Formation of principles of a customer-oriented approach by transport enterprises in conditions of sustainable development

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Abstract. The article examines the content and process of forming the principles of a customer-oriented approach to the management of transport enterprises in the context of sustainable development. The author's definition of the concept of “principles of a customer-oriented approach to the management of transport enterprises” is given on the basis of its understanding as strategic and tactical areas of activity aimed at maximizing the satisfaction of customers' needs and expectations through the use of digital technologies and innovative approaches. The key principles of a customer-oriented approach to managing transport enterprises in the context of sustainable development are developed, among which the following are highlighted: understanding customer needs; personalization of service; interaction at all stages; digital transformation of processes; data analysis and forecasting; creation of a digital environment; training and development of personnel; culture of service and open communication; continuous analysis and improvement; focus on the sustainability of relations, etc. The author's own model of digital transformation of transport enterprises using the principles of a customer-oriented approach is proposed. A generalized characterization and impact on the processes of customer focus of individual digital technologies for managing customer relations of transport enterprises is presented.

1 Introduction

The development of digitalization processes on a global scale has a profound impact on transport enterprises, changing the paradigm of their management and encouraging them to seek ways for sustainable development. In this context, the development of a customer-centric approach is becoming extremely important for successful adaptation to modern realities. Given the constant changes in consumer attitudes and technological progress, the management of transport enterprises should be aimed at meeting customer needs. This requires not only the use of the latest technologies, but also a review of customer engagement strategies at all stages of their interaction with the company.

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The development of a customer-oriented approach contributes to the efficiency and competitiveness of transport companies. It allows them to adapt to the changing needs of customers by offering them customized and innovative solutions. In addition, a customer-centric approach helps build long-term relationships with customers, which is key to stability and success in today's competitive environment.

In today's business environment, transport companies face a number of challenges that require effective management strategies. Compliance with the key principles of the customer-centric management approach becomes extremely important in this context. Management based on the basic principles of customer focus allows to ensure effective interaction with customers at all stages of their interaction with the enterprise. In addition, this approach allows businesses to adapt to the changing needs and expectations of consumers in the digital age. It helps build long-term and sustainable relationships with customers, which is key to the successful operation of an enterprise in an intensely competitive environment. Through the use of digital technologies, these businesses can optimize their operations and improve the quality of customer service. It also reduces costs and increases the efficiency of managing various aspects of transportation activities, opens up new opportunities for optimizing logistics processes, ensuring safety, and increasing customer satisfaction. Thus, the use of customer focus principles in the activities of transport companies is an important factor in ensuring their success and sustainability.

The aim of the study is to generalize the theoretical foundations and develop methodological approaches to the formation of the principles of a customer-oriented approach to the management of transport enterprises in the context of sustainable development.

Paper [1] considers a customer-oriented approach to logistics services in the information economy. The author substantiates that achieving full customer orientation becomes possible through the systematic accumulation, effective structuring and active exchange of information. In today's information economy, a high level of competitiveness becomes unattainable without a proper customer-oriented approach to the provision of customer services.

The scientific publication [2] notes that creating a sustainable development strategy aimed at meeting customer needs is a complex and lengthy process. This stage requires full attention to the company's core value - its customers. Especially in a turbulent economic situation, the importance of focusing on customer needs becomes even more critical to ensure the sustainability and success of the enterprise.

Adherence to the principles of customer focus in the activities of enterprises is crucial for their success and sustainability in the market. First of all, it allows businesses to retain and attract customers by meeting their needs and expectations. In addition, providing a high level of customer service and attention to customers fosters positive feedback and recommendations, which help attract new customers. Finally, a customer-centric approach contributes to the image of the company as a reliable and responsible partner, which is important for its reputation and market positioning.

