DOI: 10.15587/978-617-7319-71-8.CH7

7 STRATEGIC PRIORITIES FOR THE DEVELOPMENT OF RAILWAY TRANSPORT ENTERPRISES IN THE CONTEXT OF ENSURING THEIR DIGITAL TRANSFORMATION

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ABSTRACT

Global trends in the development of the world transport complex indicate that digitization is the key tool for the transformation of its business models and service provision system today. Technologies of the Internet of Things, artificial intelligence, big data, memory on a neural network, unmanned transport, Blockchain, automated processes using robotic systems allow not only to organize the work of enterprises in a qualitatively new way, but also to change the system of relations with stakeholders, ensuring the formation of a system values in accordance with the needs of modern consumers.

The successful future of domestic railway transport enterprises depends on the level and progressiveness of implemented digital technologies, which will allow optimizing operational activities in the industry, increasing the effectiveness and efficiency of management actions, and qualitatively improving the level of customer service. These circumstances indicate the expediency of considering the scientific and applied problem of determining strategic priorities for ensuring the digital transformation of railway transport enterprises in the dynamic conditions of their operation.

KEYWORDS

Digitalization, transformation, railway transport, digital development, innovative progress.

7.1 DIGITIZATION AS A KEY TOOL FOR THE DEVELOPMENT OF THE TRANSPORT COMPLEX

Digitization is a key tool for the development of the transport complex today. Digitization includes the processes by which digital technologies and information are used by railway companies to change their organizational models, improve efficiency and create new values. From companies, digitalization requires a customer-oriented business strategy and major organizational changes. So, for example, the use of digital modeling technologies or VIM technologies makes it possible to transform the process of designing, building and operating railway infrastructure by creating an opportunity to model the infrastructure object virtually, without spending time on making its prototype. Big data technologies, which allow monitoring their parameters and managing maintenance processes in real time, also create huge opportunities for maintaining infrastructure and rolling stock in a technically sound condition. The use of data array technologies makes it possible to move to a new system of managing the condition of railway infrastructure objects and rolling stock,

namely to manage their life cycle, thereby ensuring the improvement of the effectiveness of repair measures and the optimization of costs for their implementation.

In the field of providing services to passengers, digital technologies make it possible to introduce new service quality standards based on the principles of interoperability, omnichannel and customer orientation. The use of Blockchain technology due to the creation of cross-corporate applications allows not only to identify passengers, reliably track the location of cargo, train or passenger, form smart contacts and purchase tickets, but also to develop progressive loyalty programs for customers, thereby supporting effective communication with consumers of transport services. In addition, a significant potential for the formation of an adaptive customer relationship management system is created by mobile applications that allow the implementation of a wide range of virtual services, starting with trip planning and ending with the support of the individual safety of each passenger [1].

The implementation of platform solutions is also observed in the field of personnel management of railway transport enterprises, which, as evidenced by the experience of European railway companies, allow not only to effectively manage the processes of adaptation, training and stimulation of employees, but also to implement an effective policy to support the company's HR branding. The most promising technological directions in the field of transport, which include:

5G technologies: devices to detect errors in received information or to prevent them; a transmission control procedure, for example, a channel level control procedure; means of synchronization; systems of automatic repetition, for example, the van Duuren system; services specially adapted for wireless communication networks in which location information is used [2].

Connected (connected) transport: closed television systems in which the signal is not used for broadcasting; computer systems based on specific computational models; structural elements – means of cooling.

Big data: electrical or hydraulic circuits designed specifically for vehicles to transmit signals between vehicle systems or subsystems; a transmission control procedure, for example, a channel level control procedure; special purpose aircraft; means or devices for reading or recognizing printed or written characters, or for recognizing images, for example, fingerprints; in determining or calculating movement parameters used in the traffic control system of a road vehicle – driving style or mode [3].

Let's consider the prerequisites, opportunities and risks that form in the environment of the functioning of railway transport enterprises under the influence of digital transformation processes.

7.2 THE OPERATING ENVIRONMENT OF RAILWAY TRANSPORT ENTERPRISES: PREREQUISITES, OPPORTUNITIES AND RISKS

The first precondition of the external level, which caused significant challenges for the digital transformation of domestic business structures "Development and transition of the world economy to the Age of Industry 4.0". In the conditions of the formation of the information society in various sectors of the economy, a huge amount of various data is created and accumulated [4].

In industry and business, the flow of information necessary for enterprise management is constantly growing. If in the past the most important factor of competitiveness and value creation for enterprises was the state of cost management and the quality of products (services), today and in the future, along with the physical product itself, the data obtained from digital marketing and smart analytics are gaining more and more value.

In order to transition to intelligent management of business processes, optimize the use of labor force and increase the efficiency of business, Ukrainian business structures need to move to the widest implementation of the Concept of the "Fourth Industrial Revolution" (English "Industry 4.0") as soon as possible, making the most of its opportunities [5].

