

# CONCEPTUAL PROVISIONS FOR ENSURING BALANCED DEVELOPMENT OF RAILWAY TRANSPORT ENTERPRISES UNDER THE CONDITIONS OF IMPLEMENTATION OF DIGITAL CHANGES IN THE INDUSTRY

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## ABSTRACT

Today, the world is experiencing an era of radical changes caused by the rapid introduction of digital technologies into all types of economic and social activities. Digital technologies change not only individual sectors of the economy, but also transform the entire system of global economic relations, creating enormous opportunities for sustainable business development and increasing the competitiveness of countries. The technologies of big data, machine learning, virtual and augmented reality, and robotics shape the leadership potential of national economies in the global system of highly effective digital communications and determine their future place on the geo-economic map of the world. Aware of the importance of digital technologies for the development of new horizons of activity in sectors strategic for the economy and ensuring their inclusive development, already today the leading states are implementing a large-scale policy of digital transformation of the country, focused on restructuring business processes, competencies and models of operation of industry, transport, trade, system public administration and education.

As mentioned in the previous sections of this monograph, the key driver for the digital transformation of Ukraine's economy is the process of digitalization of infrastructure industries and, above all, domestic railway transport, the activity of which creates a multiplier effect, which is manifested in the ability not only to satisfy the needs of business entities in transportation, but also to stimulate the growth of economic activity in related industries by forming demand for products of metallurgy, instrument and wagon building, chemical and fuel and energy complexes.

## KEYWORDS

Digitalization, railway transport, modernization of services, business model, potential of railway transport enterprises.

### 9.1 THE NEED FOR DIGITIZATION AS A CHALLENGE TODAY

The urgency of the need for a digital restructuring of the business model of the functioning of Ukrainian railways is actualized in connection with the need to implement the Association Agreement between Ukraine and the EU, the provisions of which define the requirements for the transformation of the railway transport system in order to implement the European integration course of the country and include railway transport in the system of trans of European communications.

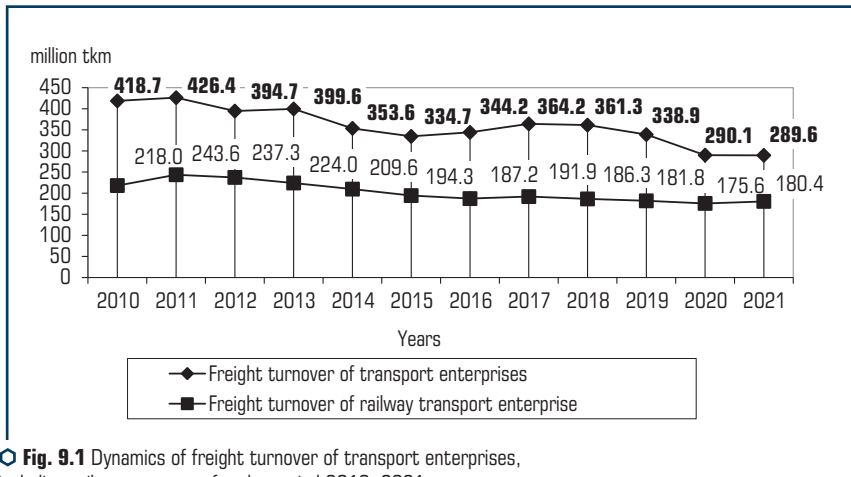
Along with this, the pressing problems of the functioning of domestic railway transport, the current system of management of the industry and the business model of the development of railway transport do not allow to take full advantage of the advantages of digitalization and ensure digital transformation and modernization of business processes of the enterprises of the industry. Currently, the enterprises of the industry face the need to solve a number of challenges associated with a high level of wear and tear of rolling stock and railway infrastructure and, as a result, a shortage of rolling stock and limited use of the infrastructure potential of the railway, a decrease in the turnover of the wagon fleet, customer dissatisfaction with the company's tariff policy and the quality of services railway transport, corruption violations in the company and strengthening of its financial obligations to international financial institutions. In the presence of a number of unresolved problems and imbalances, it is extremely difficult to ensure the implementation of innovative projects for the development of railway transport, in particular, aimed at the digital transformation of business processes and the business model of railway transport in general. In this regard, the formation of a conceptual basis for ensuring the balanced development of railway transport enterprises and the development of tools for its achievement, which will allow to level the imbalances of their activities and realize the potential of the enterprises of the industry in the direction of their digitalization, is of great importance.

The scientific work of a wide range of scientists is dedicated to the study of the processes of ensuring the sustainable development of enterprises, in particular, railway transport, and to the determination of the features of the implementation of digital changes. However, today, taking into account the acceleration of the processes of development of the global digital transport and logistics space and the inability of railway transport enterprises in the conditions of the growing systemic crisis in the industry to ensure the implementation of qualitative digital changes, the formation of conceptual provisions for ensuring the balanced development of railway transport enterprises as a basis for the digital modernization of activities is of great importance enterprises of the railway industry.

The state and development trends of railway transport enterprises in recent years indicate a critical reduction of their economic potential and a gradual loss of technical ability to fully satisfy the demands of consumers for transport services. The implementation of radical organizational and structural changes in the railway transport management system and the gradual liberalization of the railway transport market took place in the conditions of deepening interstate conflicts, the complication of the political and economic situation, the introduction of epidemiological restrictions in connection with the spread of the pandemic and the reduction of the volume of work of enterprises, which led to the exacerbation competition in the market of transport services and the reduction of the share of JSC "Ukrzaliznytsia" in the transport market of Ukraine. Therefore, the share of the railway company in the freight transport market decreased from 57.3 % in 2010 to 50.7 % in 2021 (the highest value was recorded in 2014, when the share of railway transport reached 62.0 %). As evidenced by the data for 2021, despite the increase in the volume of freight transportation by railway transport by 2.9 % compared to the previous year, the increase in the volume of work of other types of transport took place at a faster pace. In particular, the rate of

increase in the volume of freight transportation by road transport amounted to 16.2 %, i.e. 13.3 % more than the rate of increase in the volume of freight work of railway transport.