Paper [3] summarizes the following important principles of customer service:

- customer service should be aimed not only at attracting new customers, but also at retaining and satisfying existing ones;
- organizations seeking to develop through optimization of customer relations should analyze not only the overall sales dynamics, but also changes in customer behavior;
- customer relations include not only direct sales, but also pre-sales and post-sales relations;
- responsibility for customer relations should be distributed among all departments of the organization;

- a centralized information system is important to provide unambiguous and consistent information about customers and their relationships with all departments of the company.

The author [4] believes that the implementation of the principles of a customer-oriented approach in the actual activities of an enterprise is a source of significant competitive advantages, both for products and for the enterprise itself.

High-tech enterprises use financial resources to increase the intensity of investment in innovation, which will further strengthen their core competitiveness and improve corporate efficiency [5].

High-tech enterprises have good basic resources for innovation, such as technology, equipment, professionals, patents, and knowledge, and their development largely depends on the continuous updating and development of advanced technologies, which helps to reduce innovation costs and risks and quickly achieve breakthroughs in innovative technologies [6].

2 Methodology

Modern economic conditions, characterized by climate change, energy shortages, and environmental problems, encourage enterprises to find new ways of functioning based on the principles of sustainable development [7].

The principles of a customer-oriented approach to managing transport enterprises in the context of sustainable development are divided into strategic and tactical ones, which include analyzing and responding to changes in the consumer approach, personalizing services, ensuring high quality services, and creating a full-fledged digital environment for customer interaction.

A summary of the key principles of the customer-oriented approach to managing transport enterprises in the context of sustainable development is given in Table 1.

Table 1. Key principles of a customer-oriented approach to managing transport enterprises in the context of sustainable development.

Principle	Characteristics
1. Understanding customer needs	Transport companies should deeply analyze the needs, expectations and preferences of their customers, taking into account the impact of digitalization on their requirements.
2. Personalization of service	The use of digital technologies allows for the creation of customized solutions and offers for each customer, which increases customer satisfaction.
3. Interaction at all stages	Ensuring active electronic communication and interaction with customers at every stage of interaction, including search, purchase, after-sales service and feedback.
4. Digital process transformation	Using digital tools to optimize transportation processes and improve customer service efficiency.
5. Data analytics and forecasting	Using data analytics to understand and predict changes in consumer behavior, enabling businesses to adapt to changing customer needs.

6. Creating a digital environment	Developing innovative digital platforms and services to simplify customer interaction and improve customer experience.
7. Training and development of staff	Training staff to use the latest digital technologies and service methods to effectively meet customer needs.
8. Culture of service and open communication	Development of a corporate culture aimed at supporting open communication and responsibility to customers in the digital space.
9. Continuous analysis and improvement	Conducting systematic monitoring and analysis of service quality to continuously improve digitalization processes.
10. Focus on relationship sustainability	Creation of strategies aimed at building long-term and sustainable relationships with customers, which becomes the basis for the successful functioning of the enterprise in the digitalization environment.

Thus, the use of digital technologies and innovative methods allows businesses to effectively interact with their customers at all stages, from search to after-sales service. The active application of these principles not only helps increase customer satisfaction and loyalty, but also provides a competitive advantage in the market. Continuous analysis and improvement of service processes is an important component of the successful implementation of these principles. This approach contributes to building sustainable customer relationships, which is key to the successful operation and development of transport enterprises in the modern digital environment [8].

In today's digitalized economy, the key strategy for transforming the customer-centric approach and ensuring sustainable development is to develop and implement a digital strategy. This means actively using digital tools and technologies to meet customer needs and expectations. Business enterprises that pay special attention to this strategy have the opportunity to create personalized solutions and services that meet the unique needs of their customers. In addition, it allows businesses to build deep and sustainable relationships with their customers, which becomes a key success factor in a competitive market [9]. An important component of a digital strategy is not only the implementation of technologies, but also an understanding of customer needs and expectations, which allows enterprises to effectively adapt to rapidly changing market conditions. The model of digital transformation of transport enterprises using the principles of a customer-centered approach is shown in Figure 1.