The project of the "Digital Agenda-2010" Concept, developed by specialists of the PA "High Tech Office" [6], is an initiative on the issue of digitalization of the economy. In the mentioned draft concept, the authors propose a forced scenario of digitization of the country, the key strategy of which is to work with the internal market, and the leading initiatives should be the formation of the subjects of the digital space of business, the state and citizens, motivation and the need to use new digital technologies.

The strategy offers an accelerated path, and the main tools that allow for a reactive breakthrough, according to the authors, should be the tools of the economic mechanism with the use of tax and customs policy tools for the introduction of special import duties on equipment and technologies intended for the development of the digital sphere, which would make it possible to reduce the cost digital means of software, equipment; implementation of lending tools for digitization of business and production projects; funding through the creation of special funds for joint investment, venture investment, which would provide financial stimulation for the development of the digital technology sector, improve the investment climate in the country and create prerequisites for attracting foreign investment in the digital technology sector [7].

Prerequisites, opportunities and risks that form in the environment of the functioning of railway transport enterprises under the influence of digital transformation processes are presented in **Fig. 7.1**.

Digitization of the world economy creates a number of opportunities and threats in the process of digital growth of enterprises, including railway transport enterprises.

World experience proves that the processes of digitalization of industries, enterprises, including railway transport enterprises, have three defining characteristics, which are expressed in the development of cooperation, intelligence and the innovation production system. Instead of reactively carrying out fragmented vertical digitalization, most economically developed countries choose a strategy of continuous joint transformation. As industries strive to go digital, they increasingly rely on platforms, sharing mechanisms, and artificial intelligence. This, in turn, involves the development of open and joint innovation systems, equipped with all the necessary elements and resources and functioning in a favorable institutional environment.

The digital transformation process is long-term and includes five stages: pilot, local expansion, replication, operations management, optimization and innovation. Among the majority of enterprises that have chosen the path of digital transformation, more than 70 % are currently in the

"local expansion" and "replication" stages, while only 3.9 % have reached the "optimization and innovation" stage. As world practice proves, the processes of digital transformation of large enterprises are long-term and large-scale from the point of view of the use of investments [8].

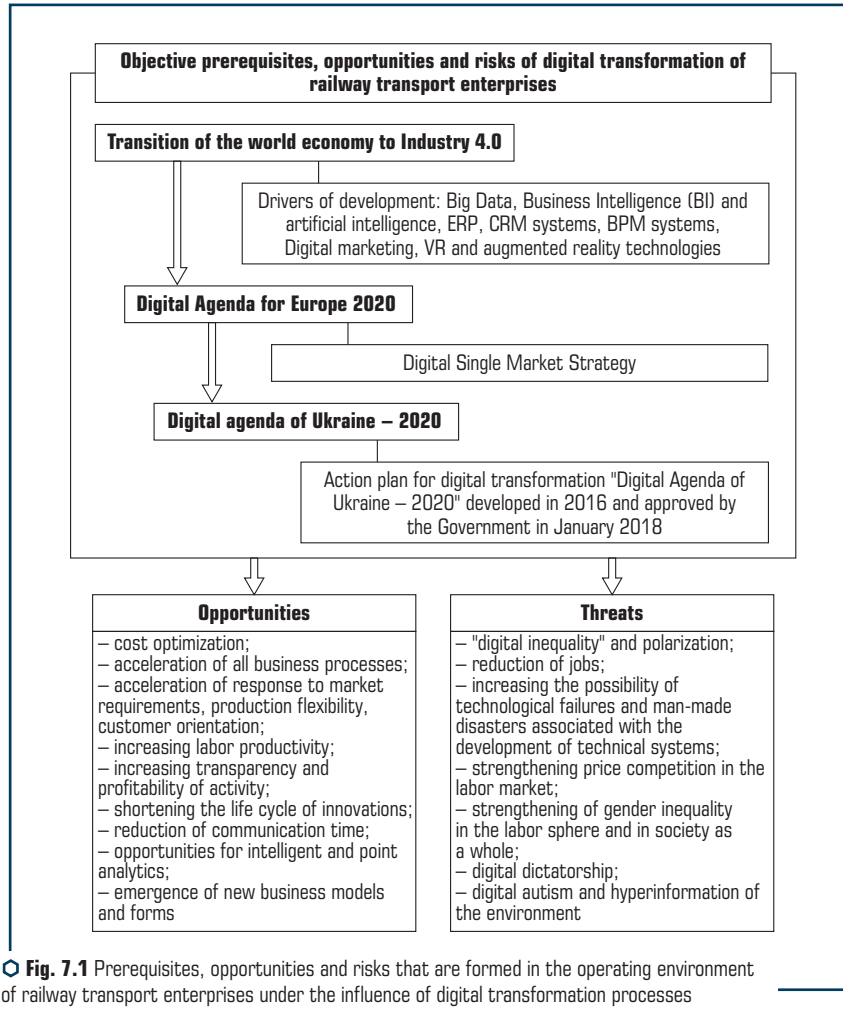

Fig. 7.1 Prerequisites, opportunities and risks that are formed in the operating environment of railway transport enterprises under the influence of digital transformation processes
Source: author's development

When choosing a digital transformation strategy, it is extremely important to achieve changes in such areas of the company's activity as informativeness, culture, organization, methodology, model.

