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The impact of innovation on the costs incurred by transport companies

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Abstract

This article analyses the impact of innovation on the costs of transport companies. In order to carry out the research, the types of innovation in the transport industry and the innovation strategies of transport companies are considered. The case method has been identified as the research method. The analysis concludes that innovation has an impact on both operational performance and shareholder value. Firstly, the value of companies is influenced by innovations related to the purchase of new equipment, the improvement of production indicators and the increase in the quality of services/goods offered.

The main objectives of digital technologies are to improve the control of operational processes, to enhance customer interaction and to reduce costs. Together with the purchase of new equipment, this can be seen as one of the ways of increasing the value of the company.

Keywords: innovation, innovation activity, transport, new technologies, efficiency.

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创新对运输企业价值的影响

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摘要

本文章探讨了创新对运输企业价值的影响。为了开展这项研究，作者分析了运输业公司的创新类型和运输公司的创新战略。案例研究法被确定为研究方法。分析结果表明，创新对运营绩效和公司价值都有影响。企业的价值主要受到与购置新设备、提高生产绩效和所提供服务/产品的质量有关的创新的影响。

数字技术的主要目的是加强对业务流程的控制，改善与客户的互动，降低成本。加上购买新设备，这些方面都可以被视为提高企业价值的途径之一。

关键词： 创新、创新活动、运输、新技术、效率。

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Introduction

The development of innovation in the transport industry is one of the key factors influencing not only the industry directly, but also related industries: industrial production, trade and the living standards.

The transport industry is at the forefront of innovation and technological development[1]. Thanks to the introduction of new technologies, cars and trains can move without human intervention, special sensors and artificial intelligence (AI) collect information on road conditions and quickly dispatch repair teams; intelligent algorithms are involved in traffic management, capable of redirecting flows online to reduce travel time and congestion [Verhoef et al., 2021].

According to Accenture Consulting and the World Economic Forum, the transport industry will be a major beneficiary of the digitalisation of the economy and the introduction of new technologies: the potential for economic growth exceeds USD 1.5 trillion by 2025, and the positive impact on society could reach USD 2.4 trillion in terms of improved quality of life and labour productivity[2].

For countries with large territories, including Russia, the speed of introduction of new technologies in the transport industry is becoming a key issue of competitiveness in the global economy.

According to a study by Strategy Partners, the transport and logistics sector is ahead of other sectors of the Russian economy in terms of readiness for digital transformation. More than half of the companies surveyed in the sector have already started implementing digital transformation strategies, and 80% of companies are partially or fully moving to new business models based on digital technologies[3]. New technologies open up a wide range of areas for industry development [Baumann, Kritikos, 2016]:

- improvment of logistics based on data;
- creation of a safe and regulated transport environment;
- automatic analysis and prediction of the technical condition of vehicles;
- optimisation of the supply chain [Daim et al., 2021].

Researchers cite artificial intelligence, predictive analytics systems, the Internet of Things, etc. as the most promising technologies for implementation. [Martin, Nguyen-Thi, 2015; Ehls et al., 2020].

Research firm Smart Nations predicts that the AI market in the global transport and logistics industry will grow to USD 3.5 billion by 2023, and Statista predicts it will grow to USD 10.3 billion by 2030[4]. According to Accenture experts, 65% of logistics and transport companies are already using or testing AI-based[5] solutions. Using AI, the model can incorporate data on traffic, weather, waiting times, loading and unloading speeds at specific locations and with specific suppliers, as well as the impact of specific company personnel and customers on delivery speed.

Another example of technology is the use of a predictive analytics system [Murata et al., 2021; Ng, Sanchez-Aragon, 2022]. The traditional approach to route planning is based on a limited number of factors that are largely static and do not take into account current changes (e.g. route length and average speed) [Malek et al., 2020; Edeh, Acedo, 2021]. Based on real-time data, such a model will be able to build an optimal route and calculate the optimal delivery time with much higher accuracy, which means simultaneously reducing costs and delivery times and increasing customer satisfaction with quality service [Ji et al., 2019; Motta, Peitz, 2021].

Another opportunity for optimisation is the use of data and analytics to predict vehicle maintenance [Olaf, Hanser, 2018; Kim, Kang, 2022]. Automatic collection of data on the condition of the machine reduces unanticipated costs, and information on actual operation (routes, road conditions, type and weight of cargo) is used to plan maintenance in a timely manner, predict component costs, and maintain a sufficient number of working machines in the fleet.

Internet of Things technologies ensure the monitoring of the condition of goods during sea container transport. Until now, it has been possible to track the movement of goods by sea only in limited areas: during loading at the port and after delivery of the cargo to the consignee. During sea transport, breakage of seals and containers and even theft of cargo occurred [Alvarez et al., 2015].

The development of the Russian transport sector is characterised by high capital intensity, which explains the growing share of companies with state participation in the transport market and the existence of natural monopolies. The high degree of monopolisation of the Russian transport market hinders the introduction of innovations. However, according to the definitions of the federal statistical authorities, these enterprises belong to the category of innovation-active ones[6].

It is important to note that this sector in Russia is currently characterised by a low level of innovation activity compared to industry; the vast majority of transport companies invest in innovation activities[7].

The closest industries with similar indicators were construction and agriculture. At the same time, according to Rosstat, noticeable innovation activity in the transport industry was recorded only in 2019. Then, the level of innovation activity was 2.8%[8].

[1] Roads of the future: how the transport and logistics market is changing right now (2021). RBC. https://trends.rbc.ru/trends/industry/60eff42e9a79478d357c6566.

[2] Digital Health Technology Vision 2020 (2020). Accenture. https://www. accenture.com/_acnmedia/PDF-133/Accenture-Digital-Health-Tech-Vision-2020.pdf#zoom=40.

[3] Global Banks 2021 Outlook (2020). S&P Global. https://www.spglobal. com/_assets/documents/ratings/research/100047456.pdf.

[4] Singapore. National Artificial Intelligence Strategy (2019). Smart Nations. https://www.smartnation.gov.sg/docs/default-source/default-doc- ument-library/national-ai-strategy.pdf?sfvrsn=2c3bd8e9_4#:~:text= The%20National%20AI%20Strategy%20is%20a%20living%20docu- ment%20to%20place,to%20our%20citizens%20and%20businesses.
How Industry 4.0 and digitization improves manufacturing responsiveness, quality, and efficiency (2021). ISA. https://blog.isa.org/indus- try-40-digitization-improve-manufacturing-responsiveness-quality- efficiency-iot.

[5] Digital Health Technology Vision 2020… https://www. accenture.com/_acnmedia/PDF-133/Accenture-Digital-Health-Tech- Vision-2020.pdf#zoom=40.

