to meet the required qualification level will inevitably result in the introduction of numerous defects and a reduction in the performance of the developed programs.

Furthermore, the high manufacturability of computer programs is evidenced by the capacity to create program code remotely [Konobevtsev et al., 2019]. The remote form of IT project team organisation offers a number of advantages over classical projects. For example, it allows for the recruitment of qualified personnel from diverse geographical locations, the implementation of performance-based remuneration, and the reduction of software development costs by eliminating the expenses associated with office rental, electricity, internet, and other utilities.

This article aims to examine the technological aspects of developing computer programs as part of information technology (IT) projects. In order to achieve this objective, the author of this article has addressed the following issues:

- the advantages and disadvantages of the concepts of software programming have been revealed;
- the techniques used for the creation of computer software (XP, RUP, AUP, RAD, DSDM, Scrum, etc.) have been analysed;
- the main models of IT project life cycles have been identified.

The incremental nature and high technological efficiency of computer software have stimulated the development of various concepts of computer software creation, including the Waterfall and Agile models.

The concept of cascading programming for ESM (Waterfal). It is thought that the concept of the cascade (classical, waterfall) approach to programming for ECM

[4] Professional Standard 06.011 'Database Administrator'. https://clck.ru/qNbpz.
[5] Professional Standard 06.022 'System Analyst'. https://clck.ru/PaFVa.
[6] Professional Standard 06.025 'Specialist in Graphic User Interface Design'. https://clck.ru/PaFGs.
[7] Professional standard 06.016 'Project manager in the field of information technologies'. https://clck.ru/PaFDk.

Table 2
Principles of the flexible programming approach to ECM

Name of the operating principle	Description of the operating principle
Frequent and continuous delivery of computer program parts	Frequent and continuous delivery of the computer programs is important to customers and users because it enables stakeholders to clarify user, functional and business requirements and shorten the return on investment period.
Maximum openness to the possibility of changing requirements	The overarching objective of the Agile concept of software program creation is to achieve the highest level of stakeholder satisfaction. Consequently, Agile endeavors to address all user, functional and business requirements wherever feasible.
Flexible processes	The principle of maximum openness to the possibility of changing requirements at any phase of the IT project lifecycle implies that processes are required to adapt promptly to new and/or altered requirements.
Systematic delivery of the current IT result	To manage risks such as bugs, defects, software code inaccuracies and vulnerabilities, failure to meet stakeholder expectations, litigation, etc., Agile involves the systematic delivery of a valid IT deliverable.
Maximum stakeholder involvement	Collaboration and open communication in Agile is more important than hierarchy and contractual constraints, so the process of creating valuable computer program for all stakeholders is possible if all interests and opinions have been taken into account.
Self-organisation of the IT project team	The Agile methodology does not prescribe a specific set of processes for implementing IT projects. Instead, it provides a general framework that outlines the key stages of the development process, including planning, requirements analysis, design, programming, testing and documentation. For instance, the decomposition of user stories is the responsibility of the IT project team. User stories are defined as a description of the requirements for the computer program being developed. To illustrate, a user story might be a bank client wanting to receive messages about changes in the status of a loan application to promptly dispose of funds. It is also worth noting that during a sprint[a], IT project participants make their own decisions about what planned work will be done and in what sequence it will be done.
Face-to-face communication	Agile believes that the most effective and efficient way for stakeholders to interact is through face-to-face communication
Effectiveness	The primary indicator of progress is the delivery of functional computer program components to stakeholders in a systematic manner.
Continuous professional development of IT project participants	Maximum openness to the possibility of changing user, functional and business requirements stimulates IT project team members to continuous professional development and learning new features of computer program creation.
Keep it short and simple (KISS)	E. Raymond states in his writings that when designing computer programs, it is essential to ensure maximum simplicity and transparency of the program code [Raymond, 2003].

[a] Sprint is the time interval during which the IT project team performs the planned amount of work..

was first developed in 1970 by the American scientist W.W. Royce [Royce, 1970]. In Royce's view, the process of creating a program code is akin to a continuous flow of water, with each phase building upon the previous one and commencing only when the preceding phase is complete. The key advantages and disadvantages of the cascade approach to computer program creation are presented in Table 1.

The concept of flexible computer software development (Agile). The agile concept of creating computer programs was developed in February 2001 by C. Beck, M. Beadle, E. W. Bennekum et al. [McConnell, 2021]. The authors used the incrementality property to formulate the basic principles of agile IT project management, which differ from the cascade concept. Table 2 provides examples of the principles underlying the concept of agile computer software development.

It is important to note that in the domestic literature, the Agile concept is most often referred to as the methodology of agile software development [Aubrey, 2019]. However, according to the classical interpretation, methodology is understood as a set of methods, means and technologies of cognition used for the purpose of organizing and constructing a research [Luzgina, 2018; Smagina, 2020]. The author considers the utilisation of the notion of 'concept' to be more appropriate, given that Agile constitutes a set of principles, approaches, best practices, ideas and ways of creating computer software. In this regard, Agile should be understood as a concept of flexible creation of computer software, which includes a set of special principles, approaches, best practices, ideas and ways to achieve project goals.