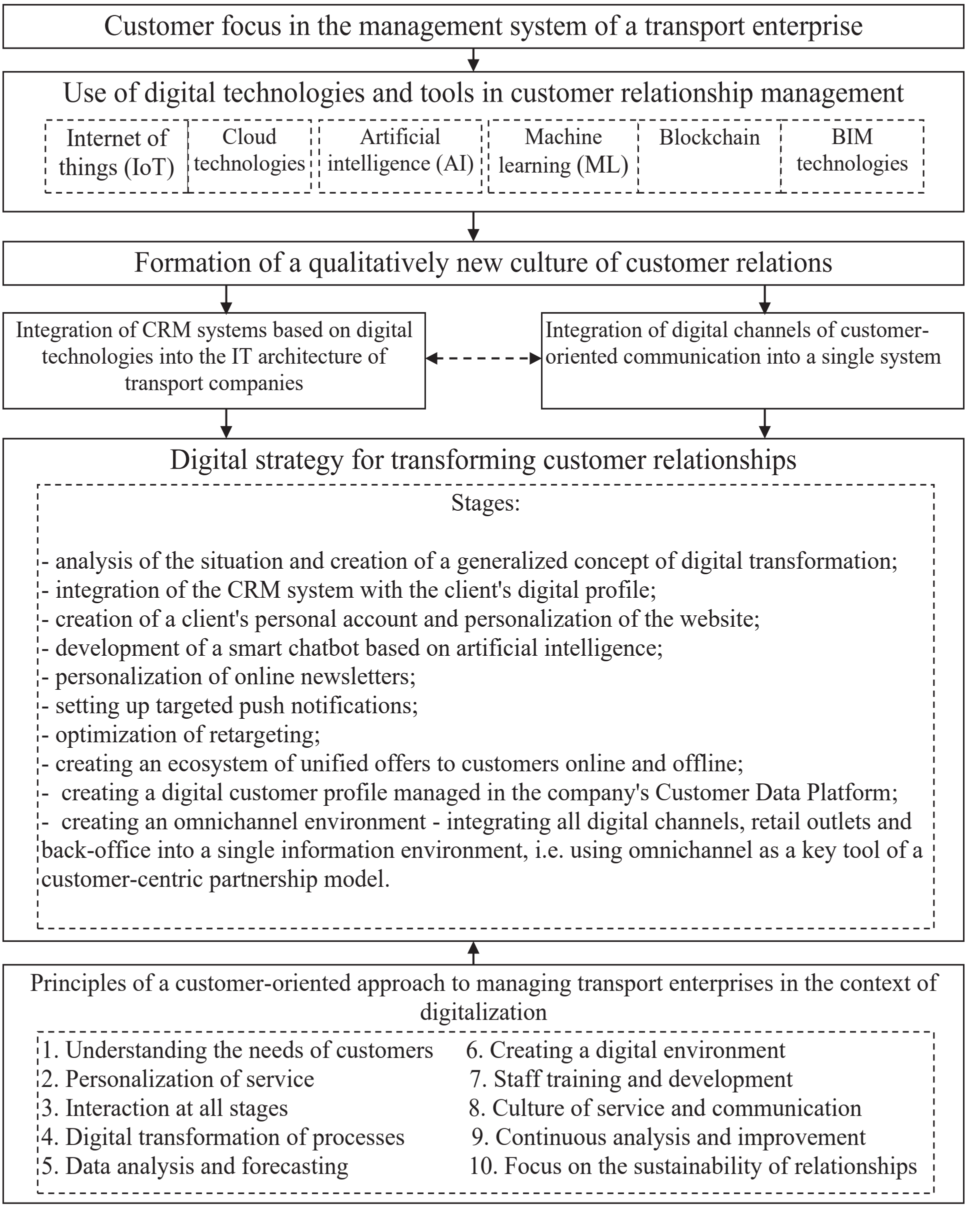

Fig. 1. A model of digital transformation of transport enterprises using the principles of a client-oriented approach

In the suggested model, the use of digital technologies and customer relationship management tools is an important component of sustainable development in the modern digital world. These technologies allow transport enterprises not only to interact effectively with customers but also to improve their experience of interaction with the brand [10].