Changes in the field of informativeness should take place through, firstly, the introduction of progressive software tools and technologies, and, secondly, focusing on the needs of the market, developing the ability to sense these needs in real time and promptly respond to them in order to create value for customers and users [9].

It is possible and necessary to lay a solid foundation for digitalization and continue to enrich and optimize options for using digital solutions by implementing digital objects, processes and rules.

Therefore, digitalization processes require the implementation of significant changes in the company and require the latter to be receptive to the introduction of digital innovations. The latter depends on the level of digital maturity of the company and its ability to support and implement transformations.

Corresponding requirements are also being put forward to railway transport enterprises that have embarked on the path of digital transformation. Undoubtedly, the ability of railway transport enterprises to successfully carry out digital reforms and create a digital image of the industry depends on their ability to perceive various types of digital innovations. Since the perception of digital changes depends on the prerequisites formed in the industry for the implementation of digital transformations, let's consider it appropriate to assess the level of digital maturity of railway transport enterprises.

Based on scientific views [10–14] regarding the content of digital maturity of companies, the last category will be defined as the readiness of the enterprises of the industry for transformations due to the introduction of digital innovations.

To assess the level of digital maturity, let's use the direct assessment method (score method), which was carried out with the involvement of 25 experts – specialists and employees of railway transport enterprises. The latter were asked to complete a questionnaire and assess their vision of the level of digital maturity of the industry.

The assessment is proposed to be carried out on the basis of the determination of such indicators as:

– existence of a clearly defined digital transformation strategy ($K1$);

– level of implementation of new business processes ($K2$);

– availability of a change management system ($K3$);

– availability of an internal communications system that ensures clear communication of digitalization goals to employees ($K4$);

– availability of a personnel motivation system that guides employees to support digital transformations ($K5$);

– availability of a corporate training system that adapts to the strategic goals of digitization ($K6$);

– availability of direct communication channels with consumers of transport and logistics services ($K7$);

– level of digitization of transport services: availability of new digital products and services ($K8$);

– availability of investments for the purchase of digital solutions ($K9$);

– level of development of technological partnership with suppliers of digital innovations ($K10$);

– availability of end-to-end information systems to support key business processes ($K11$).

The conducted survey of experts regarding the rank of each indicator, who assigned the latter ranks in the range from 1 to 11, allows to establish the importance of each individual indicator and calculate the general value of the level of digital maturity of railway transport enterprises.

Table 7.1 shows the results of the expert survey and the established values of the specific weight of each indicator.

To find out the specific weight of a partial indicator, let's use the formula:

$$S_{wK_i} = \frac{\sum A_{Ki}}{\sum \left(\overline{A} - \sum A_{Ki}\right)^2}, \tag{7.1}$$

where $\sum A_{Ki}$ – the sum of ranks assigned by experts to the j-th indicator; $\sum \left(\overline{A} - \sum A_{Ki}\right)^2$ – the total sum of ranks determined by experts for all partial indicators.

Let's determine the Kendall concordance coefficient, which will allow to establish the quality of the results of expert assessment and talk about the level of agreement of the opinions of the involved experts [15]:

$$W = \frac{S}{\frac{1}{12} \cdot m^2 \cdot (n^3 - n) - m \cdot \sum_{j=1}^{m} T_j}, \tag{7.2}$$

$$T_j = \sum_{k=1}^{H_j} (h_k^3 - h_k), \tag{7.3}$$

$$S = \sum_{t=1}^{n} \left(\sum_{j=1}^{m} r_{ij} - \overline{r} \right)^2, \tag{7.4}$$

$$\overline{r} = \frac{1}{n} \cdot \sum_{i=1}^{n} r_i, \tag{7.5}$$

where T_j – the indicator of connected (same) ranks in the j-th ranking; H_j – the number of groups of connected ranks in the j-th ranking; h_k – the number of connected ranks in the k-th group of connected ranks with the j-th expert; n – number of objects; m – number of experts; r_{ij} – the rank assigned by the j-th expert to the i-th object; $\overline{r}$ – the average rank.

To interpret the results of the calculation of the concordance coefficient, let's use a well-known rating scale, where the values of the concordance coefficient in the range of 0.4–0.5, at which the quality of the assessment is satisfactory, and in the range of 0.7–0.8 is high.

Table 7.2 presents data on the ranks of partial indicators provided by each of the involved experts.

Using the provided assessment, the concordance coefficient was calculated, which indicates a satisfactory level of consistency of experts' opinions, as it is 0.55 and, accordingly, indicates the importance of these partial indicators in the process of assessing the level of digital maturity of railway transport enterprises.