In addition to the technological properties that have led to the differentiation of computer software creation concepts,

Table 3
Techniques for writing programs for ECM

Technique name	Technique description
eXtreme Programming, XP	The name is based on the idea of using only the best practices of creating software code, taking the process of its creation to a new level - extreme. For example, when checking the created program code, it is recommended to involve two programmers at the same time, so that one is busy creating the program and his partner is busy checking it [Beck, 2003]. This best practice is commonly referred to as pair programming. Among the advantages of the XP technique, it is worth mentioning that the first version of a computer program for ECM is obtained quickly, which enables users to start its testing
IBM Rational Unified Process (RUP)	The program creation for ECM comprises nine processes and four phases. The principal processes encompass business modelling, requirements management, analysis and design, implementation, testing, deployment, project work management, change management and infrastructure (the internal environment of software code creation). The phases are as follows: initial phase, refinement, design and implementation.
Agile Unified Process (AUP)	AUP is a simplified version of RUP. AUP, which includes 7 processes: modelling, implementation, testing, deployment, configuration management, project management, and infrastructure creation [Edeki, 2013]
Rapid Application Development (RAD)	RAD is recommended for short-term IT projects characterised by tight deadlines, limited budget, small scope of work, graphical interface and low computational complexity [Beynon-Davies et al., 1999].
Dynamic Systems Development Method (DSDM)	DSDM is based on the RAD concept of rapid application development. The toolkit is based on its own life cycle, which consists of the following phases: assessment of technical feasibility; business case; creation of a functional model; design; development.
Scrum	Scrum consists of such elements as roles, artefacts and processes. There are three main roles in Scrum - product owner, scrum master and project team. The artefacts are the prioritised list of requirements (product backlog), the list of requirements that have been selected for sprint (sprint backlog) and the incremental code. The processes in Scrum are related to communication. In particular, a short meeting of the project team to synchronise work (scrum meeting), sprint planning (project team meeting to decompose user story) and retrospective analysis [Kohn, 2011]
Disciplined Agile Delivery (DAD)	The DAD toolkit developed by IBM is based on Scrum. The main difference is the extended IT project lifecycle, which starts with the classical project initiation and ends with the use of the obtained IT result by the user
Kanban	Kanban is based on Japanese lean manufacturing technology - 'just-in-time'. The main advantage of the toolkit is an even workload among the project team members. The tasks are entered into a separate list (pull) as they become available
Lean Software Development (Lean SD)	Lean SD was developed in [Poppendieck, Poppendieck, 2010]. The technique is based on traditional Lean principles such as elimination of wastage and pauses in the development process, emphasis on learning, extremely delayed decision making based on facts, extremely fast delivery of a working IT result to the customer, motivation of the project team, integration, holistic vision
Feature Driven Development (FDD)	FDD uses an ideal labour input model to easily monitor the progress of IT result creation, where 1% is allocated to subject area analysis, 40% to design, 3% to design verification and refinement, 45% to software code creation, 10% to software code testing and refinement, and 1% to implementation
Model Driven Development (MDD)	This technique of creating computer programs is characterised by an abstract description of the desired result, where some aspects may be left out. This is done in order to simplify the design and documentation process
Development and Operations (DevOps)	The main feature of DevOps is the maximum integration between programmers and information technology specialists in the maintenance of information systems
Microsoft Solutions Framework (MSF)	Microsoft Corporation offers MSF for managing the work of a team of organisation-level programmers. According to MSF authors, there are many reasons that lead to failures: errors in forecasts, changes in requirements, inaccurate specifications, etc. MSF consists of 3 models: team model, project team model and design process model
Oracle Custom Development Method (Oracle CDM)	Oracle CDM consists of 3 models: Classic, Fast Track and Lite. Each model has its own set of phases and processes. For example, Classic has 6 phases and 11 processes. Classic is used for long-term (duration of more than 6 months) and complex IT projects. Fast Track is oriented to custom development projects with duration not exceeding 6 months. Fast Track development life cycle consists of 3 phases (requirements modelling, design and creation, implementation) and 11 processes. Lite is used for short-term projects and consists of 2 phases (prototyping and building, implementation) and 9 processes

Table 4
Lifecycle models for IT projects

Lifecycle Model	Description of the Lifecycle Model
V-shaped	IT project phases follow each other sequentially in a strictly defined order [Balaji, Sundararajan, 2012]. Requirements testing occurs too late in the life cycle, so it is impossible to make changes without affecting the project work plan
Spiral	The spiral model emphasises analysis, design and risk management [Boehm, 1981]. At each turn of the spiral, a new version of the computer program is created. One turn of the spiral represents a complete project cycle based on the cascade concept
Iterative	The principle of operation of the iterative LC model is similar to the spiral model. The difference is that in the iterative model the result of work is a mock-up-prototype of a fragment of a future computer program. During the development process iterations are performed until the mock-up-prototype acquires all the necessary properties in accordance with the ToR. As a rule, the iterative model is applicable for short-term (less than 2 months) and medium-term (2-6 months) IT projects
Cascade	The lifecycle phases occur in a sequential order. Despite a number of drawbacks, the cascade model can be applied to any type, size and complexity of IT project. The following phases are considered universal in the context of project management: project initiation, project organisation and preparation, project execution and project closure.