[6] Order of Rosstat of 27 December 2019 No. 818 'On approval of the methodology for calculating the indicator "Level of innovative activity of organisation"'. http://srv-consplus/cons/cgi/online.cgi?req=doc&ts=7SzQObTaziHixrlE&cacheid=530A4FC39904BA8CFE526982A184E4B7&mode=splus&rnd=0.08568365793935362&base=LAW&n=344264 - CO1ROb TQ09Q01xf.

[7] Federal State Statistics Service (Rosstat). Science, innovation and technology. https://rosstat.gov.ru/statistics/science.

[8] Id.

In this respect, the study of the innovative development of transport companies and its impact on increasing their value is relevant.

1. Research methodology

The methodology used in this study is inductive, characterised by the description of the empirical information collected and the interpretation of the results obtained. This raises the problem of selecting the objects to be studied. In order to obtain data, a case analysis method was chosen, namely an analysis of innovative activities using the example of large companies. The choice of this approach is justified by its universality and the possibility of using an integrated approach to the problem at hand.

The article studies three domestic companies: Aeroflot PJSC, TransContainer PJSC and State Transport Leasing Company JSC, which are active in the field of transport and logistics. The choice of companies is based on their significant market share (all three companies are classified as large and have a large market share in their respective segments), as well as the opportunities for innovation due to the presence of large financial flows.

The choice of large companies is determined by the adequacy of resources for introducing innovations and the segmentation of the transport market: Aeroflot JSC specialises mainly in passenger air transport, TransContainer JSC in rail freight transport, and State Transport Leasing Company JSC in vehicle leasing. A study based on a sample of these companies will allow us to draw conclusions about general trends in the transport industry, as well as to highlight the characteristics of individual transport segments: aviation, rail transport and transport leasing services.

2. Data collection

Data collection was carried out in four stages. In the first stage, a general assessment of innovative activity in the industry was carried out based on the analysis of open data: consolidated studies on the industry, as well as official documents, primarily the Passport for the Digital Transformation Strategy of the Transport Industry of the Russian Federation. This is necessary to identify the main types of innovations that experts consider to be the most important and effective. This will make it possible to compare how they operate and to assess how much progress they make in the proposed areas.

In the second stage, the financial statements of these companies for the year 2021 were analysed, as well as other official documents. This identified the main performance indicators of the enterprises, problems and difficulties in carrying out their activities, development prospects and information on the innovative activities carried out and the enterprises' plans to improve indicators and performance results through innovation. A brief description of the review of the enterprises' activities is given below.

In the third stage, a mixed format remote interview was conducted with 15 employees from each company on the implementation of innovation, the complexity of innovation activities and the identification of factors influencing innovation activities.

In the fourth stage, the same respondents were asked about the potential impact of the innovations developed in these companies on the main financial indicators such as turnover and profit. The lists of innovations for each company were obtained by analysing the companies' annual reports and the information available on official websites.

3. Research findings

3.1. Types of innovation in transport companies and an overview of innovation activities in the transport sector

The analysis based on open sources of information (strategic development documents of the Russian Federation, publications of specialist media, data from statistical agencies, reports of Aeroflot OJSC, TransContainer OJSC, State Transport Leasing Company OJSC, as well as consulting companies) shows the interest of the business community in various categories of innovations, as reflected in Table 1.

The global environmental agenda sets the trend for the development of mobility devices powered by alternative fuels [Pinsonneault, Choi, 2022]. Thus, the Transport Strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Transport Strategy) provides for reducing the negative impact on the environment through the development of electric transport[9].

Autonomous control technologies occupy a special place in the development of transport. A pilot project to test unmanned taxis is currently underway in Russia[10]. The Line Ministry is implementing a number of projects to introduce unmanned vehicles. According to the Russian Ministry of Transport, by 2030 the use of drones will increase the speed of delivery of goods and passengers by 25% and reduce the accident rate by 20%[11].

The companies discussed in this study contribute to the implementation of government policy by implementing measures to renew parks with energy-efficient equipment - electric transport, which ensures a reduction of harmful emissions into the atmosphere and a reduction of noise and vibration levels in megacities. According to the passport of Aeroflot PJSC's innovative development programme, the company has been conducting research in the field of using drones for aircraft maintenance since 2017. JSC State Transport Leasing Company implements state policy in the field of development of autonomous means of transport in the following areas: unmanned vehicle transport, unmanned navigation, unmanned aircraft[12].

[9] Transport strategy of the Russian Federation until 2030 with a forecast until 2035. http://static.government.ru/media/files/7enYF2uL5kFZlOOpQhLl0nUT91RjCbeR.pdf.
[10] The government has allowed Yandex to launch driverless taxis in Moscow (2022). RBC. https://www.rbc.ru/business/17/03/2022/623331689a79475ba96d9404 .
[11] Passport of the strategy of digital transformation of the transport industry of the Russian Federation. https://mintrans.gov.ru/activities/297/documents.
[12] Transport in detail. Unmanned technologies on land, sea and in the air. STLC. https://www.gtlk.ru/press_room/drone/.

Table 1
Types of innovation in transport companies

Order	Innovation category	Modes of transport
1	Electric transport	Road transport, municipal passenger transport
2	Unmanned vehicles	All modes of transport
3	High-speed transport systems	All modes of transport
4	Immersive technologies (VR, AR)	All modes of transport
5	Smart contracts	All modes of transport
6	Biometric technologies	All modes of transport
7	Traffic Management Technologies	Motor vehicles
8	Predictive analytics	All modes of transport
9	Electric vertical take-off and landing technologies	Air transport
10	Automated fleet maintenance (AMOS)	Air transport
11	Hydrogen fuel cell trains	Rail transport
12	Smart port	Sea/river transport

Source: compiled by the authors based on the study of media materials and annual reports of PJSC Aeroflot, PJSC TransContainer, JSC State Transport Leasing Company.

With sanctions restricting the supply of components for the production of drones, domestic manufacturers will fall significantly behind the leading countries in the autonomous transport market. According to J'son & Partners Consulting, the global structure of the drone market in 2035 will be represented by China (33%), the US (26%) and European countries (21%)[13].

Another promising direction is the development of Intelligent Transport Systems (ITS), which aim to optimise and redistribute transport flows, transmit key production indicators online and thus increase the efficiency of business management and reduce business costs.

Transport companies use virtual reality (VR, AR) to train employees in the aviation and rail industries.

With regard to the overview of the innovation activity market [Zezulka et al., 2016; Pinsonneault, Choi, 2022; Razzak et al., 2022], the transport and logistics industry is currently entering a phase of transition to innovation in the course of its activities [Innovation activity indicators..., 2022]. This was triggered by the COVID-19 pandemic, which led to a sharp decline in the market and disruption of supply chains. Falling profits have forced operators to pay more attention to innovation: around 80% of companies are moving to new business models linked to digital technologies and using innovations of various kinds[14].