Table 7.1 Ranking of partial indicators for assessing the level of digital maturity of railway transport enterprises

Expert	Ranks by partial indicators										
	***K*1**	***K*2**	***K*3**	***K*4**	***K*5**	***K*6**	***K*7**	***K*8**	***K*9**	***K*10**	***K*11**
1	2	3	3	5	6	7	8	9	10	11	11
1	8	6	5	7	9	9	7	9	9	9	6
2	7	6	5	6	9	9	9	9	9	9	7
3	9	6	4	7	9	9	9	8	9	9	7
4	9	6	5	6	9	8	8	8	8	8	6
5	9	6	5	8	9	9	7	7	8	8	6
6	7	5	5	6	9	9	8	7	8	8	5
7	8	5	4	5	9	9	9	7	10	9	7
8	8	5	5	5	8	9	9	8	8	7	6
9	8	5	4	6	8	8	9	8	8	10	6
10	9	7	4	7	9	10	8	8	10	9	6
11	9	7	6	5	9	10	7	8	9	9	5
12	9	6	5	7	9	9	7	8	9	9	6
13	9	6	5	6	8	9	8	9	9	8	6
14	9	6	5	5	9	10	9	9	9	7	6
15	9	6	5	6	9	9	8	7	10	9	5
16	8	6	5	6	8	10	7	9	8	9	6
17	8	5	4	6	9	10	8	9	9	8	7
18	9	5	5	6	9	10	8	9	9	9	6
19	9	5	6	6	9	8	8	8	10	9	6
20	9	5	5	5	9	9	8	8	10	8	6
21	8	6	5	6	8	10	8	9	9	7	5
22	8	6	4	6	9	9	8	9	9	7	5
23	9	5	5	5	9	10	9	8	9	9	6
24	9	6	5	6	9	9	7	7	9	9	6
25	9	5	5	5	8	9	8	8	4	9	5
Sum of ranks $\sum A_{Ki}$	213	142	121	149	219	230	201	204	219	212	148
Average sum of ranks $\sum\left(\bar{A}-\sum A_{Ki}\right)^2$	187.09	232.27	232.27	232.27	232.27	232.27	232.27	232.27	232.27	232.27	232.27
Deviation from average sum of ranks	25.91	–90.27	–111.27	–83.27	–13.27	–2.27	–31.27	–28.27	–13.27	–20.27	–84.27
The square of the deviation $\sum\left(\bar{A}-\sum A_{Ki}\right)^2$	671	8149	12381	6934	176	5	978	799	176	411	7101
The specific gravity of the indicator S_{wK_i}	0.10	0.07	0.06	0.07	0.11	0.11	0.10	0.10	0.11	0.10	0.07

Table 7.2 Calculation of consistency of experts' assessments

Expert ratings (K)	Number of people (n)	The product of the variant by the frequency $\left(\sum K_i = nK\right)$	Average score $\left(\overline{K} = \frac{\sum K_s}{\sum n}\right)$	Deviation of options from the average $\left(K - \overline{K}\right)$	Squares of deviation $\left(K - \overline{K}\right)^2$	Product squared deviations per frequency $\left(K - \overline{K}\right)^2 \times n$	Mean square deviation $G = \sqrt{\frac{\sum\left(K - \overline{K}\right)^2 \times n}{\sum n}}$	K variation, % $K_v = \frac{G \times 100}{\overline{K}}$
1	2	3	4	5	6	7	8	9
***K*1**	4	4		–1.68	2.82	11.29		
1	8	16		–0.68	0.46	3.70		
2	7	21		0.32	0.10	0.72		
3	4	16		1.32	1.74	6.97		
4	2	10		2.32	5.38	10.76		
5	25	67	2.68			33.44	1.16	43.15
In total								
***K*2**	4	4		–1.32	1.74	6.97		
1	9	18		–0.32	0.10	0.92		
2	12	36		0.68	0.46	5.55		
3	0	0		1.68	2.82	0.00		
4		0		2.68	7.18	0.00		
5	25	58	2.32			13.44	0.73	31.60
In total								
***K*3**	4	4		–1.68	2.82	11.29		
1	4	8		–0.68	0.46	1.85		
2	13	39		0.32	0.10	1.33		
3	4	16		1.32	1.74	6.97		
4	0	0		2.32	5.38	0.00		
5	25	67	2.68			21.44	0.93	34.55
In total	4	4		–1.68	2.82	11.29		
***K*4**								
1	2	2		–1.36	1.85	3.70		
2	14	28		–0.36	0.13	1.81		
3	7	21		0.64	0.41	2.87		
4	2	8		1.64	2.69	5.38		
5	0	0		2.64	6.97	0.00		
In total	25	59	2.36			13.76	0.74	31.44

