

*Research article***Scenario-based financial planning: the case of Ukrainian railways**

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Abstract: The crisis in the global and national economies negatively affects the predictability of companies. In such conditions, it becomes impossible to correctly forecast and plan based on the traditional methods and models. Therefore, the aim of this study is to develop an approach to forecasting and planning in conditions of high uncertainty in the functioning of companies. The methodological basis of the study is evolutionary-institutional management, which allows to consider the development of the company as a complex evolutionary process. A scenario approach is used as the basis for forecasting, which allows to study the dynamics of any company in an unstable environment. The study includes three blocks: developing scenarios, scenario forecasting, financial planning. The study is conducted based on data on the functioning of Ukrainian Railways, JSC, which is the operator of the rail infrastructure and the national carrier of goods and passengers in Ukraine. Scenarios are developed considering the specifics of the products of rail companies and based on factors (key uncertainties) that determine the effectiveness of their functioning. Scenario forecasting is based on considering the peculiarities of the company's production process, its cash cycle, and the formation of financial resources. As a result, forecast estimates are obtained for three scenarios (optimistic, pessimistic, and negative). The financial planning model is developed as a system of interrelated models of cash flow planning (operational, investment and financial). This approach allows to plan the sources of funds of the company and their use, taking into account possible changes in the external and internal environment of the company and, as a result, ensure its stable functioning in the implementation of any scenario.

Keywords: financial planning; forecasting; scenario; cash flow; company; rail company

JEL Codes: O21, D80, C53, L92

1. Introduction

The necessity and appropriateness of planning the development of social and economic systems is not questioned either by the scientists or practitioners. The importance of planning in management is expressed by the aphorism “to plan or to be planned”. Management classics (Ackoff, Ansoff, Porter, Khan) noted that in a market economy, the absence of planning is accompanied by the danger of unexpected fluctuations, erroneous manoeuvres, and untimely change of business lines, which negatively affects the effectiveness of the companies and prevents its development. Companies cannot count on prosperity without developing plans and not monitoring their implementation (Houlden, 1995; Graham et al., 2009; Brealey and Myers, 2011). As studies show, in the absence of accurate and systematic financial planning and control, companies can lose up to 20% of possible profits (Tarasyuk and Shvab, 2003).

Planning is a specific management activity aimed at choosing the optimal alternative to the development of the control object, designed for a certain period. Ackoff (1985) wrote that planning creates clear advantages for social and economic systems (countries, corporations, companies): it makes possible the preparation for the use of future favourable conditions; creates the possibility of foresight and a more effective solution to emerging problems; stimulates managers to implement their decisions in future work; improves coordination of activities in the organization; creates the prerequisites for improving the educational training of workers involved in planned work; increases opportunities in information support of the organization; contributes to a more rational distribution and use of resources; and improves organization control.

Despite the obvious advantages of planning, its use is not a prerequisite for the effectiveness of current activities and rapid growth in the future. The American researchers Rittel and Webber (1973) noted that it is not worth idealizing planning since it allows you to describe the future of the company only approximately. Many companies start planning only when crisis situations of various nature (production, marketing, financial, etc.) arise. The main criticism of planning is associated with the low quality of the source data and the low reliability of the forecasts based on which the plans are developed (Peters and Waterman, 1982; Sherden, 1998; Linstone, 2002; Fernandez and Swanson 2017). However, despite maintaining a critical attitude, forecasting remains the basis for planning and decision making. The researchers identify other factors that limit the use and effectiveness of planning. So, Alekseeva (2002) identified the following factors limiting the use of planning in countries with a transformational economy: a high degree of uncertainty; low level of capital accumulation, which does not allow for the implementation of effective costs for the organization of planning; lack of effective legal and ethical standards governing the behaviour of entrepreneurs, lack of culture of the domestic market.

In recent years, interest in planning in general and financial planning in particular has begun to revive: it is recognized that forecasting and financial planning are important elements of the corporate planning process and are aimed at ensuring consistency (balance) between existing and

available sources of the financial resources and the need for them, as well as identification of specific areas of their use to achieve the expected results of the corporation.