Table 5
Phases of the cascade model lifecycle for creating ECM programs according to national standards

Lifecycle Model	Description
Formation of requirements (pre-design phase)	The applicant contractor(s) shall conduct a survey of the customer's existing infrastructure, identify current problems, threats and opportunities, justify the need to create an IT result, identify user, functional and business requirements
Development of the automated system concept	An applicant for contractors (executors) creates an As Is model, e.g. in the form of an IDEF0 model, works out options of possible IT solutions that satisfy user, functional and business requirements, and develops a 'To Be' model [Kovalenko, Chokla, 2020]
Development of ToR	By virtue of GOST 19.101-77[a] and GOST 15.016-2016[b] a statement of work is a document that formalises the purpose and scope of a computer program, technical and special requirements. In the literature it is also possible to meet other names of TOR. For example, in [Vigers, Beatty, 2022] the technical specification is called a specification of requirements for a computer program
Development of preliminary design	According to GOST 2.119-2013[c] and GOST2.103-2013[d] the conceptual design is understood as a set of design documents that contain basic solutions that give a general and preliminary idea of the purpose, design, principle of operation of a computer program, as well as data defining their basic parameters. The preliminary design allows selecting a suitable IT solution for further development of the program[e]
Technical project development	In accordance with GOST 2.120-2013[f] the technical project is a document where the final technical solutions are fixed in accordance with the ToR and sketch of the project. It should be noted that the concept, TOR, sketch and technical design are parts of the project documentation. Project documentation is understood as documentation in text and graphic form containing information necessary for the development, maintenance and operation of the IT result
Documentation	Working documentation is the materials in text and graphic form, according to which the IT result is created

Table 5 – *remainder*

Модель ЖЦ	Описание
Commissioning	During this phase, installation and commissioning works are carried out, preliminary tests and pilot operation are carried out, employees are prepared and trained, and acceptance of the created computer program is carried out. By virtue of clause 1.4 of GOST 34.201-89[g] acts of work completion, acceptance into pilot operation, acceptance into industrial operation, etc. are developed.
Maintenance	This phase is characterised by the performance of works (rendering of services, supply of goods) in accordance with warranty obligations, as well as post-warranty maintenance

[a] State Standard of the Union of Soviet Socialist Republics. Unified system of program documentation. Types of programs and program documents. GOST 19.101-77. M.. Standardinform, 1980.
[b] Interstate standard. System of product development and putting products into production. Technical Assignment. Requirements for content and design. GOST 15.016-2016. Moscow, Standardinform, 2020.
[c] Interstate standard. Unified system of design documentation. Sketch project. GOST 2.119-2013. M., Standardinform, 2018.
[d] Interstate standard. Unified system of design documentation. Stages of development. GOST 2.103-2013. M., Standardinform, 2019.
[e] State Standard of the Union of Soviet Socialist Republics. Ensuring manufacturability of product design. General requirements. GOST 14.201-83. M., Standardinform, 2009.
[f] Interstate standard. Unified system of design documentation. Technical project. GOST 2.120-2013. Moscow, Standardinform, 2015.
[g] State Standard of the Union of Soviet Socialist Republics. Information technology. Complex of standards for automated systems. Types, completeness and designation of documents when creating automated systems. GOST 34.201-89. M., Standardinform, 1989.

Table 6
Phases of the IT project lifecycle

Lifecycle Phase	Description
Starting an IT project	Для этой фазы характерно проведение переговоров между заинтересованными сторонами, обычно между заказчиком и подрядчиком (исполнителем, поставщиком), в рамках которых утверждаются требования к программе для ЭВМ, даты начала и окончания работ, цена, способы нивелирования и ослабления коммерческих, комплаенс- и проектных рисков и др. Как правило, по окончании фазы между сторонами заключается гражданско-правовой договор (контракт)
Defining the requirements for the computer program for ECM to be created	The identified user, functional and business requirements are formalised in ToRs
Planning	Based on the TOR and communications with stakeholders, the IT project manager defines the concept and technique of creating a computer program, prepares the necessary resources and basic project documents
Coding	The phase entails the development of software code in accordance with user, functional, and business requirements.
Testing	At this stage, the software code is subjected to testing to ascertain the degree of correspondence between the actual behavior of the developed algorithms and their anticipated behaviour[a]. In accordance with clause 4.2 of GOST 34.603-92[b] the documentation required for testing includes the TOR, acceptance certificate for experimental operation, working logs of experimental operation, and so forth.
End of IT project	In consideration of the specific requirements of compliance, this phase encompasses the acceptance of the computer program that has been created and the signing of the pertinent documents.

[a] Software Engineering. Software Engineering - Guide to the Software Engineering Body of Knowledge (SWEBOK). ISO/IEC TR 19759:2005. 2005.
[b] State Standard of the Union of Soviet Socialist Republics. Information technology. Types of tests of automated systems. GOST 34.603-92. M., Standardinform, 1993.

the implementation of IT projects is also influenced by a number of other factors, including uncertainty and variability in user, functional and business requirements; intellectual labour; different management styles; limited resources; cross-communication with stakeholders; and others. Taking these factors into account in management has stimulated the development of many different techniques of creating computer programs: XP, RUP, AUP, RAD, DSDM, Scrum and others.

The list of techniques of computer software creation is presented in Table 3.

The technological characteristics of computer software, the differentiation of the concepts and the variety of techniques used to create such software have influenced the logical relationships between the phases of IT projects, thus stimulating the creation of different life cycle models.

A project lifecycle is defined as a series of phases through which a project progresses from its inception to its completion. A project phase (or stage) can be defined as a set of operations that culminate in the achievement of planned results. Typically, a project phase ends with a checkpoint (or milestone) [Isaev et al., 2021]. Project phases can be sequential, iterative and/or overlapping [Polonsky, Vasiliev, 2018]. Table 4 provides examples of lifecycle models relevant to IT projects.