● **Continuation of Table 7.2**

1	2	3	4	5	6	7	8	9
***K*5**								
1	3	3		–1.68	2.82	8.47		
2	6	12		–0.68	0.46	2.77		
3	12	36		0.32	0.10	1.23		
4	4	16		1.32	1.74	6.97		
5	0	0		2.32	5.38	0.00		
In total	25	67	2.68			19.44	0.88	32.90
***K*6**								
1	2	2		–1.64	2.69	5.38		
2	8	16		–0.64	0.41	3.28		
3	13	39		0.36	0.13	1.68		
4	1	4		1.36	1.85	1.85		
5	1	5		2.36	5.57	5.57		
In total	25	66	2.64			17.76	0.84	31.93
***K*7**								
1	7	7		–1.28	1.64	11.47		
2	9	18		–0.28	0.08	0.71		
3	5	15		0.72	0.52	2.59		
4	3	12		1.72	2.96	8.88		
5	1	5		2.72	7.40	7.40		
In total	25	57	2.28			31.04	1.11	48.87
***K*8**								
1	5	5		–1.68	2.82	14.11		
2	6	12		–0.68	0.46	2.77		
3	7	21		0.32	0.10	0.72		
4	6	24		1.32	1.74	10.45		
5	1	5		2.32	5.38	5.38		
In total	25	67	2.68			33.44	1.16	43.15
***K*9**								
1	0	0		–1.64	2.69	0.00		
2	15	30		–0.64	0.41	6.14		
3	4	12		0.36	0.13	0.52		
4	6	24		1.36	1.85	11.10		
5	0	0		2.36	5.57	0.00		
In total	25	66	2.64			17.76	0.84	31.93

Continuation of Table 7.2

1	2	3	4	5	6	7	8	9
***K*10**								
1	4	4		–1.68	2.82	11.29		
2	7	14		–0.68	0.46	3.24		
3	8	24		0.32	0.10	0.82		
4	5	20		1.32	1.74	8.71		
5	1	5		2.32	5.38	5.38		
In total	25	67	2.68			29.44	1.09	40.49
***K*11**								
1	7	7		–1.32	1.74	12,20		
2	7	14		–0.32	0.10	0.72		
3	8	24		0.68	0.46	3.70		
4	2	8		1.68	2.82	5.64		
5	1	5		2.68	7.18	7.18		
In total	25	58	2.32			29.44	1.09	46.77

In order to say whether the level of digital maturity of railway transport enterprises is acceptable or not, a scale of interpretation of the values of the generalizing indicator has been developed, which provides for the following gradation: the level of digital maturity will be considered high for assessments of 5 points, sufficient – for assessments of 4 points, satisfactory – 3 points, unsatisfactory – 2 points, and critical – 1 point.

Table 7.2 shows the results of the calculation of the level of agreement of experts' opinions, which allow to speak about the homogeneity of this population, because the value of the coefficient of options for each indicator is within the norm, that is, no more than 33 %. Based on the importance of the partial indicators and the results of the point assessment, let's establish the level of digital maturity of railway transport enterprises based on a defined system of partial indicators that reflect the level of ability and readiness of the enterprises of the industry to implement digital transformations, by calculating the appropriate generalizing indicator:

$$DM_{RTE} = \sum DM_{RTE_{Ki}} \cdot E_{vK_i}, \tag{7.6}$$

where DM_{RTE} – a general indicator of the level of digital maturity of railway transport enterprises; $DM_{RTE_{Ki}}$ – the level of digital maturity for each partial indicator through the comparison of the maximum possible and actual values;

$$DM_{RTE_{Ki}} = \frac{\sum K_i}{\overline{A}}. \tag{7.7}$$

The calculation of the general indicator of the level of digital maturity of railway transport enterprises, which is given in **Table 7.3**, allows to assert the digital immaturity of railway transport enterprises, that is, their unwillingness to implement digital transformations.

Table 7.3 Determination of the level of digital maturity of railway transport enterprises

Indicator	Specific weight, %	Average sum of ranks	Actual value of the characteristics and	Assessment of the level of digital maturity by each indicator	General indicator of the level of digital maturity of RTE
Having a clearly defined digital transformation strategy (*K*1)	10	187.09	67	0.36	**0.32**
Level of implementation of new business processes (*K*2)	7	187.09	58	0.31	
Availability of a change management system (*K*3)	6	187.09	67	0.36	
Availability of an internal communications system that ensures clear communication of digitalization goals to employees (*K*4)	7	187.09	59	0.32	
Availability of a personnel motivation system that guides employees to support digital transformations (*K*5)	11	187.09	67	0.36	
Availability of a corporate training system that adapts to the strategic goals of digitization (*K*6)	11	187.09	66	0.35	
Availability of direct communication channels with consumers of transport and logistics services (*K*7)	10	187.09	7	0.04	
Level of digitization of transport services: availability of new digital products and services (*K*8)	10	187.09	67	0.36	
Availability of investments for the purchase of digital solutions (*K*9)	11	187.09	66	0.35	
Level of development of technological partnership with suppliers of digital innovations (*K*10)	10	187.09	67	0.36	
Availability of end-to-end information systems to support key business processes (*K*11)	7	187.09	58	0.31	

To interpret the values of the general indicator of the level of digital maturity of railway transport enterprises, let's use the following scale:

– 0.2–0.39 – critical – the level of digital maturity does not correspond to the trends of digitalization of railway transport, it is necessary to take measures to ensure the digital development of enterprises in the industry;

– 0.4–0.59 – unsatisfactory – the level of digital maturity in most parameters does not correspond to the trends of digitalization of railway transport;

– 0.6–0.69 – average – the level of digital maturity does not fully correspond to the trends of digitalization of railway transport;

– 0.7–1 – high level – railway transport enterprises have a sufficient level of digital maturity to ensure their own digital development.