Since 2019, the transport sector has been characterised by a noticeable increase in innovative activity. Other statistical indicators are shown in Table 2.

The share of costs of innovation activities in the total volume of transported goods was 2.6% in 2019 and 2% in 2020. At the same time, the volume of innovative goods, works or services created by transport companies amounted to 47.7 billion roubles and 125.5 billion roubles in 2019 and 2020, respectively. Growth in the share of innovative goods, works or services in the total volume of the companies' products, 0.5% in 2019 and 1.2% in 2020, is also indicative of the industry's turn to innovative activity[15].

It is worth noting that the main activity involved was purchasing machinery and other equipment needed to carry out their activities. This was the case for 39.8 % of enterprises engaged in innovation. Research and development carried out by enterprises to improve the quality of their products, reduce costs and generally update production processes came second (30.2 %). The third (26.5%) most common type of innovative activity of transport enterprises was the acquisition or independent development and implementation of computer programs and databases necessary to improve enterprise control in terms of ensuring transparency of operational processes, identifying weaknesses and growth points [Lin et al. , 2016; Tidd, Bessant, 2018].

Table 2
Statistical information on the innovative activity of transport companies

Indicators	2019	2020
Level of innovation activity	2.8	4
Share of innovation activity costs in the total volume of goods shipped (%)	2.6	2
Volume of innovative goods, works or services created by transport enterprises (billion roubles)	47.7	125.5
Share of innovative goods, works or services in the total volume of the enterprises' products (%)	0.5	1.2

Source: compiled by the authors on the basis of Rosstat data.

[13] Global self-driving car market, 2020–2035. J'son & Partners Consulting. https://tadviser.com/index.php/Article:Self-driving_cars_(global_market)#Json_.26_Partners_study.
[14] Roads of the future... (2021). RBC. https://trends.rbc.ru/trends/industry/60eff42e9a79478d357c6566.
[15] Federal State Statistics Service (Rosstat). https://rosstat.gov.ru/statistics/science.

The comparative share of the main types of innovative activities of transport enterprises and those providing services as part of their main activity is shown in Table 3.

Table 3
Comparison of innovation shares in transport and services (%)

	Transport industry	Companies providing services
Research and development	30.2	33.9
Acquisition of machinery and equipment	39.8	44
Marketing and branding	1.6	3.9
Staff training and retraining	9.6	13.7
Engineering design	1.1	1.5
Engineering services	7.2	7
Development and purchase of computer programs and databases	26.5	35.5
Acquisition of rights to the results of intellectual activity	9.6	8.4
Planning, developing and implementing new ways of doing business, organising workplaces and external relations	3.5	5.1
Other types of innovation activity	20.1	16.4

Source: Compiled by the authors on the basis of Rosstat data.

The main types of innovation used in transport and service enterprises are shown in Table 4.

Table 4
Main types of innovation used by transport and service companies (%)

	Transport industry	Companies providing services
Product innovation	57.9	65.9
Process innovation	71.7	67.7
Methods of producing and developing goods and services	18.4	18.6
Methods of logistics, supply and distribution	23.5	11.3
Information processing and transmission methods	45.7	38.5
Business practices, corporate governance	32.1	26.3
Business relations and external relations practices	16.4	14.1
Methods of labour management	25.3	19.6
Marketing methods for the promotion, provision and pricing of goods and services	14,5	12,3

Source: Compiled by the authors on the basis of Rosstat data.

Product and process innovations were used by 57.9 % and 71.7 % respectively of enterprises engaged in innovation activity in transport. These figures can be explained by the fact that the main types of services provided by transport enterprises cannot be changed conceptually. Instead, they focus on improving operational performance and the quality of services provided. Most of these innovations are related to changes in methods of processing and transmitting information (45.7%), as well as to new methods of doing business, corporate governance, accounting and financial reporting (32.1%).

Clearly, access to logistics infrastructure and the management of resources and components are linked to the provision of transport services. Therefore, 23.5% of the innovations introduced were related to improving logistics and distribution methods.

The problem of improving the quality of the human capital used is one of the main tasks in innovation, and the professional development of employees is an important factor determining the success of innovation. This problem is particularly pronounced in cases where the work of the company involves the operation of complex equipment or other objects. In this regard, innovations related to the labour resources of transport companies are quite obvious and are combined with the following material devoted to the analysis of the innovative activity of PJSC Aeroflot, PJSC TransContainer and JSC State Transport Leasing Company.

An analysis of the organisational structure shows that only 0.5% of companies in the sector have an R&D department . In general, the existing business model of such enterprises does not imply a close connection with the fundamental development of new types of material base for their activities or other forms of self-sufficiency with new technologies. The total number of people employed in these departments in 2020 was 2817. This is also reflected in the frequency of research and development activities. In 2020, 26.9% of enterprises regularly develop the innovative solutions they need and 73.1% of enterprises regularly address this issue[16].

The total cost of innovation activities of transport companies in 2020 amounted to 203.7 billion roubles. The lion's share of these costs came from own resources (193.4 billion roubles, or 95%), the rest from subsidies (2.8%) or targeted payments from the federal or regional budgets. Only 5.1% of enterprises received financial support from the government. The share of credits and loans for innovation in total costs seems to be quite low - only 0.4%. This suggests that, for the most part, transport enterprises are not financially starved and have sufficient resources to implement innovation initiatives.

165.3 billion roubles were spent on product innovation and 38.3 billion roubles on process innovation[17]. Despite the importance of process innovations and the fact that they are used one and a half times more than product innovations, a large share of the costs of the latter is understandable. Transport enterprises deal with complex equipment, especially in air transport, so that the purchase of more

[16] Id.
[17] Id.

Table 5
Frequency and cost of innovation use by transport companies

	Frequency of using innovation activity (%)	Cost of expences (million roubles)
Research and development	30.2	9 685.1
Acquisition of machinery and equipment	39.8	184 342
Marketing and branding	1.6	29.4
Staff training and retraining	9.6	1 072.5
Engineering design	1.1	25.1
Engineering services	7.2	1 698
Development and purchase of computer programs and databases	26.5	1 808.2
Acquisition of rights to the results of intellectual activity	9.6	108.7
Planning, developing and implementing new ways of doing business, organising workplaces and external relations	3.5	49.7
Other types of innovation activity	20.1	4 929.9

Source: Compiled by the authors on the basis of Rosstat data.

advanced similar objects as well as components for them is more expensive than investing in other types of innovations. This also explains the high share of transport in total innovation costs for the services sector. It accounts for 22.3% of total innovation expenditure by services enterprises[18]. Expenditure on innovation by type of economic activity and frequency of use is shown in Table 5.