Financial planning as a branch of scientific and practical activity reflects the initial assumptions and basic hypotheses of the dominant economic paradigm and is based on the developed theoretical principles. The neoclassical paradigm remains the theoretical and methodological foundation of the modern economic science, the foundations of which were developed at the end of the 19th century and are presented in publications by Jevons, Menger, Walras, which laid the foundation for the Western economic theory. Neoclassical theory proceeds from the idea of the optimality of the market system, regarded as a perfect self-regulating mechanism that is in equilibrium and allows the best use of all production factors, not only for each individual economic agent, but also for the economic system as a whole. The neoclassical approach assumes that the activities of the economic agents are carried out in conditions of complete “perfect” information about possible changes in the external environment. This approach has led to the understanding that the behaviour of economic agents (companies), that is, the determination of the volume and structure of the resources used and the products produced, can be deduced from the premises characterizing the external environment (Kleiner, 2011). This understanding of the mechanism of functioning of the companies has led to the development and implementation of budgeting and financial planning practices based on the mechanical transfer to the future of existing trends. The process of financial planning occurred within the framework of a hypothetical-deductive model of cognition. This model provides for forecasting and the further development of the financial plans based on a clearly defined and predetermined set of prerequisites, within the framework of which a logically rigorous formal analysis is carried out and, using the deductive method, the conclusions are drawn about the future conditions of the economic agent.

The determinism of the external and internal environment of the economic agents led to the fact that the forecasting process was based on the extrapolation of already existing trends in both functioning and possible deviations. Emerging changes were considered as “obstacles” that can be overcome based on experience (Zub, 2007). In this case, the task of allocating available financial resources in the implementation of the financial planning turns out to be a task for a conditional extremum or, as it is otherwise called, an optimization problem under restrictions, and the planning approach itself is an optimization one (optimizing). The practical implementation of such an approach to planning became possible with the development of economic and mathematical methods and models that made it possible to build prognostic and planning models of the financial management based on a given objective function and a set of one or more restrictions. In this case, the task of financial planning was to search for such values of controlled variables that, under given restrictions and fixed uncontrollable conditions, optimized the efficiency of the system. This approach to financial planning in relatively stable environment was justified. In the modern conditions, the neoclassical model cannot be used to describe real economic processes. So, Nelson and Winter (2002) pointed out that the neoclassical theory is based on unreasonable and unrealistic assumptions that do not allow obtaining real models of both the economic agents themselves and their relationships.

An approach to the analysis of various aspects of the activity of economic agents, including financial planning, based on considering changes in the external environment and adaptation to these changes, was proposed by evolutionary economic theory. The basis of evolutionary economics is the understanding of economic processes as spontaneous, irreversible and self-reproducing, which are the result of the interaction of external and internal factors and manifest in changes in the structure of the economy and the economic agents operating in it. The recognition of the variability of economic

agents and the external environment was reflected in a change in the approach to financial planning. From the standpoint of evolutionary theory, one of the main conditions for the success of an economic agent is its ability to adapt, that is, such a reaction to changes in the external and internal conditions of functioning that counteracts a real or possible decrease in the effectiveness of its functioning. For the process of adaptation of an economic agent to dynamically changing operating conditions to be successful and focused, it must be managed (Booher, 1999).

One such tool is adaptive planning, which has developed as part of a planning approach called adaptivizing. With this approach to planning, the main benefit is not the availability of already drawn up plans, but in the process of drawing up these plans, that is, managers benefit, primarily by participating in the planning process, and not by using its results. In this case, adaptive financial planning is the development and justification of goals, determining the best methods and ways to achieve them with the effective use of all necessary resources, taking into account the possibility of destabilizing effects of the external and internal environment of the corporation and their levelling. The result of adaptive planning should be a planned trajectory with an assessment of sustainability, highlighted by “narrow” and “wide” places for targeted monitoring of the implementation of the plan at the stage of its implementation (Skurikhin et al., 1980).