Freight turnover of railway transport enterprises decreased by 17.2 % from 218.0 billion tkm in 2010 to 180.4 billion tkm in 2021 (**Fig. 9.1**). To a large extent, this situation is caused by the spread of the coronavirus pandemic in the world, social isolation and the narrowing of production and transport links between countries.



**Fig. 9.1** Dynamics of freight turnover of transport enterprises, including railway transport for the period 2010–2021  
Source: built on the basis of these works [1, 2]

Analyzing the volume performance indicators of the railway industry enterprises for previous years, it can be concluded that the volume of freight transportation for 2010-2021 decreased from 432.5 to 314.3 million tons, respectively, that is, by 27.3 %. In particular, in 2021, railway transport enterprises transported 149.8 million tons of cargo in domestic traffic, 112.4 million tons for export, 40.6 million tons for import, and 11.5 million tons for transit. The following types of cargo accounted for the largest share in the structure of railway transport cargo: iron and manganese ore – 24.7 %, construction materials – 20.9 %, hard coal – 16.0 %, and grain and their grinding products – 10.7 % (33.6 million tons) [3]. In turn, during January-August 2022, JSC "Ukrzaliznytsia" transported 106.1 million tons of cargo, which is 95.6 million tons less compared to the same period in 2021 [4]. In September 2022, 11.7 million tons of cargo were transported, which is 8.4 % more than the figure for August 2022 [5]. at the same time, about 30 % is the transportation of grain cargoes and products of their grinding, the volume of which was 3.4 million tons in September, and 1.916 million tons in 19 days of October [6].

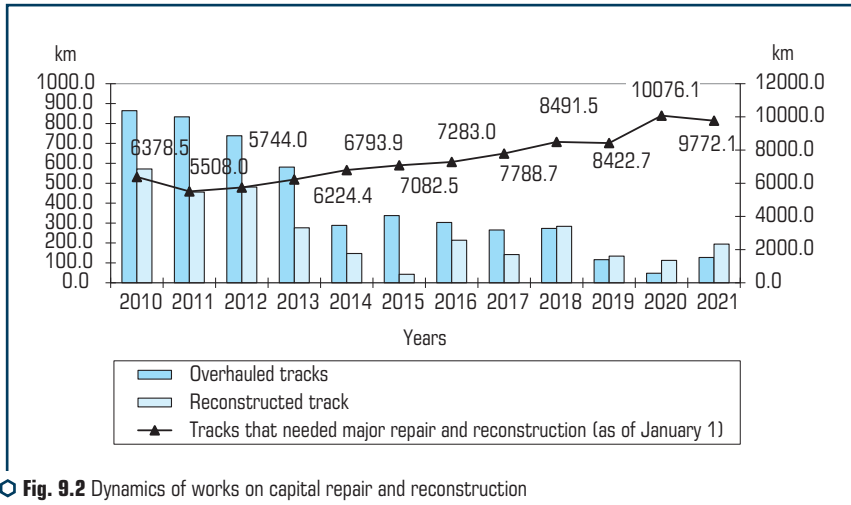
The presence of a number of system problems that have not been solved for many years complicates the work. Among them: high physical and moral wear and tear of rolling stock, railway

infrastructure objects, production and repair base, loss of transit potential, decrease in innovation and investment activity, imperfect personnel policy, decrease in customer loyalty and their reorientation to services of other types of transport. In particular, the wear and tear of locomotives today is estimated at 98.3 % (thermal locomotives) and 94.4 % (electric locomotives). Taking into account the technical unsuitability of most units of traction rolling stock for the full and timely performance of transportation volumes and the growing threat of stopping railway transport, the Government in August 2021 presented the Concept of working with the locomotive fleet of JSC "Ukrzaliznytsia" until 2033, which determined the need for 2,347 units of traction rolling stock (currently 2,088) by the specified period to fully ensure the growing volumes of transportation. In particular, we are talking about the need for 120 double-powered electric freight locomotives, 490 alternating current and 352 direct current. The number of shunting diesel locomotives in 2033 is predicted at the level of 850 units. As for the required amount of financial resources for the renewal and modernization of the fleet of traction rolling stock, in 2021 the need was estimated at 3.2 billion UAH, in 2022 – 4.7 billion UAH (taking into account the purchase of the first 5 new dual-powered electric locomotives), in 2023 – 6.7 billion UAH. In total, by 2033, 86.7 billion UAH will be needed for the maintenance and development of the locomotive fleet, of which more than 50 % is for the purchase of new machines [7]. However, given the events of recent months, the implementation of the planned plans is in jeopardy.

As of the end of 2021, 6,883.4 km of main tracks required major repairs, and 2,888.7 km required reconstruction of the railway track. For example, in 2021, only 78.5 km of main and 48.8 km of station and special tracks were rehabilitated, the level of track reconstruction was 194.3 km (**Fig. 9.2**) [8]. The trend of increasing the amount of overdue capital repair and reconstruction of the railway track has been maintained for many years, which is due to the reduction of the amount of modernization, capital repair and reconstruction of railway tracks.

The wagon park is no less worn out. So, if in 2010 the number of freight cars reached 120.6 thousand units, then as of June 2021 there was a significant decrease in them by 13.0 % to 104.9 thousand units, of which the working fleet is 46.3 % (48.5 thousand units), and non-working – 51.1 % (56.3 thousand units). Therefore, today the level of wear and tear of freight cars is a total of 92.72 %, in particular, the highest level of wear and tear is characteristic of such types of rolling stock as mineral carriers – 99.99 %, cement carriers – 97.28 %, grain carriers – 96.68 %, rolling stock carriers – 94.16 %, covered wagons – 93.05 %. The wear and tear of passenger cars is currently 92.8 %. In 1992–2021, about 700 units were purchased, and many times more were written off – more than 5 thousand units. At the same time as the reduction of the technical, innovative-technological and investment resources of railway transport enterprises, there is a loss of personnel potential in the railway industry, which is gradually losing highly qualified specialists who have significant practical experience and are capable of implementing quality reformation transformations in this area. In recent years, an alarming trend of a decrease in the number of employees has been recorded: in general, for the period 2010–2020, the average number of employees in the main activity has halved from 343.2 thousand people in 2010

to 174.2 thousand people in 2020. During 2021 the number of employees of the railway company decreased by 11 thousand people [11, 12].