Unwillingness to implement digital technologies is indicated by low values for such assessment parameters as the presence of direct communication channels with consumers of transport and logistics services, the presence of end-to-end information systems to support key business processes, the level of implementation of new business processes, the presence of an internal communications system that ensures clearly communicating the goals of digitization to employees. It is worth noting that all parameters for assessing the level of digital maturity of railway transport enterprises are at a critical level, since they do not exceed the value of 0.36 (**Fig. 7.2**), which means that in order to achieve success in digital reforms, it is necessary to form an effective digital transformation strategy, which would determine the goals, tasks and tools for ensuring the digital development of enterprises in the railway industry.

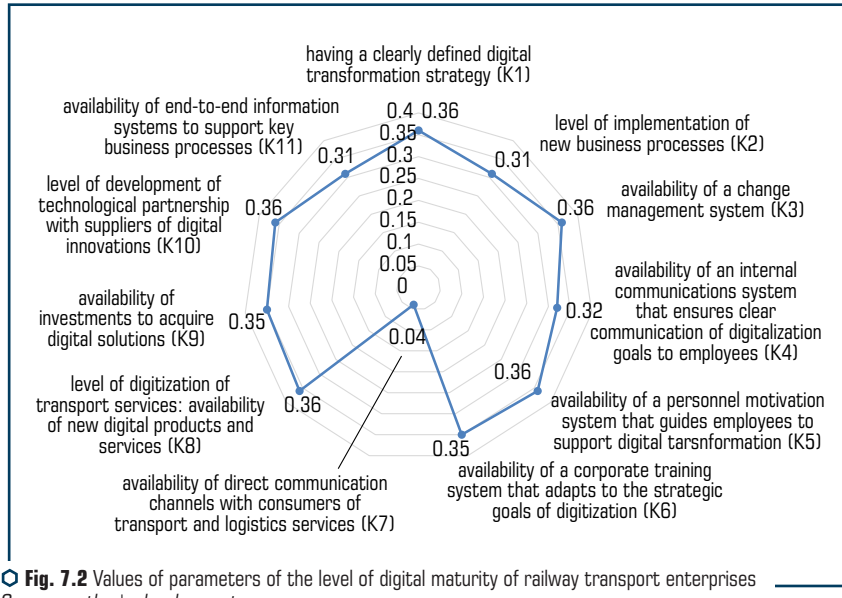

Fig. 7.2 Values of parameters of the level of digital maturity of railway transport enterprises
Source: author's development

So, wit is possible to say that despite the targeted orientation of the Industry Development Strategy on the implementation of digital transformations, currently the measures of railway

transport enterprises in this direction are limited to the implementation of individual software products aimed at expanding the online platform of consumer service.

Unfortunately, the slowdown in the processes of digital transformation of the industry is due to the action of a number of negative factors taking place in the environment of railway transport enterprises.

Firstly, the lack of clearly established standards for the use of digital technologies in railway transport and the presence of numerous legislative gaps in the field of intellectual property rights are holding back the process of digital transformation. The lack of a clearly defined strategy for their digital transformation does not contribute to the acceleration of digital changes at the enterprises of the industry [15, 16].

Secondly, the political and economic situation in the country does not contribute to the implementation of digital changes in the industry. Protracted military actions for the sovereignty of our state and a difficult economic situation as a result of the destruction and shutdown of a significant number of industrial productions do not allow the Government to financially support projects of digital transformation of railway transport enterprises [17].

Thirdly, due to the significant cost of projects of digital transformation of railway transport enterprises and the high risk of their failure in wartime conditions, investors are not interested in allocating funds for the implementation of digital technologies at railway transport enterprises.

Fourthly, significant resistance of employees to changes in the traditional forms of fulfilling their obligations remains. The low level of awareness of employees and a misunderstanding of the content of digital transformation complicate the implementation of digital technologies at enterprises of the industry, etc. [18].

Taking into account the above, in order to level the impact and accelerate the implementation of digital changes at railway transport enterprises, there is a need to develop a strategy for their digital transformation, which would reflect the goals, key directions and tools for the implementation of digital transformations in the industry.