When developing approaches to adaptive financial planning, one can rely on the use of adaptive forecasting methods, a characteristic feature of which is the ability to continuously take into account the evolution of the dynamic characteristics of the processes under study, to adapt to this evolution, giving, in particular, the greater weight and the higher information value of the available observations, the closer they are to the current moment of forecasting. It is noted that adaptive forecasting methods allow updating forecasts with minimal delay and using relatively simple mathematical procedures (Hanke, 1992). However, adaptive financial planning has drawbacks that impede their active implementation in the practice of managing financial activities of companies, namely, (i) the evolutionary methodology is effective only in conditions of relatively stable economic systems, with increasing uncertainty and dynamism of the external environment, it begins to fail; (ii) the lack of a clear and comprehensive concept and systematic methodology for adaptive planning (Ackoff, 1972); (iii) in adaptive financial planning, structural components are not taken into account, with the help of which one could study the morphology of the external environment, the structure of routines, traditions, rules and take into account their influence on changing financial and economic aspects of the functioning of companies.

An approach that allows to consider the morphology of the external environment, the rules, and traditions of the functioning of economic agents in this environment when planning, is an institutional economic theory. The first attempts to combine neo-institutional theory and planning theory were made in the early 90s of the twentieth century, but this attempt was unsuccessful. This is since the influence of institutions and opportunistic characteristics of economic agents is exceedingly difficult, and most often impossible to formalize and present as coefficients in analytical forecasting and planning models. Especially if it is necessary to take into account individual preferences, decisions and behaviour of the economic agents as the main parameters in economic and mathematical models: this task is more than incomprehensible for planning (Teitz, 2007), since they are formed under the influence of a subjective perception of economic agents, which, in turn, determines the choice formal rules and the development of informal constraints.

Neo-institutionalism is reflected in a satisficing planning approach, the implementation of which involves the development of plans aimed at achieving a certain level, not necessarily the

maximum possible, but satisfying the leadership of the corporation. Ackoff (1972), analysing a satisfied planning approach, noted that to satisfy is to do well, but not necessarily in the best way. With a neo-institutional approach to planning, the main emphasis is on managing financial resources, which leads to the recognition of the predominant role of the financial planning in the company's planning system. One of the main drawbacks of this approach is the development of the financial plans based on a single forward-looking forecast and, as a result, obtaining a point plan. Such an approach to planning cannot be considered as correct since the main requirement of satisfactory planning is not ensured—the development of an accurately implemented plan. The main drawback of such a planning system is the use of already acquired knowledge and an already achieved understanding of the planned system, highlighted the influence of institutions. As noted by Ackoff (1972), such planning is not of a research nature. In addition, North (1997) believes that the occurrence of long-term changes in institutions is not predetermined and deliberate, which greatly complicates their consideration in long-term forecasting and, as a result, in long-term and strategic planning. Therefore, its use for long-term forecasting and, accordingly, planning is rather doubtful since the transfer of the existing structure of the institutional environment to the future can lead to a significant increase in the transaction costs.

Building a rational system of financial planning, including short-term, long-term, and strategic financial planning, based on initial assumptions and basic hypotheses of only one economic paradigm, is ineffective in modern conditions. This can be explained by the fact that the forecasting horizon and the possibility of obtaining verified forecasts, as well as building realistic financial plans, directly depends on the level of uncertainty in the environment in which the economic agent operates. In this study, this problem will be solved using a combined approach, which is based on a synthesis of institutional and evolutionary economic theories.

This study is based on the example of Ukraine, which economy is characterized by sharp and poorly predictable changes in macroeconomic indicators, the dynamics of which do not correspond to the normal market cycle, but rather are inherent in crisis or post-crisis economic processes. In terms of the macroeconomic stability in 2018, it occupied 131 position (from 140 countries), and in 2019—133 position (from 141 countries), in terms of inflation—130 and 131 positions, respectively (World Economic Forum, 2020a). In addition, the country is rapidly losing its economic potential from an industrialized country, which in the early 90s of the twentieth century had an aerospace, nuclear industry, produced the most advanced technologies, and turned into an agricultural one. This allows us to consider the national economy of Ukraine as an extremely negative example of development in a crisis caused by both economic and geopolitical factors.