**Fig. 9.2** Dynamics of works on capital repair and reconstruction of tracks for the period 2010–2021

Source: built on the basis of these works [9, 10]

So, summarizing the above, it is necessary to state the imbalance of the management system of the industry and the increased vulnerability of railway transport enterprises to the challenges of the environment of their operation. Therefore, the deepening of the internal problems of the development of railway transport enterprises not only limits their potential to implement digital changes in the industry, but also increases the inconsistency of the development trends of domestic railway transport enterprises with the world standards of the growth of the railway industry. The latter is reflected in the growth of imbalances in the functioning of railway transport enterprises of Ukraine in the areas of service development, innovation and investment activities, and the development of personnel competencies. The systematization of imbalances in the development of railway transport enterprises in the conditions of the transformation of world growth trends is presented in **Fig. 9.3**.

Taking into account the complexity of the problems of the development of railway transport enterprises and, in general, the imbalance and inconsistency of the current industry management system with the global growth trends of railway companies, it is expedient to use the potential of digital transformation and modernization of railway transport enterprises as a basis for ensuring their balanced growth requires an assessment of the current state of coherence between the goals of the development of enterprises in the industry and the tools for their practical implementation. In view of this, the development of a methodical basis for assessing the balanced development of railway transport enterprises is of great importance.

# INNOVATIVE DEVELOPMENT OF THE ROAD AND TRANSPORT COMPLEX: PROBLEMS AND PROSPECTS

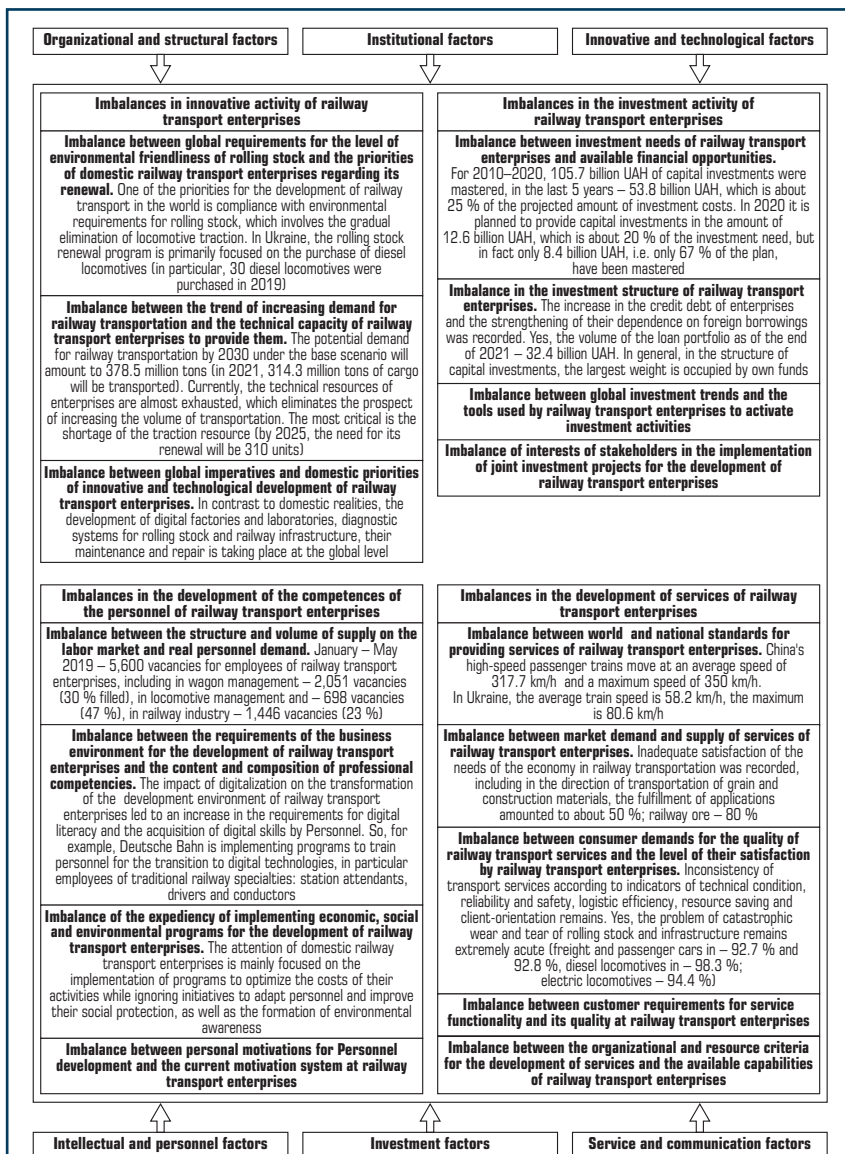
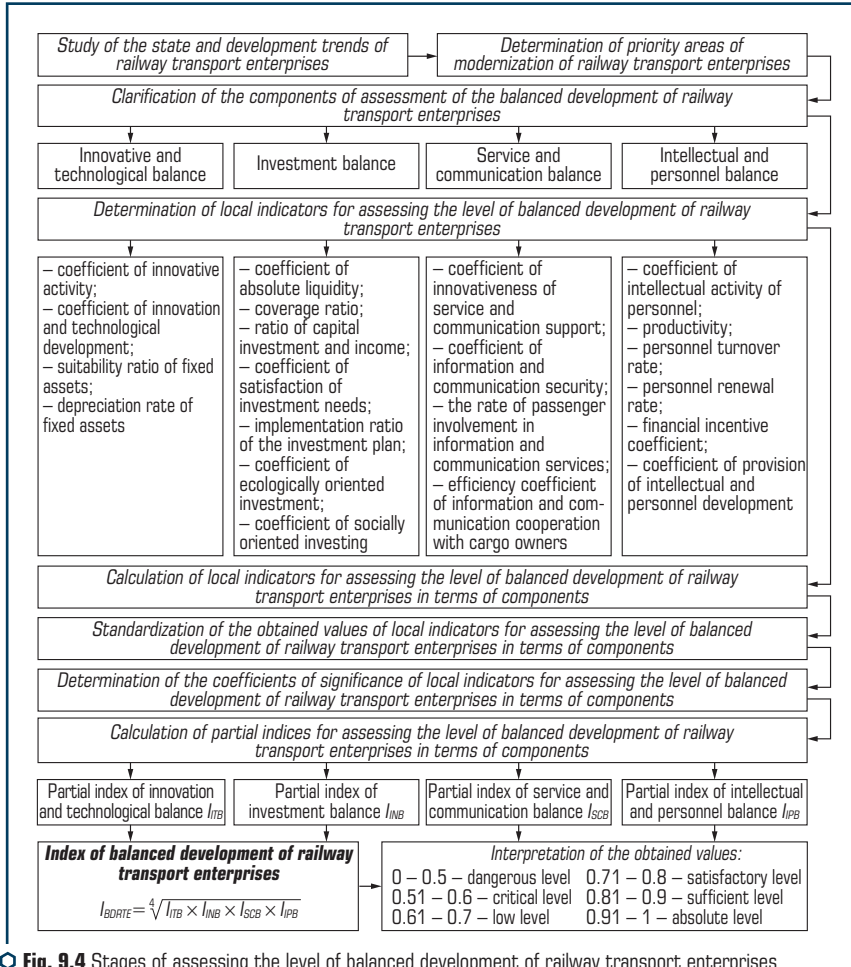