It is interesting to note that transport companies are leading the way in environmental innovation. 16.9% of companies in the sector are currently innovating or have already completed projects to implement environmental innovations. This mainly concerns reducing pollution (84.3% of organisations), saving energy costs and switching to energy efficient technologies (35.7% of organisations), reducing carbon footprint and replacing raw materials with safer or less hazardous analogues (21.4% each). The main objective of environmental innovation is to ensure compliance with modern technical regulations (92.9% of companies). Many large transport companies are international in scope and it is important for them to implement environmental initiatives as part of the growing attention to the green agenda and the tightening of production standards in this area. Many companies (82.7%) voluntarily follow environmental principles[19].

At the same time, the lack of dedicated departments in the structure of transport companies forces them to seek outside help when introducing innovations. Payments to contractors account for 78.9% of all costs incurred by transport companies in implementing innovations. Certain categories of innovation activities are not actually carried out by the enterprises themselves. In the case of marketing and brand creation, 99.8% of the costs are paid to third parties; in the case of the training and re-training of staff, it amounts to 96.3 %; the cost of developing and acquiring computer programs and databases is 86.2%[20].

The total volume of innovative goods and services produced by transport companies in 2020 amounted to 125.6 billion roubles against 47.5 billion roubles in 2019[21]. This indicates an active process of introducing innovations and a gradual increase in their share of the total volume of products manufactured. It should be noted that the share of completely new or significantly modified products dramatically exceeds

[18] Id.
[19] Id.
[20] Id.
[21] Federal State Statistics Service (Rosstat). https://rosstat.gov.ru/statistics/science.

the volume of improved products. Thus, in monetary terms, the share of the former amounted to 98.1 billion roubles, and the share of the latter was 27.4 billion roubles. This indicates a sharp increase in interest in innovation and some practical successes in this regard. At the same time, the share of innovative products in the total volume did not exceed 1.2%, which, of course, does not give the right to talk about a radical transition of the industry to innovation.

Domestic transport companies did not present any conceptually new goods or services on the global market. It seems that the industry is in the phase of getting to know each other and taking the first serious steps in the application of innovative technologies. This can be partly explained by the current economic situation in which many transport companies, especially leading ones, find themselves cut off from foreign technologies or components.

However, it is worth noting that 30% of the innovative products of enterprises were created using intellectual property belonging to Russian economic and scientific entities. Most of the innovative products of transport companies are consumed within the country. In 2020, only 5% of the volume of innovative products was exported (the total amount of exports amounted to 6.2 billion roubles)[22]. At the same time, the main export destinations were non-CIS countries, which accounted for 99.5% of exported innovative products[23].

On the basis of the data presented, we can conclude that the situation in the Russian transport market can be described as unfavourable from the point of view of the introduction of innovations; innovation activity in the transport industry is insignificant.

This is mainly due to the fact that transport companies provide services and do not produce but operate innovations. At the same time, they are the ones who create the demand for innovation in the transport market and make significant investments in improving the material and technical base. For this reason, they are classified as being active in innovation.

As far as the dynamics of research in the field of innovative activity of transport companies is concerned, the process of introducing innovation started quite a long time ago, but the relatively noticeable results of this activity appeared only in 2020. Despite the small comparative indicators of the share of innovative products in their total volume, as well as the share of expenses for innovation activities in the cost structure of enterprises, the annual dynamics gives reasons to assume an increasing role of the innovative component in the activities of enterprises of the transport sector.

All of this speaks to the industry's high potential for innovation, as well as the need to increase the level of sustainability of companies to the current market conditions of the transport market, which is characterised by a high level of monopolisation.

3.2. The impact of innovative activity on the performance indicators of Aeroflot PJSC, TransContainer PJSC, JSC GTLK State Transport Leasing Company

Let us turn to the analysis of the innovative activity of Aeroflot PJSC, TransContainer PJSC, JSC GTLK State Transport Leasing Company. Data on market shares, productivity levels, passenger traffic, throughput and some other indicators are used to determine the impact of the innovations applied. The study uses data from the companies' annual reports. It also draws on the results of a survey of employees in the companies surveyed.

Aeroflot PJSC's most significant product innovation[24] was the launch of Russia's first low-cost carrier, Pobeda Airlines, in 2014. In 2014, Pobeda's share in the Aeroflot Group's total passenger traffic was only 0.4%, and in 2021 the airline carried 14.4 million passengers, or 31.5% of

Table 6
The impact of 'Pobeda Airlines' on financial indicators

Year	Passengers carried by Pobeda Airlines (million people)	Total number of passengers carried by the Group (million people)	Ratio of Pobeda Airlines passenger traffic to the Group's total passenger traffic (%)
2017	4.6	50.1	9.2
2018	7.2	55.7	12.9
2019	10.3	60.7	17
2020	9.1	30.2	30.1
2021	14.4	45.8	31.4

Source: compiled by the authors on the basis of Aeroflot PJSC's 2021 report.

[22] Id.
[23] Id.
[24] Aeroflot joined the Digital Transport and Logistics Association (2019). https://www.aerof lot.ru/ru-ru/news/61473.

Table 7
PJSC 'Aeroflot' innovation performance indicators

Indicator	2018	2019	2020	2021
Labour productivity (million km/person)	4.551	4.907	2.478	3.779
Passenger traffic (billion pkm)	143.2	156.3	68	100.1
Year-on-year cost reduction (%)	0.27	0.15	0.37	0.63
Flight punctuality (%)	89.9	94.8	96	93.8
Customer loyalty index (%)	72	73	*	74.6
Flight safety level (%)	99.974	98.932	99.965	99.973
Return on investment in innovation (%)	0.17	0.17	0.17	0.1**

* In 2020, the loyalty index was not evaluated.
** The indicator set at the mandatory level was reduced in accordance with the company's appeal to the Ministry of Transport and the Ministry of Economic Development of the Russian Federation.

Source: Compiled by the authors on the basis of Aeroflot PJSC reports for 2019 and 2021: https://rspp.ru/upload/uf/252/AFLT-ar19-ru__1_.pdf; https://ir.aeroflot.ru/fileadmin/user_upload/files/rus/common_info/gosa_doc_2022/Aeroflot_AR21_RUS_book_v2_0706_1740.pdf.

the Group's total passenger traffic. The impact of Pobeda Airlines on the Group's passenger traffic is shown in Table 6.