The selection of the appropriate IT project lifecycle model is typically based on four key criteria: cost, risk, quality and speed of development. These criteria are interrelated, so it is not possible to achieve all four goals simultaneously. For instance, if the deadline for the final version of the program needs to be brought forward, this will require additional human resources, which will increase the cost of the IT project.

Our analysis of the national standards revealed that the standard practice in the domestic market for creating computer programs is based on the cascade model of the life cycle[8], which comprises eight phases[9]. Examples of these phases are presented in Table 5.

In light of the analysis of national standards for the systematisation of computer software creation methods, the author of this article identifies six phases of the IT project life cycle as being of particular relevance:

- start of the IT project,
- defining the requirements for the computer program to be created,
- planning,
- coding,
- testing,
- end of the IT project (Table 6).

A review of the technological features of IT project management reveals the following conclusions.

- The primary characteristics of computer software development within the context of IT projects are incrementality and high manufacturability (Nikolaenko, 2020; Nikolaenko & Sidorov, 2023).
- A variety of techniques and methodologies are employed in the creation of computer software, including the cascading and agile concepts of the waterfall and agile models, as well as 14 techniques such as XP, RUP, AUP, RAD, DSDM, Scrum, DAD, Kanban, Lean SD, FDD, MDD, DevOps, MSF and Oracle CDM. Additionally, there are over four lifecycle models, including the V-model, Boehm's lifecycle model, iterative and cascading lifecycle models.
- Any IT project implemented according to the cascade lifecycle model, regardless of its scale, complexity, duration, type and management methods, passes through six phases: the beginning of the IT project, definition of requirements to the computer program to be created, planning, coding, testing and the end of the IT project.

In light of the above, it can be concluded that a comprehensive understanding of computer software concepts, techniques and life cycle models is a fundamental competency for all those involved in IT projects. A lack of these skills can jeopardise the achievement of planned project objectives, the production of functional software code and the fulfilment of transactional obligations. This, in turn, can lead to the subsequent materialisation of compliance and project risks.

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Decisions on cooperation with partners in the field of jewellery production from precious stones and metals

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Abstract
The current stage of economic development is inconceivable without the functioning of partnerships in various forms. In the production of jewellery made of precious metals and precious stones, unions, joint ventures and subsidiaries, companies operating on a franchise basis are generally accepted world practice, explained by undoubted advantages. The presence of partners provides an opportunity to expand its presence in the highly competitive global jewellery market.
Competition should not be seen as a factor limiting production. On the contrary, the economic essence of this category is to improve the quality of goods, expand the range of products on offer, curb price increases, increase the rate of turnover and the share of profits received. Fair competition with encourages you to look for partners. The Russian Federation is open to economic cooperation with all countries that pursue friendly policies. In the area under study, the closest cooperation has been established with the EAEU countries that have signed the relevant agreement. Despite the fact that it has not yet been possible to create a single market for jewellery products in the EAEU, examples of successful partnerships exist and are developing, confirming the hypothesis that it is possible to combine competitors with obvious benefits.
Keywords: competition, partners, benefits, demand, global market, jewelry, EAEU countries, cooperation.

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就与合作伙伴合作生产宝石和贵金属珠宝作出决策

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简介
在现代经济发展阶段，没有各种形式的合作协会是无法想象的。在贵金属和宝石珠宝生产领域，联盟、合资企业、子公司和特许经营企业因其毋庸置疑的优势而成为全球通行的实践。合作伙伴为扩大在竞争激烈的全球珠宝产品市场的影响力提供了机会。
竞争不应被视为限制生产的因素。相反，它的经济本质是提高商品质量、扩大供应范围、抑制价格上涨、提高周转速度和利润份额。 公平竞争鼓励寻找合作伙伴。俄罗斯联邦愿意与所有奉行友好政策的国家开展经济合作。在这一领域，与签署了相关协议的欧亚经济联盟国家建立了最密切的合作关系。 尽管尚未能在欧亚经济联盟建立起珠宝产品的单一市场，但成功的合作伙伴关系的例子已经存在并正在发展，这证实了在明显互利的情况下联合竞争对手的可能性。
关键词：竞争、合作伙伴、利益、需求、世界市场、珠宝、欧亚经济联盟国家、合作。

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Introduction

The production of jewelry made of precious metals and stones (hereinafter referred to as DMDC) is subject to state regulation in terms of turnover. The Ministry of Finance of the Russian Federation[1]. is the authorized body. The state is committed to fostering business growth and fostering mutually beneficial partnerships with countries worldwide. However, the pronounced specificity of competition in the industry presents an obstacle to joint development.

The quantity of jewellery sold is constrained by a number of factors, including the perceived necessity of the purchase, the purchasing power of the consumer, the degree to which the product design matches consumer desires, fashion trends and established traditions. As highlighted by Bykov et al. (2022), in demand-constrained systems, the limit to increasing production is the demand of buyers. It is important to note that demand constraints are more limited than physical resource constraints. Current resource availability allows for increased production, but firms do not take advantage of this opportunity due to potential product scarcity.

The common jewellery market of the EAEU is a mixed economy in which the state's involvement in regulating the sector is enshrined in legislation and companies determine their own development strategy. At the same time, state support for international cooperation allows companies to compensate for the lack of resources through mutually beneficial partnerships that do not exclude competition.