Now humanity is facing a new threat to its development and survival, namely the COVID-19 pandemic. According to the experts, this may have the most dangerous consequences for both national economies and the global economy. This can lead to a change in their structure, reduction of certain types of activities, reformatting of production and sales chains (World Economic Forum, 2020a). At the same time, the service sector will suffer more than the production sector. The fall in world's GDP in 2020 will be 2.4%, in the US—5.2%, the Eurozone—7.3% (S&P Global Ratings, 2020). As a result of the pandemic in 2020, the global economy is projected to decline by 3%, that is, more than during the financial crisis of 2008–2009 (International Monetary Fund, 2020b). And although in 2021 the world economy is expected to grow to 5.9%, the balance of risks remains negative and its development can go according to the worst-case scenario (“the data has gone from bad to worse”). In such a situation, consideration of the data of Ukraine is interesting and useful.

This will allow, on the one hand, preventing the collapse of the national economies in a crisis. On the other hand, ensuring (maintaining) a sufficient level of economic security for companies in conditions of high uncertainty of the future.

One of the most effective tools for ensuring the sustainable functioning of the companies is financial planning. This is because it is not only a tool for managing the financial resources of companies and maintaining their financial equilibrium. In the planning process, it is possible to identify “dangerous” areas in the functioning of companies, probable problems in the external environment, which will allow us to timely develop and implement measures to mitigate negative situations in the future. Financial planning will be considered based on the rail transport of Ukraine (Ukrainian Railways, JSC). The choice of a rail company is not accidental, since now in industrialized countries, rail transport is experiencing a period of renaissance. At the same time, the rail companies in many countries are under reform, which increases the requirements for the financial plans being developed. This explains not only the desirability, but also the mandatory consideration of possible changes in planning. In addition, studying the morphology of the external and internal environment will help to reduce the uncertainty and asymmetry of information, which will allow, as Lecours (2002) notes, effectively overcome market failures.

At the same time, the institutions characterizing the external and internal environment of the rail companies and determining the value of transaction costs and, as a result, the effectiveness of its functioning in the current environment, will not be considered static in the long term, and the impact of their changes is completely predictable. The consequence of this is increased requirements for the reliability of plans (Lusby et al., 2018). This leads to the necessity of incorporating into the financial plans of rail companies the adaptive abilities for possible changes to obtain the necessary (satisfactory) result. Consequently, the ability to adapt should be embedded in long-term, and especially, strategic financial plans that cover financial and investment policies, planning and coordination of cash flows of companies included in the structure of the rail corporations or interacting in the transportation process, a strategy for attracting external resources, accounting and tax policy, as well as forecasting the results of its impact on the economic environment.

In addition, the rail transport in long term should be considered as a developing system, the functioning of which is simultaneously characterized by the relative constancy (existing infrastructure, available fixed assets, established technological process) and variability (changes in production and economic relations as a result of reforming, transportation capacity of the industry, customer requirements to the volume and quality of services provided, the state of the transport market, etc.). Moreover, the current and future conditions of the industry as a system characterized by substantial inertia will largely depend on path dependence. This necessitates the application in long-term oriented financial planning of the basic principles and hypotheses of evolutionary economic theory aimed at understanding and modelling the dynamic properties of the economic systems. Financial planning, based on a synthesis of institutional and evolutionary paradigms, will consider not only the achieved level and existing operational experience, but also the possible impact of institutional changes on the intensity and rhythm of cash flow generation.

2. Materials and method

Financial planning was carried out as part of evolutionary-institutional management. This allows to consider the development of rail company as a complex evolutionary process, which is a

consequence of the interaction of the institutional environment (limited in space and time by a set of the formal rules and informal restrictions, enforcement mechanisms that structure a certain type of social interaction) with organizational forms (evolutionary processes that reflect changes in the internal environment of the company).

The development of the theoretical foundations of financial planning in a non-stationary institutional environment was based on the hypothesis of the possibility of a targeted evolution of the company in accordance with changes in the external and internal environment through forecasting and planning of cash flows. The application of this approach will allow not only to study the dynamics of the development of any economic system in a non-stationary environment, but also to determine ways to overcome possible crises for its least painful transformation into an effective market structure.