Fig. 9.3 Systematization of imbalances in the development of railway transport enterprises in the conditions of transformation of global trends in the growth of the railway industry  
Source: author's development

## 9.2 DIGITAL TRANSFORMATION AS A BASIS FOR ENSURING BALANCED GROWTH

Given the fact that the effectiveness of the implementation of digital changes in the industry primarily depends on the level of investment security and innovative and technological development of railway transport enterprises, their intellectual and personnel competence and service and communication maturity, it is advisable to conduct an assessment of the balanced development of the enterprises of the industry in terms of these components (**Fig. 9.4**).



**Fig. 9.4** Stages of assessing the level of balanced development of railway transport enterprises  
Source: author's development

Standardization of the obtained values of local indicators for assessing the level of balanced development of railway transport enterprises should be carried out on the basis of assigning the indicators to stimulators or destimulators. Based on the standardization of the obtained values of local indicators and the determination of their significance coefficients, the calculation of partial indices for assessing the level of balance in the development of railway transport enterprises is carried out in terms of the components of innovation-technological (IITB), investment (IINB), intellectual-personnel (IIPB) and service-communication (ICSB) balance. On the basis of the obtained values, the balance index of the development of railway transport enterprises is calculated as the geometric mean partial indicators of the assessment of innovation-technological, investment, service-communication and intellectual-personnel balance. The results of the calculations are given in **Table 9.1**.

● **Table 9.1** Results of the calculation of partial indices for assessing the level of balanced development of railway transport enterprises for the period 2017–2021

| Indicator                                                             | Value by years |               |               |               |               |
|-----------------------------------------------------------------------|----------------|---------------|---------------|---------------|---------------|
|                                                                       | 2017           | 2018          | 2019          | 2020          | 2021          |
| Partial index of innovation and technological balance                 | 0.7296         | 0.6215        | 0.6165        | 0.5510        | 0.4610        |
| Partial index of investment balance                                   | 0.6722         | 0.7245        | 0.9472        | 0.6723        | 0.4665        |
| Partial index of service and communication balance                    | 0.8830         | 0.8309        | 0.7461        | 0.8570        | 0.8244        |
| Partial index of intellectual and personnel balance                   | 0.8393         | 0.7469        | 0.8921        | 0.6991        | 0.6200        |
| <i>Index of balanced development of railway transport enterprises</i> | <i>0.7765</i>  | <i>0.7271</i> | <i>0.7896</i> | <i>0.6863</i> | <i>0.5758</i> |

Thus, based on the assessment results, the following values of the comprehensive index of the balanced development of railway transport enterprises for the period 2017–2021 were obtained: in 2017, the balanced index of the development of the industry enterprises is 0.7765, in 2018 – 0.7271, in 2019 – 0.7896, in 2020 – 0.6863, in 2021 – 0.5758. Taking into account the fact that a characteristic feature of the modern stage is the provision of balanced growth of business entities due to the achievement of multifactorial consistency of economic, ecological and social goals within both the traditional and virtual environment, for the interpretation of the obtained values of the index of balanced development of railway transport enterprises, it is appropriate the following rating scale is used:

- from 0 to 0.5 – a dangerous level of balance in the development of railway transport enterprises, which reflects the complete imbalance of their management system and indicates the lack of own opportunities to implement qualitative transformations both within the limits of the real and virtual environment of the enterprises of the industry;
- from 0.51 to 0.6 – a critical level of balance in the development of railway transport enterprises, which indicates the disharmony of their growth goals and the insufficient level of resource provision of enterprises in the industry for the implementation of planned digital changes in their activities;
- from 0.61 to 0.7 – a low level of balanced development of railway transport enterprises, which indicates their focus on preserving existing positions and overcoming ripe problems due to the situational implementation of traditional digital solutions by enterprises of the industry;

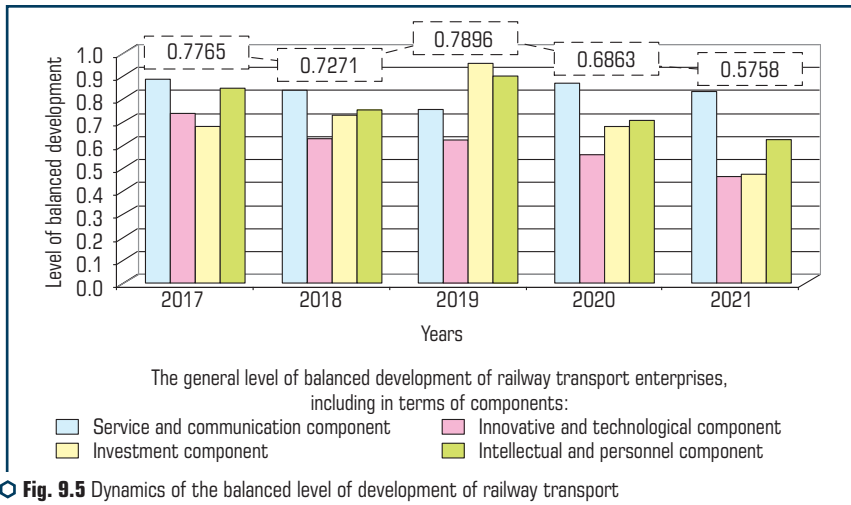


– from 0.71 to 0.8 – a satisfactory level of balanced development of railway transport enterprises, which indicates a sufficient level of resource provision of the enterprises of the industry for the implementation of the priority goals of their growth and the implementation of local solutions in key areas of activity;