7.3 DISCUSSION OF THE RESULTS OF THE DEVELOPMENT PRIORITIES OF RAILWAY TRANSPORT ENTERPRISES IN THE CONTEXT OF ENSURING THEIR DIGITAL TRANSFORMATION

To achieve the targets of the digital transformation of railway transport enterprises, it is necessary to comprehensively implement digital innovations and implement projects in the areas of digital security and management of transport and logistics services, digital production and service, digital services and effective communications, digital HR [19].

The key provisions of the strategy of digital transformation of railway transport enterprises are presented in **Fig. 7.3**.

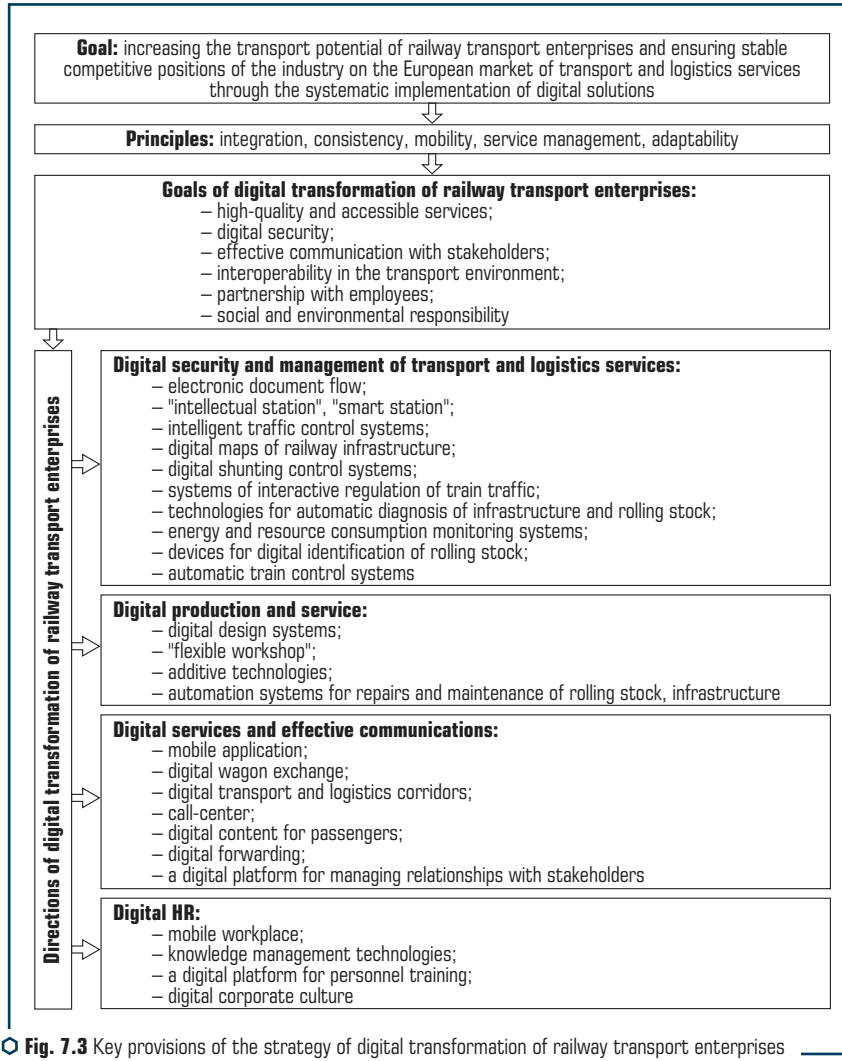

Fig. 7.3 Key provisions of the strategy of digital transformation of railway transport enterprises
Source: development of the authors

To achieve digital security and management of transport and logistics services, it is necessary to:

– implement electronic document flow, ensure the creation of an "intelligent station", "smart stations", implement intelligent traffic management systems, digital maps of the railway infrastructure, digital shunting management systems, systems for interactive regulation of train traffic, technologies

for automatic diagnosis of the state of infrastructure and rolling stock, energy and resource consumption monitoring systems, devices for digital identification of rolling stock, as well as automatic train control systems, etc.;

– it is possible and necessary to form digital production and provide digital service by implementing a digital design system, additive technologies, a system for automating repairs and maintenance of rolling stock, infrastructure, as well as a "flexible shop" system. Implementing digital services and maintaining effective communications with stakeholders is possible through use mobile applications, the creation of a digital wagon exchange, digital transport and logistics corridors, the expansion of all-center capabilities, the introduction of digital content for passengers, digital forwarding services, as well as the creation of a digital platform for managing communications with stakeholders;

– increase the loyalty of employees and improve communications with them, it is necessary to implement digital HR tools, namely to ensure the creation of mobile workplaces, a digital platform for personnel training, digital corporate culture, as well as knowledge management technology, etc. [20].

It is worth noting that the implementation of the digital transformation strategy of railway transport enterprises is impossible without a decision-making support system, which will be the subject of the next Chapter 8.