In the case of a joint business, competition is manifested in determining the share of profits, production conditions, etc. Competition, according to the theory of economics, indicates the presence of conditions for business development. In [Dovtaev, 2018] it is stated: 'The fundamental principle of the process of increasing the competitiveness of the products of any company in any country in the world is investment and innovation activity, the dynamics of economic, especially industrial growth. Without this, there is no scientific and technological progress, which excludes the possibility of improving the competitiveness of goods and enterprise'. The analysis of competition and partnership relations in the sphere of DMDC jewelry turnover confirms this conclusion, as well as the correctness of the idea of uniting the business of the EAEU countries in the creation of a single market and joint access to world markets.

1. Research Methods and Hypothesis

Partnership relations and economic alliance in the sphere of sales of any products and services are beneficial only in case of joint production with profit distribution according to the share of participation or under the condition of division of labor: assignment of the area and scope of work to specific business participants.

This is a basic tenet of economic theory. If a new competitor enters the market with similar products, there will inevitably be a loss of customers. For example, the opening of an unlimited number of hairdressing salons in a town with a stable population will eventually lead to a decline in profits for all.

In order to expand the sales market for jewelry, it is not sufficient to increase the number of potential customers; the proportion of the population willing and able to purchase jewelry must also grow. The fact that jewelry is not a necessity leads to a reduction in demand, which in turn increases competition and encourages businesses to seek out partners. The hypothesis of this study was therefore formulated as follows: expansion of the jewelry market is possible only through mutually beneficial cooperation with other countries, despite the presence of competition.

The establishment of a unified jewelry market for EAEU countries is mutually advantageous, driving growth in the sector. This will be achieved by ensuring compliance with the fair competition rules set out in the agreement on precious metals and stones within the Eurasian Economic Union[2].

2. The limited nature of the jewelry market

The principal factor contributing to the emergence of competition in the jewelry market is its limited nature. Although the jewelry market is more diverse, a

[1] Federal Law of 26.03.1998 No. 41-FZ 'On Precious Metals and Precious Stones' (as amended). https://base.garant.ru/12111066/?ysclid=lxq17fj5i8742535466.
[2] Agreement on the peculiarities of operations with precious metals and precious stones within the Eurasian Economic Union of 22.11.2019. http://publication.pravo.gov.ru/Document/View/0001202105280015?ysclid=lnta5ize7t351504704.

refund for an additional item of jewelry will typically be substantially higher than the purchase price, making it unprofitable for retailers. If the item also has a precious stone, then additional difficulties in returning or selling the item will be the search for a pawnshop or a pawnshop with a certified gemologist. According to industry experts, there is currently no state-level market for gemstones in Russia[3]. This opinion reflects the current lack of clarity regarding the classification of precious stones. The question is whether a diamond or a natural pearl cultivated by man should be considered precious. In terms of their characteristics, they are virtually indistinguishable from those created by nature. At the same time, such inlays significantly reduce the cost of the product, but they are not cheap either. It is therefore not worth hoping that a potential buyer of a ring with a diamond (even a synthetic one) will buy two rings at a discount. The manufacturer needs to identify a target audience for the product.

The existing limits to consumption in the event of an increase in production volumes and the emergence of competitors make it necessary to look for additional sales markets. Undoubtedly, it is possible to increase sales in markets where the company has a stable reputation and, above all, a circle of regular customers. Such methods include broadening and adapting the product range to customer segments not yet covered, reducing prices, various promotions, stimulating demand, etc. However, these measures, even if they are innovative, are quickly copied by competitors and do not lead to a significant increase in consumption.

In today's global marketplace, identifying new market opportunities is a significant challenge. Many companies have already explored most potential markets, and the most sought-after products overseas are widely available or can be purchased through marketplaces or manufacturer websites. In today's digital marketing environment, companies can quickly gain insight into potential customers, understand their needs, tailor products to their personalities and streamline feedback processes. Regardless of geographical location, companies can interact with consumers from all over the world [Medvedeva, Kozhina, 2021].

Successful jewellers are expanding their product range in the digital space. So if you are looking at the online marketplace as a solution to finding new markets, you need to be prepared for even more competition. 'Governments around the world have begun to take action to address abusive practices in digital markets and to provide guidance on adapting competition policy to the digital age, including raising awareness among businesses of competition issues specific to the digital sphere' [Varagic, 2023].

The key to entering wider, global markets is demand, which can be shaped by offering a decent, wide range of products. Unification for the purpose of joint market expansion is a long-established global marketing strategy. In Russia, there are numerous examples of trade in the form of joint platforms for different manufacturers with shared geographical characteristics, such as 'goods from India', 'Belarusian goods', 'fur coats from Pyatigorsk', and so on.

The formation of the Union of Eurasian States (EAEU) has created a unified cross-border market for manufactured goods and services. However, this does not extend to the global market, where there is currently no dedicated EAEU goods marketplace. The Ministries of Finance of Russia and Belarus, in collaboration with the Eurasian Development Bank, have established an international jewelry marketplace. 'The entire turnover within the Russian Federation is digitized, and the platform is integrated with that of the Republic of Belarus. This provides jewelers with the chance to showcase their products on a unified platform with minimal costs, supported by professional marketers, and to present these products on the international market'[4]. However, by the planned launch date of March 2024, the platform was still not operational. The reason is once again competition. It is challenging for the newly-created marketplace to compete with established and well-known digital trading platforms. In 2022, the majority of suppliers selected the Wildberries marketplace for their activities, with a quarter of the market belonging to Ozon, approximately 10% to Yandex.Market, 4% to Sbermegamarket and AliExpress (Tretyakova et al., 2023).