The launch of a new service for domestic consumers not only attracted customers from competitors, but also changed consumer preferences: 12% of passengers did not use air travel before Pobeda Airlines. The key elements of Pobeda Airlines' business model are:

1) efficient flight operations and routes that reduce economic and time costs;
2) high labour productivity, ensured by modern technologies and introduced innovations (in 2021 there were 7,113 passengers per company employee);
3) low level of transaction costs - the CASK, reflecting the cost per seat-kilometre, amounted to 2.3 rubles in 2021;
4) stimulation of the market, namely the offer of low prices for air transport (12% of customers before the appearance of Pobeda used only ground transport);
5) high demand, especially seasonal. However, due to the company's high market share, the average seat load factor on flights was 94%, reaching 96% in the peak months of the summer season;
6) operating an efficient fleet with high seat capacity.

Aeroflot PJSC clearly considers this innovation to be one of the most important. The results of a survey of Aeroflot PJSC employees show that about 78% of all key innovations implemented within the Group are tested or primarily implemented during the work of Pobeda Airlines.

According to the Passport of Aeroflot's Innovative Development Programme[25], the key areas for increasing the efficiency of innovation activities are as follows:

1) increase in labour productivity (million km/person);
2) increase in the efficiency of production and/or business processes, expressed in terms of passenger turnover (billion pkm);
3) reduction of costs, unit costs of production and service provision;
4) improvement in the quality (consumer characteristics) of the products manufactured and services provided, which includes flight punctuality, consumer loyalty index and flight safety levels;
5) economic efficiency of investment in innovation, measured as the ratio of R&D costs and other costs according to the established list to sales;
6) growth in non-resource export volumes, expressed as the share of local air transport revenue in the company's total revenue;
7) increase in energy efficiency and environmental friendliness of production, understood as a reduction in fuel and lubricant consumption compared to the previous year.

Given the sharp decline in the airline industry in general and the performance of Aeroflot PJSC in particular in 2020 due to the COVID-19 pandemic, it is difficult to draw conclusions about the effectiveness of innovation activities based on these indicators. Meanwhile, the speed

[25] Passport to the innovative development programme of PJSC Aeroflot. https://www.aeroflot.ru/media/aflfiles/media/strategy/pasport_2022.pdf.

Table 8
Existing IT systems in PJSC 'Aeroflot'

B2C	B2B	B2P
Aeroflot website, including mobile web check-in	Corporate loyalty programme	Maintenance management system
Mobile application	Agent loyalty programme	CrewTablet (SITA)
Customer loyalty management system	Investor website	Contact centre voice platform
Big data	Electronic aircraft customs declaration	SAP ERP Enterprise management system
E-commerce platform	Corporate system tax monitoring	Sirax Revenue accounting system
Unified payment solution		Electronic document management system and electronic digital signatures
Internet and inflight entertainment systems		Manager Monitor; EFB (Electronic Flight Briefcase)
		Base airport resource management system

Source: Compiled by the authors on the basis of Aeroflot PJSC reports for 2019 and 2021: https://ir.aeroflot.ru/fileadmin/user_upload/files/rus/common_info/gosa_doc_2022/Aeroflot_AR21_RUS_book_v2_0706_1740.pdf.

of their recovery can be used as a measure of success in this direction. On the basis of the company's official publications, the following conclusions can be drawn about the success of Aeroflot PJSC's innovative activities (Table 7).

Based on the information in Table 7, it can be seen that with a 50% reduction in labour productivity and passenger turnover in 2020 compared to 2019, the rate of recovery in 2021 shows the same result compared to 2020.

A similar situation is observed when comparing the dynamics of decline and recovery in other indicators, although to a lesser extent. For example, the cost of aviation fuel increased significantly in 2021 compared to 2020. Aeroflot PJSC's expenses for this cost indicator increased by 58.9%[26]. A similar situation is observed when comparing the dynamics of decline and recovery in other indicators, although to a lesser extent. For example, the cost of aviation fuel increased significantly in 2021 compared to 2020. Aeroflot PJSC's expenses for this cost indicator[27] increased by 58.9%.

Aeroflot PJSC is actively implementing digital technologies. According to the company's 2021 annual report, 100% of business processes are fully automated, making the Group one of the four most digitised airlines in the world. The development of digital technologies is a priority direction of the company's innovative development. Existing IT systems are shown in Table 8.

Aeroflot PJSC's IT systems, which are currently under development, will ensure stable growth of the company after 2020 and create an incentive for further development (Table 9). This is confirmed by the assessments of experts from the Ministry of Transport of the Russian Federation, who evaluated these innovations from the point of view of their impact on the value of the company.

According to the data presented, the current and promising types of innovation aim to solve the current problems related to increasing the efficiency of innovation activities. They are the only way out of the situation of restrictions and prospects for the company's growth.

The total cost of innovation for the Aeroflot Group in connection with the implementation of innovative projects and activities and research, development and technological work (R&D) in 2021 will amount to 117,641,096 million rubles, which is 103.16% higher than the actual figures for 2020[28]. A significant factor that had a noticeable impact on the Group's financial results in 2021 was the decrease

[26] https://ir.aeroflot.ru/ru/novosti/article/57983/.
[27] Annual report for 2021. https://ir.aeroflot.ru/fileadmin/user_upload/files/rus/common_info/gosa_doc_2022/Aeroflot_AR21_RUS_book_v2_0706_1740.pdf.
[28] Passport of the innovative development program of PJSC Aeroflot for 2021. https://www.aeroflot.ru/media/aflfiles/media/strategy/pasport_2022.pdf.

Table 9
Key innovations under development or already partially implemented in PJSC 'Aeroflot'

Types of key innovations	Innovation performance indicator that is influenced by the factors
Conducting training on complex flight simulators with scenario simulation depending on the individual skills of the flight crew using artificial intelligence technologies.	Level of flight safety Labour productivity Cost reduction Reduction in fuel consumption
Digitisation of freight sales. Predictive quotas and pricing of freight transport	Cost reduction Labour productivity
Introduction of biometric passenger identification at the airport for domestic flights and voice biometrics for customer authentication	Improving the quality (consumer characteristics) of products manufactured and services provided Level of flight safety
Development and use of intelligent bots with AI in chats on the website, instant messengers and online services	Improving the quality (consumer characteristics) of the products and services produced
Creation of a single portal for pilots and an electronic pilot profile	Level of flight safety Labour productivity
Development of a hardware and software complex for the use of IoT (Internet of Things) technology to automatically determine the location of containers	Return on investment in innovation Cost reduction compared to the previous year
Implementation of a fuel efficiency system to analyse in-flight fuel consumption	Cost reduction compared to the previous year
Corporate loyalty programme	Improving the quality (consumer characteristics) of the products and services produced
Production NDC environment	Cost reduction compared to previous year
Application of RFID technology in the business processes of PJSC Aeroflot	Return on investment in innovation Cost reduction Labour productivity

Source: Compiled by the authors on the basis of Aeroflot PJSC reports for 2019 and 2021: https://rspp.ru/upload/uf/252/AFLT-ar19-ru__1_.pdf; https://ir.aeroflot.ru/fileadmin/user_upload/files/rus/common_info/gosa_doc_2022/Aeroflot_AR21_RUS_book_v2_0706_1740.pdf.

in passenger traffic associated with the industry's operating conditions during the COVID-19 pandemic.