REFERENCES

1. Gudz, O. (2018). Digital economy: changing values and guidelinesenterprise management. Ekonomika. Menedzhment. Biznes, 2, 4–12.
2. Obruch, A. (2020). Digitalization as a key megatrend for transforming the global economic environment. Odessa National University Herald. Economy, 25 (1 (80)), 163–170. doi: https://doi.org/10.32782/2304-0920/1-80-28
3. 5 rokiv Industrii 4.0 – de Ukraina? (2019). Available at: https://investgazeta.ua/blogs/5-rokiv-industriji-4-0-de-ukrajina Last accessed: 03.11.2022
4. Derhachova, H. M., Koleshnia, Ya. O. (2020). Digital business transformation: essence, signs, requirements and technologies. Economic Bulletin of National Technical University of Ukraine "Kyiv Polytechnical Institute", 17, 280–290. doi: https://doi.org/10.20535/2307-5651.17.2020.216367
5. Savchuk, S. V. (2020). Shchodo pytannia otsinky tsyfrovoi zrilosti pidpryiemstva v umovakh tsyfrovoi transformatsii. Naukovyi visnyk IFNTUNH. Seriia: Ekonomika ta upravlinnia v naftovii i hazovii promyslovosti, 1 (21), 78–85.
6. Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions (2020). Digital agenda for Europe 2020. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245R(01)&from=EN Last accessed: 21.10.2022
7. Skitsko, V. I. (2016). Industry 4.0 as industrial production of the future. Investytsii: praktyka ta dosvid, 5, 33–40.

8. Dykan, V. L., Tokmakova, I. V., Ovchynnikova, V. O. et al. (2022). Ekonomichna diahnostyka. Kharkiv: UkrDUZT, 284.
9. Kraus, N. M., Holoborodko, O. P., Kraus, K. M. (2018). Digital economy: trends and perspectives of the abangard change of development. Efektyvna ekonomika, 1. Available at: http://www.economy.nayka.com.ua/pdf/1_2018/8.pdf Last accessed: 18.11.2022
10. Veretyuk, S. M., Pilinsky, V. V. (2016). Determination of the priority directions for digital economy's developmentin Ukraine. Naukovi zapysky Ukrainskoho naukovo-doslidnoho instytutu zv'iazku, 2, 51–58.
11. Strutynska, I., Dmytrotsa, L., Kozbur, H. (2019). Methodology of determination of digital maturity level of business structures by clustering method. Entrepreneurship and Innovation, 10, 188–194. doi: https://doi.org/10.37320/2415-3583/10.29
12. Shatilova, O. V., Shyshuk, N. O. (2020). Digital Tools of a Business Organization Innovative Development. The problems of economy, 4 (46), 249–255. doi: https://doi.org/10.32983/2222-0712-2020-4-249-255
13. Klochkova, E., Sadovnikova, N., Darda, E., Samotsvetova, A. (2018). Digital Transformation in the Energy Industry: Trends and Prospects. Perspectives on the Use of New Information and Communication Technology (ICT) in the Modern Economy, 726, 288–299. doi: https://doi.org/10.1007/978-3-319-90835-9_34
14. Gorodenko, Л. М. (2012). Digital & Information Divides in the Network Communication. Інформаційне суспільство, 16, 56–59.
15. Shchehliuk, S. D. (2019). Morfolohiia tsyfrovoi ekonomiky: osoblyvosti rozvytku ta rehuliuvannia tsyfrovykh tekhnolohichnykh platform. Lviv: DU "Instytut rehionalnykh doslidzhen im. M. I. Dolishnoho NAN Ukrainy", 18.
16. Dorozhnia karta tsyfrovoi transformatsii zaliznytsi. Versiia APPAU. Available at: https://railexpoua.com/novyny/dorozhnya-karta/ Last accessed: 18.11.2022
17. Yelahin, Yu. V., Hlushchenko, Yu. V., Tsapko, L. V. (2018). State and replenishment of the rolling stock in conditions of ukrzaliznytsia reform. The bulletin of transport and industry economics, 64, 209–216.
18. Hryhorenko, Yu. (2022). Velyki plany: na shcho pidut investytsii "Ukrzaliznytsi" u 2022 rotsi. Available at: https://gmk.center/ua/posts/velyki-plany-na-shcho-pidut-investytsii-ukrzaliznytsi-u-2022-rotsi/ Last accessed: 22.11.2022
19. Korin, M. V., Lanovyi, O. A., Poddubkin, M. M., Zaitseva, L. D. (2022). Development of the digital transformation strategy of railway transport enterprises. Visnyk ekonomiky transportu i promyslovosti, 78-79, 36–45.
20. Pro zvit Tymchasovoi slidchoi komisii Verkhovnoi Rady Ukrainy z pytan perevirky ta otsinky stanu aktsionernoho tovarystva "Ukrainska zaliznytsia" (2022). Postanova Verkhovnoi Rady Ukrainy No. 2055-IX. 16.02.2022. Available at: https://zakon.rada.gov.ua/laws/show/2055-20#Text Last accessed: 11.11.2022