Despite the growth of digital trade and the ability to select from a range of marketplaces in the country of manufacture, offline trade in precious jewelry remains a viable and important sector. For items of jewelry made of precious stones and metals, the visual purchase, at least at the selection stage, will always be the preferred option due to the value of the goods. The survey revealed that over 60% of consumers anticipate the continued dominance of online shops over traditional stores in the future. The results of the survey indicate that the majority of respondents are not in favor of the long-term disappearance of offline shops. In fact, the majority of consumers who took part in the survey (57%) are not ready to make expensive

[3] Dobrynina K. '99.9% of stones in shops are fake' - "stone hunter" Konstantin Anisimov. https://moskvichmag.ru/lyudi/999-kamnej-v-magazinah-poddelnye-ohotnik-za-kamnyami-konstantin-anisimov/?ysclid=lvbd3157bp19700376.

[4] The Ministry of Finance of Russia together with the Ministry of Finance of Belarus and the EDB developed the structure of an international jewellery marketplace. 2023. 8 June. https://minfin.gov.ru/ru/press-center?id_4=38521-minfin_rossii_sovmestno_s_minfinom_belorussii_i_eabr_razrabotali_strukturu_mezhdunarodnogo_yuvelirnogo_marketpleisa&ysclid=lvcnww3iin710935254.

purchases in the online environment [Krasovskaya, Lukanina, 2023].

The challenges of promoting jewelry products on global markets were reflected in the agreement signed by Russia with the EAEU countries, entitled 'On the Specifics of Operations with Precious Metals and Precious Stones'[5]. The document outlines a framework for collaborative action that is designed to avoid any infringement of the interests of the partners. According to the hypothesis put forward in this article, this task is achievable. Therefore, the countries continue to follow the division of labor in the precious metals and gemstone turnover sector, inherited from the former common market: mining is mainly concentrated in Ru 'An example of active co-operation between economic entities of Belarus and Russia is the Kristall Production Association in Gomel and the Kristall plant in Smolenskssia, Kazakhstan and Kyrgyzstan, while stone cutting is primarily located in Armenia and Belarus. The vast majority of gold and silver chains on the Belarusian market are manufactured in collaboration with Russian enterprises. In turn, about 40% of diamonds produced in Belarus at Gomel PO Kristall are supplied to the Russian Federation and are used by manufacturers to make products with gemstone inserts' [Umgayeva, Ivanova, 2023].

The investment projects of the raw material base of the jewelry industry are being successfully implemented. To illustrate, Russia has constructed a state-of-the-art refinery (gold refining plant) in Kyrgyzstan in collaboration with EAEU member countries. 'It took about $400 million to create the necessary infrastructure, 1/3 of which was investor money, the rest of which was credit investment by Russia's largest bank VTB' [Mitrofanov, 2023]. [Mitrofanov, 2023]. A number of significant players in the global jewellery market have identified potential benefits in expanding their cooperation with the EAEU countries, including the UK, India, and the USA. The share of investments of these countries in the diamond cutting sector in Armenia is high. Concurrently, Russia continues to serve as Armenia's primary trade partner, with approximately half of Armenia's exports comprising products from the DMDC sector and related items. 'In the first 10 months of 2023, Armenia's exports grew by 38 per cent, or about $ 1 billion 610 million, of which about $ 1 billion 300 million was exported to the EAEU countries. In the total Armenian exports (which amounted to $5.1 billion in January-October), the share of the EAEU countries was about 54%, the share of Russia - 52%'[6].

It is important to note that even when jewelry manufacturers engage in joint activities such as the extraction of raw materials and their processing, competition between them remains a key factor. This is because these activities fall within different areas of the business. Assistance to Kyrgyzstan in gold mining has not increased jewelry production in the country. 'Year on year, jewelry production is declining. According to the latest data, in 2021, the decline in jewelry production was almost double from the peak (by almost 49%). At the same time, imports have increased several times in recent years, while exports accounted for less than 5% of total production. In the shadow turnover, as experts write, this figure is much higher. Kyrgyzstan is turning more and more every year into a predominantly importer of jewelry' [Mitrofanov, 2023].

3. The Russian Federation in the EAEU jewelry market

The Russian Federation proved to be the most competitive in the EAEU jewelry market: 'in Russia in 2023, gold jewelry production grew by 18% to 30.8 million pieces'[7]. The cancellation of the simplified taxation system from January 2024 for Russian jewelry manufacturers threatened to transfer business to partner countries. This did not occur primarily due to notable variations in the scope of technical, economic, commercial, and legal assistance, as well as differences in the evaluation of the final product's quality which confirms the fact of competition in terms of technical and economic indicators not only within the producing countries, but also between the EAEU countries.

It is precisely due to the competitive nature of the global market that joint entry has not yet been possible for the partner countries. This is largely due to the fact that the jewelry manufacturing and sales industry, even within the borders of one country, is not yet willing to risk its well-calibrated business strategy for the benefit of a common one. 'Underestimating the extent of the impact of competition on business can cost any state dearly, namely, in competing with the best imported analogues, national companies may fail and curtail their production, which will lead to a reduction in the volume of exports of products and, as a result, to a decrease in the financial operations of an entire country. Thus, competition stimulates the development of the world market, as well as creates opportunities for modernisation of the economy of a particular state' [Tretiakova et al., 2023].