The characteristics and impact on customer focus processes of individual digital technologies for managing customer relations of transport enterprises are presented in Table 2.

Table 2. Characteristics and impact on customer focus processes of individual digital technologies of customer relationship management of transport enterprises [1, 4, 8].

Digital technology	Use in the customer management system of a transport company
Internet of Things (IoT)	It allows real-time tracking of vehicle locations and accurate information on arrival times to customers. Using sensors and IoT platforms, it is possible to create personalized services, such as customized routes or recommendations for places to stay, which improves the user experience.
Cloud technologies	It allows you to store and process large amounts of customer data securely and efficiently. In addition, cloud-based solutions can improve data accessibility for employees in different departments of the transportation company, which facilitates quick response to customer requests and improves service levels.
Artificial intelligence	It allows you to automate customer interaction processes, ensuring fast and efficient processing of their requests and questions. In addition, using data analysis and machine learning, AI systems can provide personalized recommendations and offers for each customer, which helps improve the user experience and increase customer loyalty.
Machine Learning (ML)	It improves the processes of analyzing large amounts of customer data and behavior to identify useful information and trends. This allows businesses to automate decision-making processes, personalize customer offers, and increase the efficiency of customer interactions, which in turn contributes to increased customer satisfaction and profitability.
Blockchain	It allows to ensure a high level of security and confidentiality of customer data by encrypting and decentralizing information. In addition, blockchain technology can create a system of interaction where information about transportation, payments and other transactions between customers and the company will be automatically recorded and available to all participants, which helps increase trust and process efficiency.
BIM technologies	It provides the ability to create virtual models of buildings and infrastructure, which allows customers to get a realistic view of future facilities and helps them understand their needs and requirements. In addition, BIM technologies can provide interactive interfaces for clients, allowing them to participate in the design process and make changes through shared platforms, which improves collaboration and customer satisfaction.

The use of digital technologies in the customer management system is critical for modern enterprises in any industry, including transportation companies. These technologies allow enterprises to optimize processes, increase efficiency, and provide personalized and high-quality customer interaction. The introduction of digital tools contributes to increased competitiveness, customer satisfaction, and profitability, so it is a necessary step to ensure their sustainable development.

3 Results and discussion

In today's unstable economic environment, the development of innovations that form highly efficient digital technologies is crucial for the management and sustainable development of the enterprise.

The use of innovative technologies and processes, development and implementation of innovative types of products allows an enterprise to occupy a leading position in the market. This will provide products with a high degree of scientific content and novelty, thereby making them competitive in the world market [11].

To ensure the sustainable development of transport enterprises, the author has developed a model for optimal management of the use of digital technologies and tools, which consists of the following stages:

Stage I. *Selection of the set on which optimal management is carried out.*

We denote the set of digital technologies that can be used by an enterprise by $S = \{S_i\}_{i=1}^{n}$. We consider six technologies: $S_1 -$ Internet of Things (IoT); $S_2 -$cloud technologies; $S_3 -$ artificial intelligence; $S_4 -$ machine learning (ML); $S_5 -$blockchain; $S_6 -$BIM technologies.

Stage II. *Evaluation of performance indicators*.

It can be carried out by the method of expert evaluation. A set of experts is considered $E = \{E_j\}_{j=1}^{m}$, each of whom determines the efficiency of the -*i* technology or E_{ij} tool on a certain predefined scale.

The obtained expert assessments must satisfy the condition of consistency, which can be checked by calculating the Spearman or Kendall's rank correlation coefficients.