– from 0.81 to 0.9 – a sufficient level of balanced development of railway transport enterprises, which indicates the presence of sufficient potential for the gradual realization of the economic, social and environmental goals of their growth based on the fragmented implementation of both local and complex digital solutions at the enterprises of the industry;

– from 0.91 to 1 – an absolute level of balanced development of railway transport enterprises, which indicates full consistency of goals and high efficiency of the tools of digital transformation and modernization of enterprises of the industry, including in terms of innovation and technology, investment, service and communication and intellectual – personnel components, in accordance with global trends of technological modernization of railway transport.

Based on the results of the assessment of the level of balanced development of railway transport enterprises and the peculiarities of their interpretation, it should be pointed out the gradual loss of stabilization capabilities of the enterprises of the industry and the limitation of the available opportunities to ensure their digital transformation and modernization. According to **Fig. 9.5**, in 2017–2019, domestic railway transport enterprises have a satisfactory state of balance, and in 2020–2021 – a correspondingly low and critical level, which is caused by the deterioration of their service-communication, innovation-technological, investment, and intellectual-personnel capabilities to ensure sustainable development.



**Fig. 9.5** Dynamics of the balanced level of development of railway transport enterprises in the conditions of digital modernization of the railway industry  
Source: author's development

All this indicates the uncertainty of the goals and tools of digital modernization of services, investment and innovation processes and personnel competencies and indicates the expediency of the comprehensive application of the latest digital solutions in the field of railway transport as a basis for ensuring the balanced growth of enterprises in the industry.

Taking into account the established theoretical provisions for ensuring the balanced growth of railway transport enterprises and taking into account the obtained results of assessing the level of balance of their development, it should be noted the feasibility of developing an effective toolkit for ensuring the balanced growth of enterprises of the industry based on the formation of a corresponding concept and a system of scenarios for its practical implementation. The latter actualizes the need to research existing approaches to the formation of this kind of concept.

### 9.3 FORMATION OF THE CONCEPT AND SYSTEM OF SCENARIOS

As world experience shows, digital technologies are currently considered as an effective tool for achieving both economic, social and environmental goals of railway transport development. Today, the most large-scale infrastructure projects are the development of transport and logistics infrastructure equipped with digital technologies. Digitalized high-speed lines, transport corridors and transport and logistics hubs are being developed at an accelerated pace. Therefore, the world's first automated high-speed railway connecting Beijing and the city of Zhangjiakou has already been put into operation. Thanks to the use of rolling stock equipped with 5G mobile communication, wireless charging devices and "smart" lighting, which reaches a maximum speed of 350 km/h, it was possible to reduce the travel time from more than 3 hours to 47 minutes. In addition, work is underway in Beijing on the construction of underground transport and logistics hubs, which will create opportunities for passengers to transfer between subway trains and railways. Railway companies also implement a number of social projects aimed at improving the professional qualities of employees and activating their intellectual abilities, attracting and adapting new employees, ensuring social security of employees. So, for example, Deutsche Bahn (Germany) hired about 24,000 new employees, including drivers, conductors, electronics and information technology specialists. In particular, a new recruiting department was created in the concern, which is engaged in the search and hiring of specialists outside of Germany, in particular in Spain, Italy, Greece, North Macedonia, Serbia and Romania. For 2020, Deutsche Bahn plans to invest about 500 million euros in employee training. At the same time, great attention is paid to the creation of training programs for training personnel for the transition to digital technologies. Such programs were created for traditional railway specialties: station attendants, drivers and conductors.

Projects of modernization of railway transport, developed taking into account the ecological goals of its development, are of interest. So, in 2018, the Coradia train was launched in Germany iLint on hydrogen fuel cells, during the movement of which emissions into the environment are made only in the form of water and steam. The first two hydrogen-powered trains have been operating in Lower Saxony since September 2018. The local transport administration LNVG plans to organize the

movement of 14 such trains from 2021. Also in Germany, the Transport Association of the Rhine-Main Region RMV ordered 27 Coradia trains from Alstom iLint, which will allow to have the world's largest fleet of rolling stock on hydrogen fuel. Other countries are gradually joining the implementation of this initiative. In particular, tests of the Coradia train are planned in the Netherlands iLint in the first quarter of 2020 with the aim of further replacing diesel trains on non-electrified lines with rolling stock with hydrogen fuel cells. The San Bernardino County Transportation Authority of the State of California (USA) has signed a contract with the Stadler company for the supply of the first hydrogen-powered FLIRT train, followed by four more such trains. In particular, the first train on hydrogen fuel should start transporting passengers in Southern California from 2024 [13].

The Directorate of Railways of Norway (Jernbanedirektoratet), based on a study of the possibilities of abandoning the use of diesel traction on non-electrified lines with the aim of completely eliminating carbon dioxide emissions, indicated five alternative solutions: hydrogen fuel, biogas, biodiesel and traction batteries – with partial electrification of the line or its complete absence. Based on the results of the study, a conclusion was made about the most convenient use of rolling stock with traction batteries in combination with partial electrification. This technology is recognized as the most reliable, and it is also compatible with the existing infrastructure: trains with traction battery batteries can run throughout Norway's railway network. In general, it is planned to reduce emissions of carbon dioxide into the atmosphere by 45 % by 2030 [14]. The effectiveness of the use of such diesel trains has been recognized by Germany, which concluded a contract with the Alstom company for the manufacture and delivery of 11 Coradia electric trains Continental, designed for power from both the contact network and batteries.