In our view, there is another area of competition with a specific set of substitutes that is particularly relevant to the sector under review and is becoming increasingly

[5] Agreement... http://publication.pravo.gov.ru/Document/View/0001202105280015?ysclid=lnta5ize7t351504704.
[6] Russia still accounts for the lion's share of export growth from Armenia. 2023. https://am.sputniknews.ru/20231226/lvinaya-dolya-prirosta-eksporta-iz-armenii-po-prezhnemu-prikhoditsya-na-rossiyu--ekonomist-70485918.html.
[7] Gold jewellery production in Russia grew by 18% in 2023. 2023. https://iz.ru/1627544/2023-12-28/proizvodstvo-zolotykh-iuvelirnykh-izdelii-v-rossii-v-2023-godu-vyroslo-na-18/

intense. As previously stated, the market for products with artificially grown stones has significantly reduced global sales of products with natural stones in 2023. 'Sales of lab-grown diamonds grew by 56% in volume and 21% in value. This gap between sales volume in pieces and money was due to a drop in the average selling price of lab diamonds by about 19-21% since the beginning of the year'[8]. The jewelry industry is also threatened by the rapidly developing costume jewelry market. 'Experts have observed that the modern elite is less inclined to spend money on expensive items to demonstrate their status, indicating a decline in the Veblen effect. The theory of the aspiration class has emerged, whereby the elite is less likely to spend on items that could potentially enhance their status externally. Accordingly, brands that continue to broadcast ostentatious luxury may lose their customers.' [Shendo, Sviridova, 2020].

Competition in the jewelry business is thus tougher: the sales market has a clear tendency to shrink. The conditions are such that it is necessary to unite only when entering new markets, and then try to get ahead of competitors in offering goods. 'Today, various systems of competitor assessment are used in marketing, such as competitor map, which assesses two key factors - market share and growth rate of the players under consideration; comparative analysis of competitors' portfolio, sales channels, advertising investments, as well as price comparative analysis; SWOT analysis, benchmarking method, etc. are widely used.' [Golovanova, 2018].

Visually, the jewelry business is united in its desire to counteract the substitution of its products by costume jewelry, constantly holding promotional campaigns to reduce the cost, attracting customers with gifts, discounts, etc. Businesses are also ready to unite in counteracting illegal circulation, which is highly competitive in terms of price. In Russia, this is the area of responsibility of the state: the federal assay chamber guarantees the authenticity of products and jewelry production facilities that are on special registration with its stamp and proof. Some EAEU countries have granted the right of assaying to manufacturers themselves, eliminating state control over the turnover of jewelry products. 'The experience of capital pooling throughout the historically traced stage of economic development testifies to the undoubtedly greater profit in case of increased turnover of any production. Based on the assessment of the pace of implementation of the agreement, it turns out that the adopted option of accounting for the turnover of jewelry products is still unprofitable for some of the participating countries' [Umgayeva, Ivanova, 2023].

As a result, the presence of uncertified, illegal precious jewellery products is periodically detected in the market of EAEU countries, including the Russian Federation. 'Nowadays, counterfeit jewelry products are a serious problem that causes damage to both manufacturers and consumers. Annually, the illegal turnover of jewelry in the domestic market amounts to about 50 billion rubles a year'[9]. In general, the jewellery market of the EAEU countries is at significant risk of losing customers due to the prevalence of low-quality products. For example, the League of Jewelers of Kazakhstan claims that the country has 'the largest shadow market among all EAEU countries for the sale of gold, silver and precious stones. It (jewelry products) comes to us from Turkey, Russia, Kyrgyzstan, and now also from Armenia. Moreover, the same Turkish gold is coming from the Russian Federation, but it is just labelled with fake Russian stamps'[10].

The objective of maintaining its own jewellery market does not exclude the pursuit of new market opportunities. By postponing the implementation of the mechanism of joint control within the single customs space of the EAEU countries; other listed potentially successful solutions to increase trade volumes are also being postponed. It turns out that the apparent advantage: a more diverse choice, an expanded offer that can reach a greater number of potential consumers - participants and organisers are assessed by participants and organizers as a risk of higher competition. 'Despite this, global competition is one of the powerful factors of business development, as it stimulates enterprises to maintain the high quality of manufactured goods, to carry out rapid renewal of the range of products, as well as to search for new market niches' [Parshina, Bereznyuk, 2017].

Given this fact, the government's task is to create conditions for domestic jewelers that are close to perfect competition in the domestic market, to provide opportunities and assistance in finding new markets by creating conditions for international cooperation.

Conclusions

The market mechanism of development of economic sectors, including those regulated by the state, implies the search for conditions for obtaining maximum

[8] Sales of natural diamonds are falling, while sales of cultivated diamonds, on the contrary, are growing. What is in store for Alrosa. 2023. https://journal.tinkoff.ru/news/review-diamond-market/.

[9] Zamakhina T. In the State Duma told about the consequences of the change of jewellery marking. 2023. 24 October. https://rg.ru/2023/10/24/v-gosdume-rasskazali-o-posledstviiah-izmeneniia-markirovki-iuvelirnyh-izdelij.html.

[10] Turkish gold with fake Russian branding: Kazakhstan has become the market leader in the sale of jewellery 'similar to gold'. 2019. 24 July. https://www.caravan.kz/gazeta/tureckoe-zoloto-s-poddelnym-rossijjskim-klejjmom-kazakhstan-stal-liderom-rynka-po-prodazhe-ukrashenijj-pokhozhikh-na-zolotye-556917/?ysclid=lv6wnqbga8286554425.

benefits and profits. The industry of DMDC jewelry production is specific, so it implies the presence of several options of partnership relations.