The study of the dynamics of the external and internal environment of the company was carried out based on a scenario approach. It is not so much an approach to predicting the future but studying and monitoring the dynamics of the state of the institutional environment and its future impacts on the functioning and development of a specific economic system (Pillkahn, 2008; Lindgren and Bandhold, 2009; Wade and Wagner, 2012; Ramírez, 2016).

The attractiveness and, to a certain extent, the feasibility of applying a scenario approach to the study of the future depends on the level of instability of the environment. So, the higher the level of uncertainty, the less opportunities there are for using traditional forecasting methods and models and the more attractive the scenario approach is (Lindgren and Bandhold, 2009; Ramírez and Selin, 2014; and others). Martelli (2001) noted that “the popularity of the scenarios is comparable to the waves that correlate with the state of uncertainty in the business environment ...”.

The scenarios are not forecasts in the generally accepted sense or a description of a relatively predictable future from the standpoint of the past and present but are closely related to the prediction of the future states. In conditions of increasing instability, the development of scenarios as an approach to studying the future has advantages over traditional forecasting methods (correlation and regression analysis, etc.). This can be explained that traditional methods are based on the hypothesis of continuity, increment and inertia of the development of processes and phenomena (Kjell and Max, 2013; Elliott and Timmermann, 2016; Ghysels and Marcellino, 2018). As one of the key success factors, the accuracy of the source data (above all, accounting data) and calculations is accepted. The consequence of this is the transfer of trends in the past to the future. However, with increasing instability, this can lead to the formation of a distorted idea about the functioning of the forecasting object (company) in the future, the state of its external environment and, as a result, the development of unrealistic financial plans. In the modern conditions, forecasting is often carried out for new economic phenomena with short statistical series or for existing (old) objects in which radical quantitative and qualitative changes have occurred, so the question of data continuity arises. Obsolete data in modelling is often useless or even harmful (Lukashin, 2003). In addition, a statistical description of the process allows exploring how it develops on average, and not how the trends that are forming now will change. This necessitates the use of approaches based on a small amount of the latest data. This approach is scenario analysis.

In conditions of increasing instability of the institutional environment, the scenario approach has significant advantages over other methods of studying the future: (i) early warning: the study of possible changes can significantly affect the future effectiveness of the company; (ii) new opportunities: knowing the nature of potential changes, the opportunities to increase efficiency can

be used; and (iii) risk reduction: preparing for possible changes can reduce the negative impact on capital and financial resources caused by uncertainty and risks.

The scenario building is based on the identification and analysis of the interaction of two groups of the factors: (1) predetermined elements, that is, the events and trends, the dynamics of which will not change during the analysed (planned) period; (2) key uncertainties, that is, any factors or trends in the external and internal environment that will have a decisive influence on the functioning of the economic system in the short and long term. The application of the scenario approach will allow solving the following financial planning tasks: (i) assessment of the future cash flows by assessing the volumes of available sources of financial resources and the directions of their use; (ii) provision of production, investment and financial activities with necessary financial resources; (iii) determining the directions for the efficient use of available capital; (iv) the identification and mobilization of reserves to improve the efficiency of the financial activities through the rational use of the available resources. A more extensive study of key uncertainties for Ukrainian Railways, JSC and the results of a SWOT analysis are presented in (Kravchenko, 2020).

To highlight key uncertainties and predetermined elements, an expert study was conducted, to which researchers in transport problems, as well as top managers of the rail companies in the CIS countries were involved. A total of 85 people was surveyed. The survey results were evaluated using the Kendall's coefficient of concordance ($W = 0.783$; the obtained value of the coefficient of concordance is expected, since experts from different modes of transport took part in the survey) and the Pearson criterion ($(\chi^2 = 689.04)$), which confirms a sufficient level of verification of the results. Based on the analysis of key uncertainties, four development scenarios have been developed (optimistic, pessimistic, probable, negative). Also, based on expert research, an assessment was made of the probability of implementing various alternatives to key uncertainties. This allows to determine the probabilities of each scenario. For each key uncertainty, two implementation alternatives were identified (optimistic (success) and pessimistic (failure)). Consequently, the probability distribution for each key uncertainty was constructed as a Bernoulli distribution.