TransContainer PJSC, based on the strategic development programme, will implement measures to digitalise its business, which will allow it to increase its level to 80% by 2030[29]. The company plans to introduce a fully automated Customer Journey Map (a product development methodology based on a detailed analysis of customer needs and actual customer interactions with the company's products), end-to-end product-centric processes, a new digital order fulfilment fleet management system, and a unified service centre for the Delo Centre group of companies. These measures will reduce the cost of support functions by 27%[30]. The proposed implementation of the efficiency programme will make it possible to purchase rolling stock at a reduced price, which will gradually reduce CAPEX (capital expenditure costs). The total benefit of such a programme is expected to be around 30 billion roubles by 2030. This digitalisation is expected to reduce the speed of development of new innovations from 6-12 to 2-6 months, increase the level of automation of business processes by up to 60% and the availability of data for online analysis by up to 90% by 2025[31]. It is clear that these measures, if fully implemented, will have an impact on the company's operating results and, consequently, on the value of the company.

The company's key performance indicators, including innovation activities, are[32]:

1) net income;
2) EBITDA;
3) share of profitable transport by rail;
4) rail container transport volumes;
5) container handling volumes and some others.

[29] Strategic Development Programme of TransContainer PJSC. https://trcont.com/the-company/strategy.
[30] Annual report of TransContainer PJSC for the year 2021. https://www.e-disclosure.ru/portal/files.aspx?id=11194&type=2&attempt=2.
[31] Id.
[32] Id.

Table 10
Changes in key operating performance of PJSC 'Transcontainer'

Operating performance	2021	2020	2019
Volume of containers handled by rail (thousand TEUs)	2634	2405	2050
Volume of containers handled (thousand TEUs)	1435	1423	1320
Empty run rate of containers (%)	14	17	17.2
Share of profitable revenue traffic in total traffic (%)	84.4	80.4	81.7

Source: compiled by the authors based on the report of TransContainer PJSC for 2021: https://trcont.com/investor-relations/reporting/financial-reports-under-ifrs1.

In connection with the development of rail transport flows, TransContainer PJSC pays attention to improving the efficiency of its activities. In particular, the company is focusing on the development of IT systems that will allow it to reduce operating costs, increase the speed of loading and unloading containers by optimising warehouse operations, and deepen planning and cargo management. TransContainer PJSC has a long history of introducing innovations - on 2 November 2017, a presentation of the new information system 'Intelligent Container Terminal' (ICT) took place. The use of ICT enabled a reduction of 0.1 days in wagon downtime during freight operations, a reduction of 0.1 days in wagon turnover, a reduction of 2 days in container downtime, a reduction of 0.2 days in container turnover and minimisation of unproductive journeys during loading and unloading at the site. This in turn led to a reduction in electricity and fuel consumption, the cost of maintaining the gas unit and the cost of repairing the container site[33].

Digital solutions accompany the entire chain of the company's services. IT solutions currently specialise in the development of digital sales channels and CRM systems and the implementation of green logistics projects; the development of a BPM system for monitoring and optimising processes and the introduction of technologies for intelligent container terminals and artificial intelligence; the creation of cross-holding services and a unified corporate data warehouse for the Group, the implementation of infrastructure projects and the development of supporting corporate systems.

In 2021, TransContainer PJSC underwent a reorganisation of its sales department. As part of the reorganisation, a customer service department has been created, whose main task is to provide one-stop support for customer orders under feasibility study contracts at all stages of transport, with the assignment of a personal manager. The main aim of the changes is to improve the quality of service by improving communication with the customer. One of the results of the

Table 11
Key innovations under development or already partially applied in PJSC 'Trancontainer'

Types of key innovations	Innovation performance indicator that is influenced by the factors
TransContainer Academy	Increasing productivity
Implementation and standardisation of TOS	Improving the efficiency of production and/or business processes
Digital twin for the route network	Improving the quality (consumer characteristics) of manufactured products
Customer Journey Map and end-to-end product-centric processes	Improving efficiency of production and/or business processes Improving the quality (consumer characteristics) of manufactured products
Развитие iSales и каналов продаж, внедрение системы iTrans	Improving the quality (consumer characteristics) of manufactured products
Digital platform for co-executors	Improving the quality (consumer characteristics) of manufactured products Reducing costs, unit cost saving
Creation of cross-holding macro services	Improving efficiency of production and/or business processes Reducing costs, unit cost saving
Technology for covering container sites by laying terminal stone	Reducing costs, unit cost saving

Source: Compiled by the authors based on the report of TransContainer PJSC for 2021: https://trcont.com/investor-relations/reporting/financial-reports-under-ifrs1.

[33] Transcontainer introduced a new information system. https://trcont.com/press-centre/press-releases/-/asset_publisher/3m9B8CrlzS4s/content/-transkontejner-prezentoval-novuu-informacionnuu-sistemu-intellektual-nyj-kontejnernyj-terminal-.

Table 12
Changes in the key operating indicators of JSC 'GTLK'

Operating performance	2021	2020	2019
Leasing portfolio (billion roubles)	1355	1293	1102
Volume of investments in new business (billion roubles)	136	196	218
Volume of the leasing portfolio by the balance of the contract value reimbursement (billion rubles)	980	898	679
Expenses as a percentage of gross income (%)	29	35	40
Problem rate of the leasing portfolio (%)	0.5	0.8	0.9

Source: compiled by the authors on the basis of the report of JSC GTLK State Transport Leasing Company for 2021: https://trcont.com/investor-relations/reporting/financial-reports-under-ifrs1.

changes was a 3.5-fold increase in multimodal transport in the company's portfolio.

These examples demonstrate the extensive involvement of TransContainer PJSC in the process of innovative transformation, which is already having an impact on the company's key operating results (Table 10).

As shown in Table 10, innovations make it possible to increase the profitability of transport, reduce the amount of unused capacity and use containers more efficiently. TransContainer PJSC is focused on the further development of innovation activities and plans to develop and implement the types of innovations presented in Table 11 in the future.

According to the annual report of JSC GTLK State Transport Leasing Company for 2021, the company has set itself the strategic goal of digital transformation and increasing the operational efficiency of the company, including through the active implementation of innovations[34].