Projects related to the transition of railway transport to alternative energy sources are being implemented at the global level. One of these projects is the construction of a solar power plant in Wasbeke as part of an agreement between the German Railways and the energy company Enerparc. The power plant with a capacity of 42 MW will be able to produce 38 GW/h of electricity annually. For the first time, the solar power plant will be connected to a converting substation that supplies power to the AC traction power supply system with a frequency of 16.7 Hz. In the future Deutsche Bahn AG intends to increase the number of solar power plants and bring the level of electricity consumption from renewable sources from 60 to 100 % by 2038.

Taking into account the two-component structure of the environment for the development of railway transport enterprises, which includes the real and virtual space of their operation, and the need to harmonize within them the multi-vector goals of the enterprises of the industry, it is expedient to develop conceptual provisions for ensuring the balanced growth of railway transport enterprises, which are based on the principle of multi- criteria coherence of the goals of their sustainable growth (**Fig. 9.6**).

The peculiarity of the developed concept is the reflection of goals, firstly, within the augmented real and virtual environment in accordance with the economic, ecological and social motives of the development of railway transport enterprises, and, secondly, in the directions of ensuring their balanced growth in the conditions of the implementation of digital changes. The strategic goal of the concept is to ensure the balanced development of railway transport enterprises based on digital transformation and modernization of the business environment of their operation.

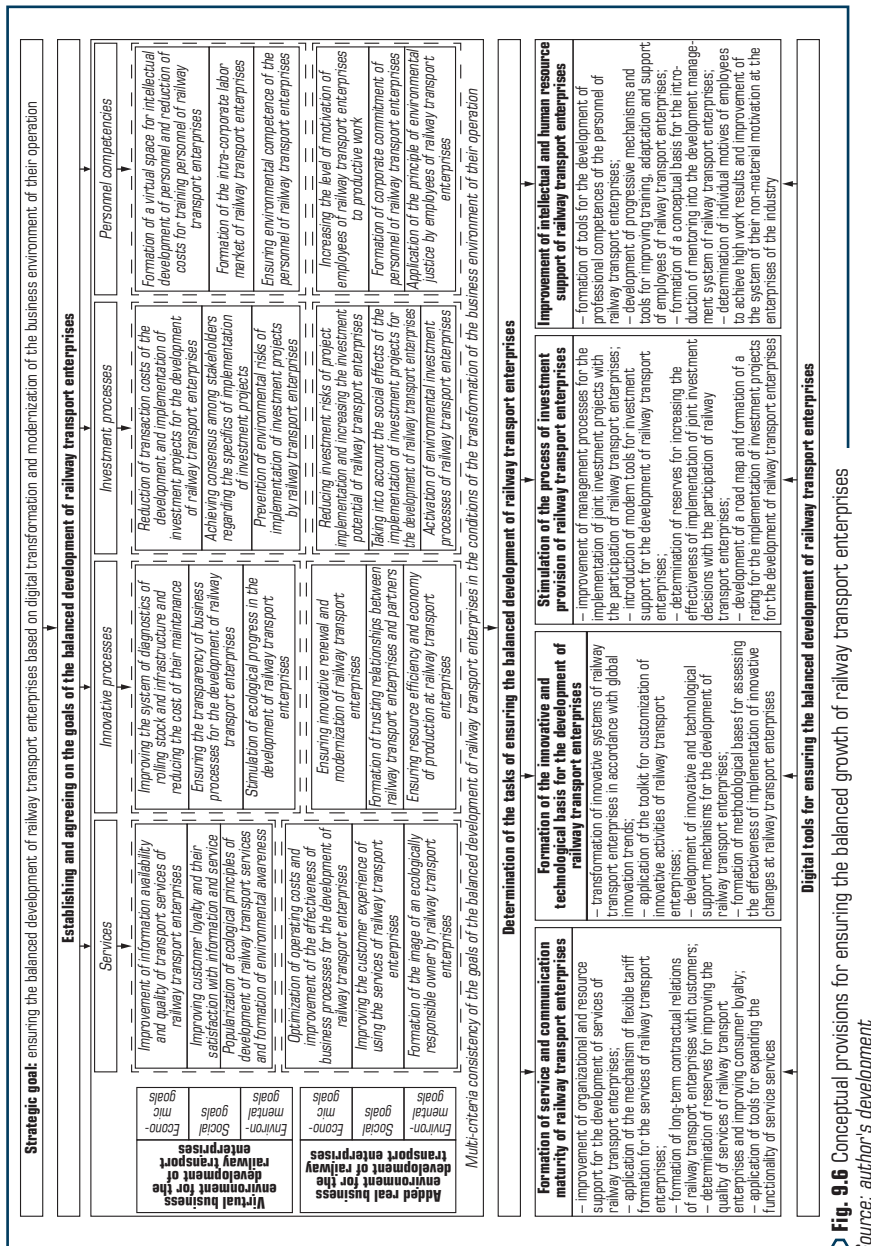


Fig. 9.6 Conceptual provisions for ensuring the balanced growth of railway transport enterprises  
Source: author's development

At the stage of establishing and agreeing on the goals of the balanced development of railway transport enterprises, the key motives for the growth of the enterprises of the industry should be determined in the following areas:

a) firstly, within the virtual business environment for the development of railway transport enterprises:

– *according to the direction of service development*: improvement of information accessibility and quality of transport services; improvement of customer loyalty and their satisfaction with information and service; popularization of ecological principles of development of railway transport services and formation of environmental awareness;

– *according to the direction of development of innovative technological processes*: improvement of the system of diagnostics of rolling stock and infrastructure and reduction of the cost of their maintenance; ensuring the transparency of business processes for the development of railway transport enterprises; stimulation of ecological progress in the development of railway transport enterprises;

– *according to the direction direction of development of investment processes*: reduction of transaction costs of development and implementation of investment projects for the development of railway transport enterprises; achieving consensus among stakeholders regarding the specifics of implementation of investment projects; prevention of environmental risks of implementation of investment projects by enterprises of the industry;

– *according to the direction of the development of personnel competencies*: the formation of a virtual space for the intellectual development of personnel and the reduction of costs for training personnel of railway transport enterprises; formation of the intra-corporate labor market of industry enterprises; ensuring the environmental competence of the personnel of railway transport enterprises;

b) secondly, within the augmented real business environment for the development of railway transport enterprises:

– *according to the direction of service development*: optimization of operating costs and improvement of the effectiveness of business processes for the development of railway transport enterprises; improvement of the client's experience of using the services of industry enterprises; formation of the image of an ecologically responsible owner by railway transport enterprises;

– *according to the direction of development of innovative and technological processes*: ensuring innovative renewal and modernization of railway transport enterprises; formation of trusting relationships between railway transport enterprises and partners; ensuring resource efficiency and economy of production at railway transport enterprises;

– *according to the direction of development of investment processes*: reduction of investment risks of project implementation and increase of investment potential of railway transport enterprises; taking into account the social effects of the implementation of investment projects for the development of enterprises in the industry; activation of environmental investment processes of railway transport enterprises;

– *according to the direction of personnel competence development*: increasing the level of motivation of employees of railway transport enterprises for effective work; formation of corporate

commitment of personnel of railway transport enterprises; application of the principles of environmental justice by employees of railway transport enterprises, etc.

Ensuring the balanced growth of railway transport enterprises requires solving the following tasks:

1) formation of service and communication maturity of railway transport enterprises, which is based on the need: improvement of organizational and resource support for the development of services of railway transport enterprises; application of the mechanism of flexible tariff formation for the services of railway transport enterprises; formation of long-term contractual relations of railway transport enterprises with clients; determination of reserves for improving the quality of services of railway transport enterprises and improving consumer loyalty; application of tools for expanding the functionality of service services, etc.;

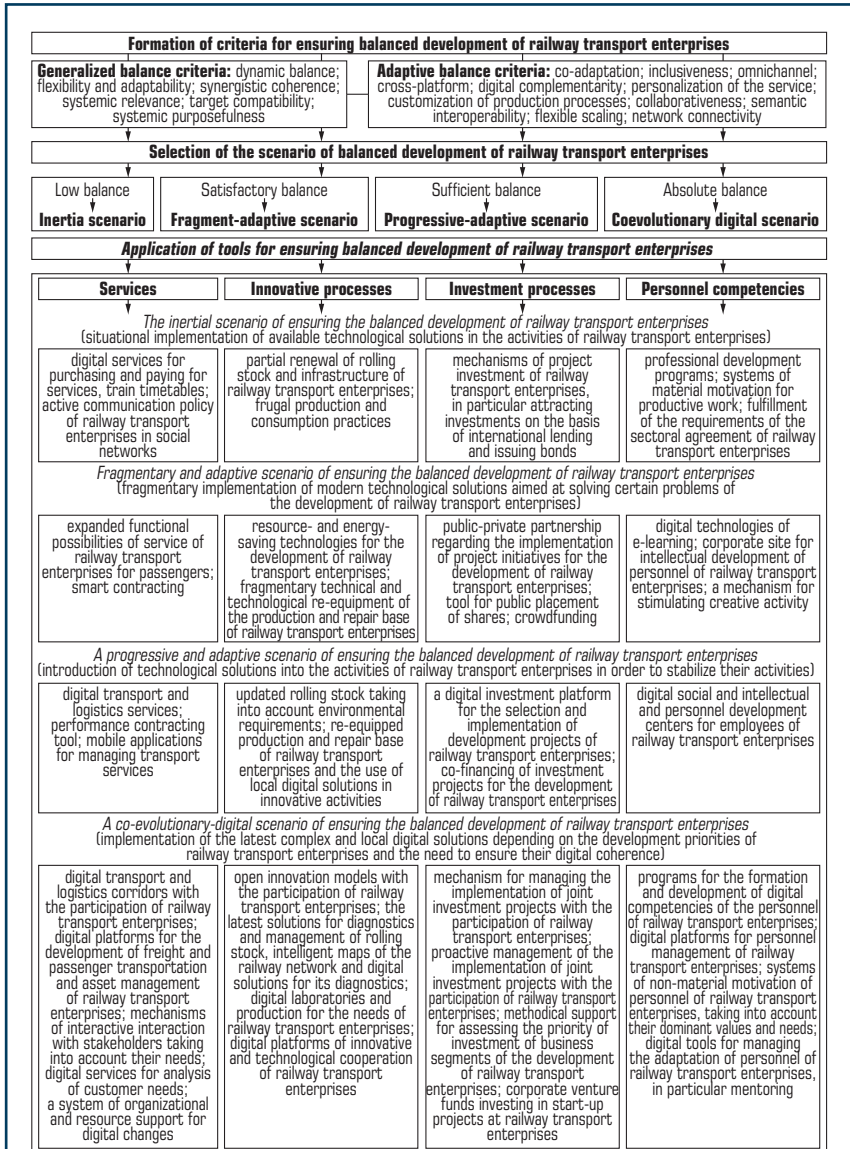
2) formation of the innovative and technological base for the development of railway transport enterprises due to: transformation of innovative systems of railway transport enterprises in accordance with global innovation trends; application of the toolkit for customization of innovative activities of railway transport enterprises; development of innovative and technological support mechanisms for the development of railway transport enterprises; formation of methodological bases for assessing the effectiveness of implementation of innovative changes at railway transport enterprises, etc.;

3) stimulation of investment support processes for railway transport enterprises, which requires: improvement of management processes for the implementation of joint investment projects with the participation of railway transport enterprises; introduction of modern tools for investment support for the development of railway transport enterprises; determination of reserves for increasing the effectiveness of implementation of joint investment decisions with the participation of railway transport enterprises; development of a road map and formation of a rating for the implementation of investment projects for the development of railway transport enterprises, etc.;

4) improvement of the intellectual and personnel support of railway transport enterprises, which is connected with: formation of tools for the development of professional competences of the personnel of railway transport enterprises; development of progressive mechanisms and tools for improving training, adaptation and support of employees of railway transport enterprises; formation of a conceptual basis for the introduction of mentoring into the system of managing the development of railway transport enterprises; determining the individual motives of employees to achieve high work results and improving the system of their intangible motivation at railway transport enterprises, etc.