The assessment of the mechanism of interaction between producers of jewelry products made of precious stones and metals, including producers from partner countries in the sphere under study, allow us to summarize the following conclusions.

1. Competition is an inherent aspect of partnership relations in the jewelry industry, which is essential for its growth and development.

2. There are several types of competition in the sector, most of which are due to the unique characteristics of the products concerned. Competition in the jewellery industry is different from that in other luxury markets. For example, the value of a car is determined by its high cost, whereas the value of a precious jewellery product is based on its scarcity and unlimited period of use. All producers of an identical group of goods compete for distribution and a share of the profits. It is inevitable that companies will compete for the sale of DMDC jewellery, even if they invest in each other's production and form joint ventures.

3. Competitors may become partners in the event of threats from producers of substitute product groups (products with artificial, semi-precious stones and quality costume jewelry), as well as producers and suppliers of uncertified, illegal products.

4. In order to create equal conditions for jewelry manufacturers, the state regulates uniform rules of registration, taxation, control, and liability, but the business itself determines the choice of partners and development strategy.

5 The development of the jewelry business of the EAEU countries implies intensification of partnership relations. For this purpose, it is necessary to fulfil the agreement on joint control over the turnover of DMDC products, which does not prevent the development of similar business in each individual country under the condition of fair competition.

Thus, partnership relations in the field of production of jewellery made of precious stones and metals with the above-mentioned manifestations of competition are indicators of successful development of the jewellery industry and, in general, the field of DMDC turnover.

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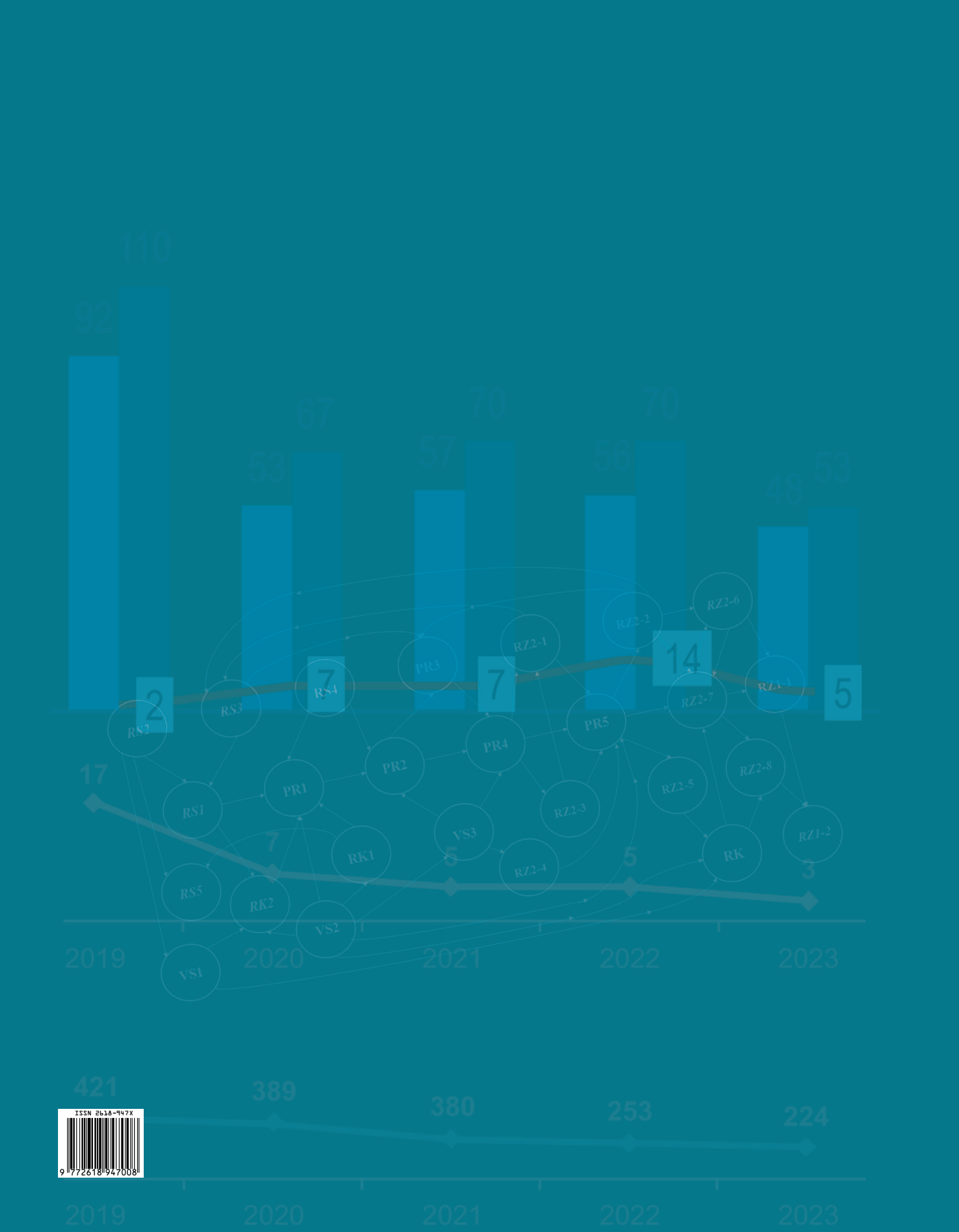

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