The main performance criteria are:

1) the increase in the net lease portfolio;
2) the volume of increasing investment in new business;
3) the increase in the leasing portfolio in terms of the balance of the compensation of the contract value;
4) the ratio of expenses to gross income;
5) the level of leasing portfolio problems and some others.

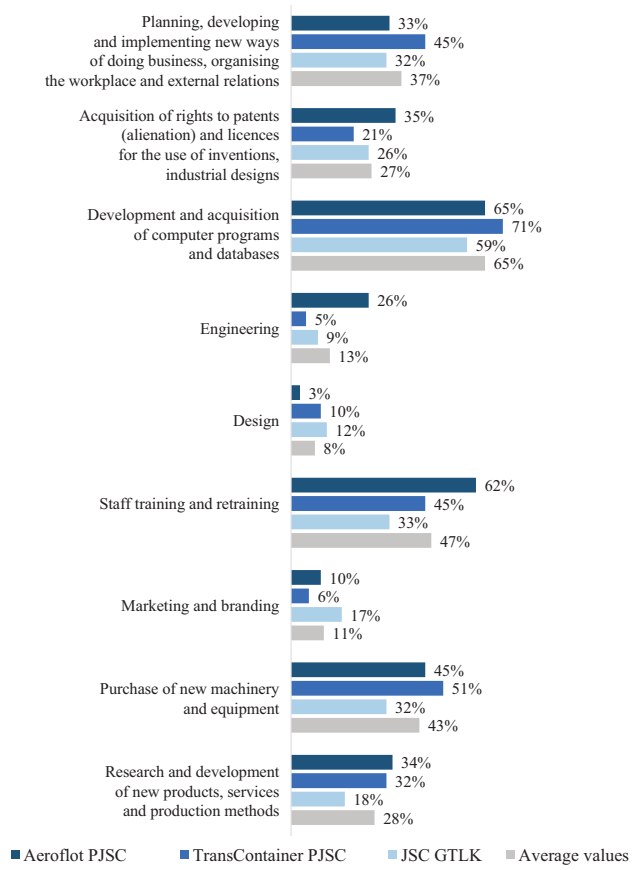
Table 13
Key innovations in JSC 'GTLK' under development or already partially implemented

Types of key innovations	Innovation performance indicator that is influenced by the factors
'Digital rooms' and 'digital passports'	Improving the quality (consumer properties) of manufactured products
Procurement management system	Improving the efficiency of production and/or business processes
Data showcase to ensure fiscal control in fiscal monitoring format	Improving the efficiency of production and/or business processes
Mobile application for the reception and transmission of equipment	Reducing costs, lowering unit costs Improving the quality (consumer properties) of manufactured products
Automation system for management and personnel selection based on the '1C: Salary and Personnel Management' software product	Increasing productivity
System for collecting and analysing operational data from aircraft	Improving the quality (consumer properties) of manufactured products
Use of big data to obtain information on technical reserves	Improving the efficiency of production and/or business processes
Business accelerator of the State Transport Leasing Company on the platform for the development of business innovations GenerationS	Increasing productivity Improving the efficiency of production and/or business processes
Application of blockchain technologies for protection of data received from transport companies	Cost reduction, unit cost reduction Improving the efficiency of production and/or business processes

Source: compiled by the authors on the basis of the report of JSC GTLK State Transport Leasing Company for 2021: https://trcont.com/investor-relations/reporting/financial-reports-under-ifrs1.

[34] Annual report of JSC GTLK for the year 2021. https://www.gtlk.ru/upload/iblock/818/nho6x4mxft7xyr8p8jmapo0lucfjx3u9/AR_2021_GTLK.pdf.

Fig. 1. Distribution of the answers to the question, 'What types of innovation are being implemented in your company?' (% of respondents)



Source: developed by the authors.

JSC GTLK State Transport Leasing Company focuses on the purchase of energy-efficient transport, primarily cars, which leads to a reduction in variable costs. The purchased domestic equipment runs on an alternative to traditional fuel, namely gas or electric traction. These vehicles are also equipped with a driver fatigue monitoring system, which should reduce accidents and vehicle breakdowns. The equipment used for passenger transport is equipped with electronic means of payment, which makes it possible not to lose part of the fare and generally leads to a 'whitewashing' of the market. The physical abilities of passengers are also taken into account. For example, most of these vehicles are low-floor, which allows people with reduced mobility to travel comfortably. In addition to reducing direct costs, innovation can also reduce operational risks and indirectly increase profitability.

At the end of 2019, JSC GTLK State Transport Leasing Company launched a programme for the leasing of digital assets, primarily for domestic development. The total volume of investments in this area is expected to reach 8.6 billion roubles by 2024.[35] JSC GTLK introduces a large volume of innovations, pursuing the main goal - to become a pioneer in the digital transformation of the transport industry in the Russian Federation[36]. This is already having an impact on the company's performance indicators (Table 12).

As mentioned above, JSC GTLK continues to actively introduce innovations in various fields of activity. The main innovations, which should be or have been partially implemented in the company, are listed in Table 13.

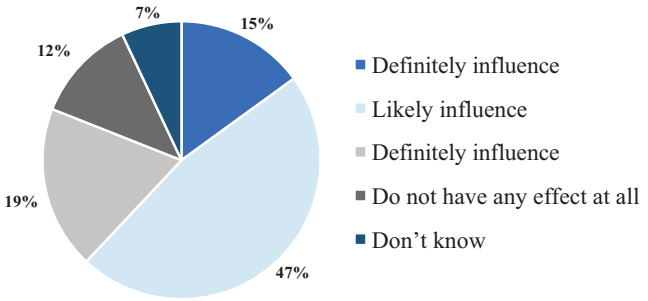
After reviewing the officially published information on the results of innovation activities of these enterprises, we turn to the results of a survey of employees in these enterprises to identify the internal characteristics of innovation implementation.

The first question aimed to identify the categories of innovations introduced by the responding enterprises (Figure 1).

As shown in Fig. 1, the main areas of innovation activity were the development of specialised computer programs, training and retraining of personnel, and the purchase of new equipment. This is generally in line with the industry indicators presented above. All enterprises show an interest in digital transformation and the transition to equipment that allows them to carry out their commercial activities more effectively.

The second question was to identify the overall impact of introduced innovations on the operational activities of enterprises. In this case, it seems obvious that successfully implemented innovations should have a positive impact on those operational indicators that are considered key in business (Fig. 2). Given that the operational indicators are not the same in the companies used for the analysis, the overall impact of innovation on them was assessed without highlighting specific parameters.