The effectiveness of the implementation of the defined tasks of ensuring the balanced development of railway transport enterprises depends to a large extent on the effectiveness of the tools used and its compliance with global trends in the modernization of the railway industry. In order to ensure the desired state of balanced development of railway transport enterprises and the successful selection of digital tools for its achievement, it is proposed to use a system of scenarios for ensuring the balanced growth of enterprises in the industry, which, as a criterion for their selection, determines the degree of penetration of digital technologies into the activities of railway transport enterprises: inertial, fragmented-adaptive, progressive-adaptive, coevolutionary-digital (**Fig. 9.7**).

## 9 CONCEPTUAL PROVISIONS FOR ENSURING BALANCED DEVELOPMENT OF RAILWAY TRANSPORT ENTERPRISES UNDER THE CONDITIONS OF IMPLEMENTATION OF DIGITAL CHANGES IN THE INDUSTRY



○ **Fig. 9.7** A system of scenarios for ensuring the balanced development of railway transport enterprises, taking into account the extent of their digital adaptation

Source: author's development

The choice of the scenario of ensuring the balanced development of railway transport enterprises depends on the current level and the desired state of balance of goals and the tools of sustainable growth of the enterprises of the industry. Accordingly, maintaining the achieved level of balanced development of railway transport enterprises requires the application of an inertial scenario, which is oriented on the situational implementation of available technological solutions in the activities of the enterprises of the industry. Achieving a satisfactory level of balance in the development of railway transport enterprises requires the application of a fragmented-adaptive scenario, which accordingly provides for the fragmented implementation of modern technological solutions aimed at solving specific problems of the development of enterprises in the industry. In turn, the progressive-adaptive scenario of ensuring the balanced development of railway transport enterprises, which involves the introduction of technological solutions into the activities of the enterprises of the industry in order to stabilize their activities, should be used in the case of achieving a sufficient level of balance. The coevolutionary-digital scenario of ensuring the balanced development of railway transport enterprises involves the implementation of the latest complex and local digital solutions depending on the development priorities of the enterprises of the industry and the need to ensure their digital coherence. Its practical implementation makes it possible to achieve absolute balance in the development of railway transport enterprises.

Taking into account the aspiration of railway transport enterprises to achieve absolute balance in their development and to form a basis for achieving stable competitive positions in the market of transport and logistics services, it should be pointed out the feasibility of using precisely the coevolutionary-digital scenario. Since the use of its tools will allow full-scale implementation of digital transformations in the direction of qualitative transformation of services, innovative and investment processes and formation of digital competencies of personnel of railway enterprises.

In particular, ensuring the balanced development of services of railway transport enterprises involves the use of such tools as digital transport and logistics corridors with the participation of railway transport enterprises, digital platforms for the development of freight and passenger transport and asset management of enterprises in the industry, mechanisms for interactive interaction with stakeholders taking into account their needs, digital analysis services customer needs, a system of organizational and resource support for digital changes, etc.

Activation of the processes of innovative and technological development of railway transport enterprises requires the introduction of such tools as open innovation models [15] with the participation of railway enterprises, the latest solutions for diagnostics and management of rolling stock, intelligent maps of the railway network and digital solutions for its diagnostics, digital laboratories and production for the needs railway transport enterprises, digital platforms of innovative and technological cooperation of industry enterprises, etc.

Stimulation of the processes of investment support for the balanced development of railway transport enterprises becomes possible thanks to the use of such tools as the mechanism for managing the implementation of joint investment projects with the participation of enterprises of the industry, proactive management of the implementation of joint investment projects with the participation of railway enterprises, methodical support for assessing the priority of investing busi-



ness segments of the development of enterprises of the industry and the formation of corporate venture funds for investment in startup projects, etc.

The development of personnel competencies as the basis of intellectual and personnel support for the balanced growth of railway transport enterprises involves the use of such tools as programs for the formation and development of digital competences of the personnel of the enterprises of the industry, digital platforms for the management of personnel of railway enterprises, systems of non-material motivation of the personnel of the enterprises of the industry, taking into account their dominant values and needs, digital tools for managing the adaptation of personnel of railway transport enterprises, in particular mentoring, etc.

#### **9.4 DISCUSSION OF THE RESULTS OF THE CONCEPTUAL PROVISIONS OF THE BALANCED DEVELOPMENT OF RAILWAY TRANSPORT ENTERPRISES**

Thus, in order to diagnose the potential of railway transport enterprises, an assessment of the level of balance in their development was carried out, the results of which allowed to come to the conclusion about the gradual loss of stabilization capabilities by the enterprises of the industry and the limitation of the available opportunities to ensure the latter's digital transformation and modernization of the business model, business processes, development of services and personnel competencies. On the basis of this, the uncertainty of the goals and tools of digital modernization of services, investment and innovation processes and personnel competencies were established and the feasibility of comprehensive application of the latest digital solutions in the field of railway transport as a basis for ensuring the balanced growth of industry enterprises was established.

Taking into account the need for timely adaptation of railway transport enterprises to the challenges of digitalization, conceptual provisions for ensuring the balanced growth of railway transport enterprises have been developed, which are based on multi-criteria consistency of the goals of their sustainable growth. The peculiarity of the concept is the display of goals, firstly, within the augmented real and virtual environment in accordance with the economic, ecological and social motives of the development of railway transport enterprises, and secondly, according to the directions of ensuring their balanced growth in the conditions of the implementation of digital transformations in the industry. It has been proven that its practical application will contribute to the creation of conditions for the digital modernization of railway transport enterprises.

In order to ensure the desired state of balanced development of railway transport enterprises and the successful selection of digital tools for its achievement, a system of scenarios for ensuring the balanced growth of enterprises of the industry has been developed, in which the degree of penetration of digital technologies into the activities of railway transport enterprises is used as a criterion for choosing alternatives: inertial, fragmented-adaptive, progressive-adaptive and coevolutionary-digital. Taking into account the desire of railway transport enterprises to achieve absolute balance in their development and to form a basis for achieving sustainable competitive

positions in the market of transport and logistics services, the expediency of using a coevolutionary-digital scenario has been proven, the use of which tools will allow full-scale implementation of digital transformations for the purpose of qualitative transformation of services, innovative and investment processes and the formation of digital competences of the personnel of enterprises of the industry.

However, it is impossible to talk about the balanced development of railway transport enterprises without the use of marketing management. The next Chapter 10 will be devoted to this issue.

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