The prediction of the key indicators was carried out using adaptive forecasting methods (Holt models), which give the best result for evolutionary processes that have or suggest the possibility of changing trends (Svetunkov, 2010). The use of the Holt model is justified by the fact that with its help it is possible (1) to single out both explicit and implicit trends in the dynamics of predicted indicators; (2) build not only short-term, but also medium-term and long-term forecasts; (3) take into account in forecasts the manifestation of a violation of stationarity in the dynamics of indicators. Forecasting was carried out for the period 2020–2024. The extension of the forecasting period seems to be impractical due to the high uncertainty of the development of the global and national economies.

To assess the financial condition of the rail company because of the implementation of individual scenarios, a three-component model of financial stability was used (Kononenko, 2012). This model is based on the determination of three indicators of the security needs in working capital sources of their formation, namely:

1. Surplus (+) or shortage (–) of working capital:

$$\pm E^w = K_w - S \quad (1)$$

where, K_w own working capital; S stocks.

2. Surplus (+) or shortage (–) of working capital and long-term borrowed funds:

$$\pm E^f = K_{fk} - S \quad (2)$$

where, K_{fk} functioning capital.

3. Surplus (+) or lack (–) of the total value of the main sources of formation of reserves and costs:

$$\pm E^s = K_{ms} - S \quad (3)$$

where, K_{ms} amount of the main sources of formation of stocks and costs.

In this case, the obtained values E are assigned with the following values: $S(E) = 1$, if $E > 0$ and $S(E) = 0$ if $E < 0$. Absolute financial stability is diagnosed if $S(E^w, E^f, E^s) = \{1, 1, 1\}$, normal financial stability $-S(E^w, E^f, E^s) = \{0, 1, 1\}$, unstable financial situation $-S(E^w, E^f, E^s) = \{0, 0, 1\}$, crisis financial situation $-S(E^w, E^f, E^s) = \{0, 0, 0\}$.

The study includes three research blocks: developing scenarios, scenario forecasting, and financial planning. The calculations are based on data on the activities of Ukrainian Railways, JSC, taken from open sources. Data that is a trade secret has been replaced by conditional data while maintaining its dynamics.

3. Results and discussions

3.1. Ukrainian rail transport

The rail transport is the basis of the transport infrastructure of Ukraine. The rail network is almost 19.8 thousand km, of which more than 47.2% is electrified (State Administration of Railway Transport of Ukraine “Ukrayins’ka zaliznytsya”, 2020). In terms of freight traffic, the railways of Ukraine occupy fourth place on the Eurasian continent, being inferior only to the railways of China, Russia, and India. The cargo intensity of the Ukrainian railways (annual traffic per 1 km) is 3–5 times higher than the corresponding indicator of the developed European countries (Ministry of Infrastructure of Ukraine, 2020).

The Ukrainian railways directly border and interact with the railways of Russia, Belarus, Moldova, Poland, Romania, Slovakia, and Hungary and provide work with forty international rail crossings, as well as serve 18 Ukrainian seaports of the Black Sea-Azov basin. The importance of the rail transport in the system of transport communications in Ukraine is also due to the fact that the main transport trans-European corridors run through the territory of the country: East—West, the Baltic—Black Sea. 3 rail transport corridors pass through the territory of Ukraine—No. 3, 5, 9. The interaction with the Pan-European corridor No. 7, which runs along the Danube River, is carried out through the Ukrainian ports of Izmail and Reni. Today, the length of the national network of the railway transit corridors in Ukraine is 3162 km.

The largest rail company is Ukrzaliznytsia (Ukrainian Railways, Joint Stock Company), which is the operator of the rail infrastructure, as well as the national carrier of goods and passengers. It participates in the fulfilment of the strategic function to ensure the economic development and security of the country. The part of the Company’s business relates to the activities of a natural monopoly entity. Now the Company provides 65% of the transport work in the general structure of cargo transportation by all means of transport and more than 35% of passenger traffic in the general structure of transport work, which is carried out by all types of transport excluding urban electric

transport. Ukrainian Railways, JSC is one of the largest employers in Ukraine, where about 260,500 employees work, or 1.6% of the total number of employees in Ukraine. 2.6% of Ukraine's GDP is generated in this company (State Statistics Service of Ukraine, 2020).