Stage III. *Determination of the main numerical characteristics.*

Based on expert opinion, determine the effectiveness of each technology. Let the survey involve m experts, each of whom determines the effectiveness of using a particular technology. Then

- is the relative efficiency of the -*i* technology according to the -*j* expert:

$$c_{ij} = \frac{E_{ij}}{E_{i,max}},$$

Where E_{ij} is the absolute value of the efficiency of the -*i* technology according to the -*j* expert, $E_{i,max}$ is the maximum possible value of the efficiency of the -*i* technology;

- is the average relative efficiency of the *i*- technology:

$$M_i = \frac{\sum_{j=1}^{m} c_{ij}}{m},$$

- is the average variation in the relative efficiency of the *i*- technology:

$$\sigma_i = \sqrt{\frac{\sum_{j=1}^{m}(c_{ij}-M_i)^2}{m}},$$

- pairwise correlation coefficients between performance indicators:

$$r_{i,k} = \frac{\sum_{j=1}^{m}(c_{ij}-M_i)\cdot(c_{kj}-M_k)}{m\sigma_i\sigma_k}.$$

Stage IV. *Building an optimal choice model.*

Let us denote by $\pi_c = (x_1, x_2, \dots, x_n)$- the vector of management of the use of digital technologies, where x_i is the share of the -*i* technology in the digital environment of the enterprise $x_i \geq 0, \ \sum_{i=1}^{n} x_i = 1$.

Depending on the ultimate goal of managing the efficiency of the digitalization process, three criteria for selecting optimal solutions can be considered:

1. *The criterion of maximum efficiency*.

Let us consider an optimization problem in which the average expected efficiency of the use of a set of digital technologies is taken as the objective function, that is:

$$F(\pi_c) = \sum_{i=1}^{n} M_i x_i.$$

In this case, we consider the optimal solution to be the vector $\pi_c^* = (x_1^*, x_2^*, \dots, x_n^*)$ for which the function $F(\pi_c)$ takes on the largest value, provided that the independent variables x_i satisfy the system of constraints:

$$\begin{cases} \sum_{i=1}^{n} \sigma_i^2 x_i^2 + 2\sum_{i \neq k} \sigma_i \sigma_k x_i x_k r_{i,k} \leq \sigma_0^2, \\ \sum_{i=1}^{n} x_i = 1, \\ x_i \geq 0. \end{cases}$$

The first inequality in the system of constraints defines the risk measure (performance variance) of the control vector. Therefore, a constraint σ_0^2 is imposed on this value from above, where the constant is defined as the average value of the variance for the previous period or as a certain value that the risk measure cannot exceed.

2. *Minimum risk criterion.*

Now consider an optimization problem in which the average risk measure of the control vector is taken as the objective function:

$$G(\pi_c) = \sum_{i=1}^{n} \sigma_i^2 x_i^2 + 2\sum_{i \neq k} \sigma_i \sigma_k x_i x_k r_{i,k},$$

for which we find the smallest value under the conditions:

$$\begin{cases} \sum_{i=1}^{n} M_i x_i \geq M_0, \\ \sum_{i=1}^{n} x_i = 1, \\ x_i \geq 0. \end{cases}$$

The first inequality in the system of constraints defines the condition of the bottom-up boundedness of the average efficiency indicator, the constant M_0 is defined as the average value of efficiency for the previous period or as a certain value that must necessarily exceed the management efficiency.

3. *The criterion of the optimal ratio of efficiency and risk.*

Since the highest value of efficiency and the lowest value of risk may not be achieved simultaneously, the objective function of the following form is considered to determine the solution that achieves the optimal ratio between these values:

$$\Theta(\pi_c) = \frac{\sum_{i=1}^{n} \sigma_i^2 x_i^2 + 2\sum_{i\neq k} \sigma_i \sigma_k x_i x_k r_{i,k}}{\sum_{i=1}^{n} M_i x_i}.$$

Since the condition of optimality is to achieve the maximum value of efficiency and the minimum value of risk, the function $\Theta(\pi_c)$ is still minimized under the following conditions:

$$\begin{cases} \sum_{i=1}^{n} x_i = 1\,, \\ x_i \geq 0. \end{cases}$$

Let's illustrate the described model on the example of transport companies: LLC “MERSK UKRAINE LTD”, ZEFKO UKRAINE LLC, PE “TRANS LOGISTICS”, whose activities were characterized by 7 expert assessments. Table 3 shows the relative expert assessments.