Fig. 2. Distribution of the answers to the question, 'Do the innovations implemented have an impact on the improvement of operational indicators?' (% of respondents)



Source: developed by the authors.

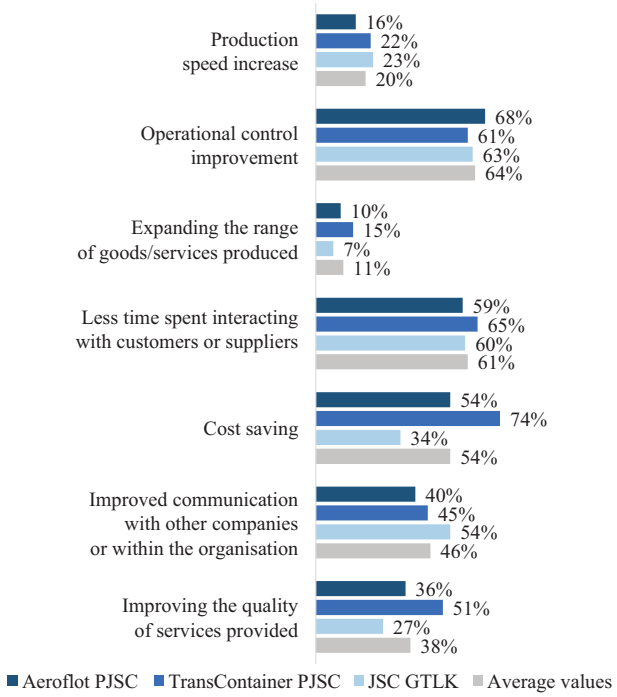
The survey showed that almost half of the respondents noted the impact of innovation on improving operational performance, which in turn is directly related to production activities, suggesting an improvement in the financial parameters of doing business.

[35] Id.

[36] Head of the State Transport Leasing Company – RBC, 'When supplying equipment abroad, we are not squeezed anywhere'. https://www.rbc.ru/business/02/09/2021/612f31219a7947ac10a86b66.

The third question was designed to identify a specific effect without reference to operational indicators. For the purposes of the study, it is important to understand exactly what improvements in what area of activity were noted by the respondents (Fig. 3).

Fig. 3. Distribution of the answers to the question, 'In your opinion, what is the main impact of the innovations that have been implemented?' (% of respondents)

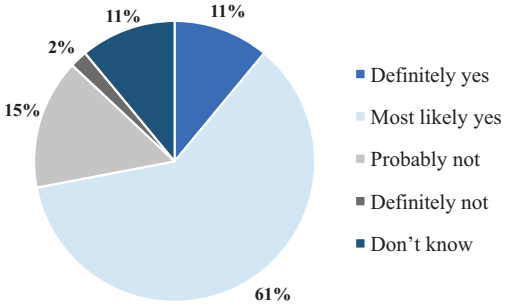


Source: developed by the authors.

The innovations introduced have had the greatest impact on improving control of operational processes, reducing time spent interacting with customers and reducing costs. The first two indicators make it possible to take business decisions more quickly and speed up production in the company. The third indicator directly proves a reduction in the company's expenses.

The fourth question revealed the relationship between the innovations introduced and the value of the company (Figure 4). Respondents were asked to give a general assessment of the potential importance of innovation for company value.

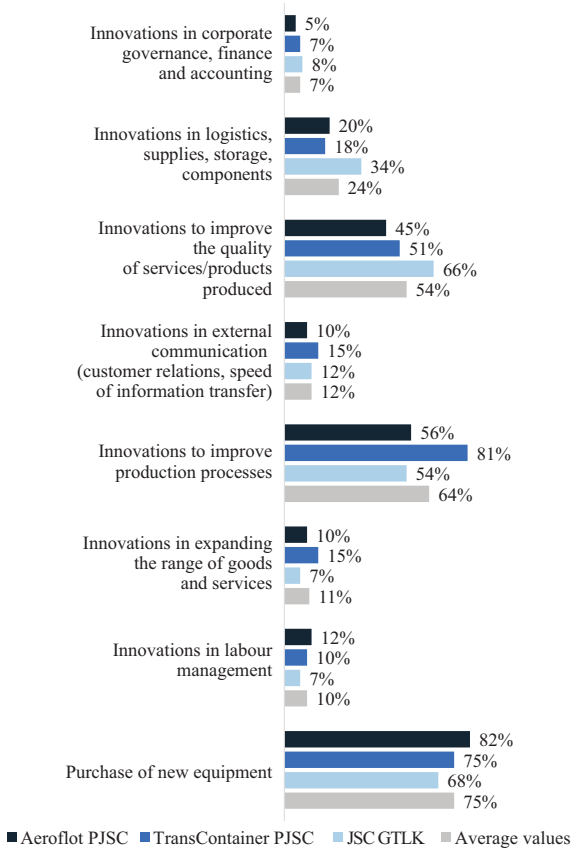
Fig. 4. Distribution of the answers to the question, 'Do you think that the implemented innovations have an impact on the value of your company?' (% of respondents)



Source: developed by the authors.

The vast majority of respondents answered that innovation had an impact on the value of the companies in which they operated. A total of 72% of respondents see value in innovation, affecting not only specific elements of a company's activities, but also its investment attractiveness in the eyes of investors, which is reflected in the value of the company.

Fig. 5. Distribution of the answers to the question, 'Which innovations do you think are most likely to influence the value of the company?' (% of respondents)



Source: developed by the authors.

The fifth question aimed to identify areas of innovation activity that, according to respondents, should primarily influence the value of the company. The survey results are shown in Fig. 5.

As the survey shows, respondents consider innovations related to the purchase of new equipment, which help to improve production indicators and the quality of services/products, to be the most important for the value of the company. For the transport and logistics sector, where companies' main assets are rolling stock, new equipment is obviously a priority area for innovation. In addition, the purchase of less energy-intensive and more efficient equipment can significantly improve production performance. As shown above, the purchase of new aircraft with a certain seating configuration, combined with the right management decisions, has had a significant impact on the financial and other indicators of Aeroflot PJSC in the creation of Pobeda Airlines. Obviously, the identified areas of innovative development are complex and interrelated.

4. Conclusions and recommendations

Innovation has an impact on both operational performance and firm value. Firstly, company value is influenced by innovations related to the acquisition of new equipment, the improvement of production indicators and the increase in the quality of the services/products offered. Value innovations predominate in the companies surveyed. Incremental innovations are less actively implemented, despite their objective importance. This can be explained by their high cost, which is a limiting factor for development in the current conditions. Digital technologies are mainly aimed at increasing control over operational processes, improving interaction with customers and reducing costs. Together with the acquisition of new equipment, these areas can be considered as one of the ways to increase the value of the company.

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