Table 3. Relative expert assessments of the effectiveness of digital technologies on a 100-point scale.

Experts	Technology					
	S_1	S_2	S_3	S_4	S_5	S_6
E_1	1			1	,	
E_2			,			
E_3					6	
E_4				5		
E_5				0	,	
E_6		,		0		
E_7						

The consistency of expert opinions was checked using Kendall's and Spearman's statistical criteria (Figs. 2-3).

Correlations

			VAR00001	VAR00002	VAR00003	VAR00004	VAR00005	VAR00006
Kendall's tau_b	VAR00001	Correlation Coefficient	1,000	,143	,524	,333	,619	,429
		Sig. (2-tailed)	.	,652	,099	,293	,051	,176
		N	7	7	7	7	7	7
	VAR00002	Correlation Coefficient	,143	1,000	,619	,619	,333	,714*
		Sig. (2-tailed)	,652	.	,051	,051	,293	,024
		N	7	7	7	7	7	7
	VAR00003	Correlation Coefficient	,524	,619	1,000	,619	,714*	,905**
		Sig. (2-tailed)	,099	,051	.	,051	,024	,004
		N	7	7	7	7	7	7
	VAR00004	Correlation Coefficient	,333	,619	,619	1,000	,524	,714*
		Sig. (2-tailed)	,293	,051	,051	.	,099	,024
		N	7	7	7	7	7	7
	VAR00005	Correlation Coefficient	,619	,333	,714*	,524	1,000	,619
		Sig. (2-tailed)	,051	,293	,024	,099	.	,051
		N	7	7	7	7	7	7
	VAR00006	Correlation Coefficient	,429	,714*	,905**	,714*	,619	1,000
		Sig. (2-tailed)	,176	,024	,004	,024	,051	.
		N	7	7	7	7	7	7

Fig. 2. Correlation test using Kendall's test, calculated in SPSS

Spearman's rho	VAR00001	Correlation Coefficient	1,000	,214	,643	,429	,750	,571
		Sig. (2-tailed)	.	,645	,119	,337	,052	,180
		N	7	7	7	7	7	7
	VAR00002	Correlation Coefficient	,214	1,000	,643	,786*	,357	,786*
		Sig. (2-tailed)	,645	.	,119	,036	,432	,036
		N	7	7	7	7	7	7
	VAR00003	Correlation Coefficient	,643	,643	1,000	,786*	,786*	,964**
		Sig. (2-tailed)	,119	,119	.	,036	,036	<,001
		N	7	7	7	7	7	7
	VAR00004	Correlation Coefficient	,429	,786*	,786*	1,000	,714	,893**
		Sig. (2-tailed)	,337	,036	,036	.	,071	,007
		N	7	7	7	7	7	7
	VAR00005	Correlation Coefficient	,750	,357	,786*	,714	1,000	,750
		Sig. (2-tailed)	,052	,432	,036	,071	.	,052
		N	7	7	7	7	7	7
	VAR00006	Correlation Coefficient	,571	,786*	,964**	,893**	,750	1,000
		Sig. (2-tailed)	,180	,036	<,001	,007	,052	.
		N	7	7	7	7	7	7

Fig. 3. Correlation test using Spearman's test, calculated in SPSS

Based on the correlation analysis, we can conclude that for most pairs of experts, there are statistically significant relationships between the assessments provided. For all experts except the second one, we can accept the hypothesis of consistency of expert opinions with a reliability level of at least 0.88, and for most experts with a reliability level of at least 0.9. Therefore, in further calculations, we used the estimates of six experts, excluding the second.

Table 4 shows the results of calculating the main numerical characteristics of the assessments of the effectiveness of digital technologies, and Table 5 shows the correlation matrix composed of Pearson's pairwise correlation coefficients.

Table 4. Main numerical characteristics of expert assessments of performance indicators.

N	Technology					
	S_1	S_2	S_3	S_4	S_5	S_6
M_i						
σ_i						

Table 5. Correlation matrix.

	S_1	S_2	S_3	S_4	S_5	S_6
S_1	1					
S_2	-0,1033	1				
S_3	0,4169	0,5602	1			
S_4	0,2142	0,7637	0,4215	1		
S_5	0,5879	0,0564	0,5223	0,4497	1	
S_6	0,2433	0,8050	0,9223	0,6959	0,4481	1

Let's calculate the optimal control vectors for each of the three criteria described above.

For the criterion of maximum efficiency under the condition $\sigma_0 = 0{,}012$:

$$F(\pi_c) = F(0;\ 0{,}168; 0;\ 0; 0{,}004; 0{,}828) = 0{,}7315.$$

For the minimum risk criterion, provided that $M_0 = 0{,}68$:

$$G(\pi_c) = G(0{,}215;\ 0{,}116; 0{,}142;\ 0{,}187; 0{,}179; 0{,}161) = 0{,}0027.$$

For the optimal ratio criterion:

$$\Theta(\pi_c) = \Theta(0{,}214;\ 0{,}117; 0{,}135;\ 0{,}187; 0{,}180; 0{,}166) = 0{,}0038.$$

From the modeling results obtained for transport enterprises: LLC "MERSK UKRAINE LTD", ZEFKO UKRAINE LLC, PE "TRANS LOGISTICS", the following conclusions can be drawn:

1. To achieve maximum efficiency, it is advisable to use the second, fifth and sixth technologies. The share of these technologies in the control vector is as follows: for the second technology - 16.8%, for the fifth - 0.4%, and for the sixth - 82.8%. This distribution is explained by the high expert assessment of BIM technology.

2. To achieve minimum risk at an acceptable level of efficiency, it is advisable to use all technologies in the following ratio of control vector components, as shown in Table 6:

Table 6. Optimal ratio of digital technologies according to the risk criterion.

Digital technology	Component of the management vector based on the minimum risk criterion	Component of the management vector based on the optimal efficiency-risk ratio criterion
Internet of Things (IoT)	21,5 %	21,4 %
Cloud technologies	11,6 %	11,7 %
Artificial intelligence	14,2 %	13,5 %
Machine learning (ML)	18,7 %	18,7 %
Blockchain	17,9 %	18,0 %
BIM-technologies	16,1 %	16,6 %

According to the criterion of the optimal ratio between efficiency and risk, the distribution of components of the control vector is close to the results obtained for the criterion of minimum risk, which indicates that this solution is close to the optimal one by two criteria.

Thus, the suggested approach to building a model for choosing the optimal management vector among the choice of digital technologies and tools makes it possible to determine the most appropriate ones for each particular transport enterprise. As already noted, digital technologies and tools contribute to the sustainable development of an enterprise.

4 Conclusions

Thus, the development of digital technologies is not only relevant but also necessary for transport enterprises in the modern environment to ensure sustainable development. Further use of digital innovations and technologies in the customer management system has a number of advantages and opportunities. The introduction of digital technologies allows enterprises to effectively optimize and automate customer interaction processes, reducing the time and effort required for this. At the same time, the use of digital management tools allows for a personalized approach to each customer, which increases customer satisfaction and loyalty. This approach helps increase sales and reduce customer losses.

Further development of approaches to identifying the principles of a customer-centric approach in the management of transport enterprises allows optimizing the processes of interaction with customers, increasing their satisfaction and loyalty, and this will be a key factor in ensuring the competitiveness and sustainable development of transport enterprises in the digitalization era.

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