The railways of Ukraine until recently provided the needs of the economy and the population in transportation. This was achieved mainly due to the excess of the technical capacities created during the USSR. Today, the technical resource of the railways is almost exhausted. In addition, there was a technical and technological lag of the Ukrainian railways from the railways of European countries. There is a threat of non-provision by the railways of the future transportation needs of the Ukrainian economy. This has already affected the volume of the transit rail traffic. Even though the transit potential of Ukraine's rail transport is estimated at 100 million tons, in 2016 it was used only by 16.9% (Figure 1).

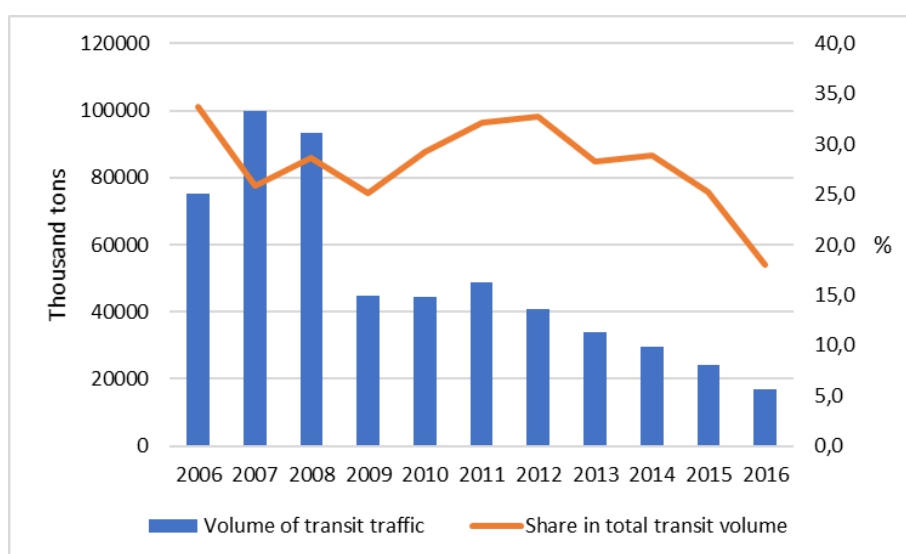


Figure 1. Dynamics of Transit by Rail Transport of Ukraine in 2004–2016.

This is accompanied by a decrease in the proportion of the rail traffic in transit by Ukraine from 32.8% in 2012 to 18.0% in 2016. This trend is very alarming, as its result will be a gradual redirection of transit flows bypassing the territory of Ukraine and, as a result, its exclusion from the international transport system and global integration processes. Unfortunately, now the routes of the new Silk Road (the PRC project “One belt— one way”) do not include the transport system of Ukraine.

At the same time, the rail infrastructure of Ukraine is excessive, as it was designed and built for significantly larger volumes of traffic (Kravchenko, 2013). Therefore, even when implementing the most optimistic scenario for the development of the world and Ukrainian economies, there is no need to increase it. Investments should be directed to the introduction of innovative technologies in the organization of transportation and the replacement of obsolete fixed assets with modern ones.

3.2. Features of financial planning in rail companies

The specifics of the financial activities of the rail companies and, as a consequence, financial planning as a reflection of this specificity, are determined by 2 groups of factors that can be conditionally divided into two groups: system-wide (typical for all types of transport) and specific (typical exclusively for rail transport).

System-wide features. The main feature of transport is its specific role in the economy: transport is its integral link that completes the production process in the circulation process, that is, it differs from other industries in that it is “a continuation of the production process within the circulation process and for the circulation process” (Marx, 2020). Accordingly, the transport products represent transport services for the movement (transportation) of goods and passengers and are not a new product that can be separated from the production process and participate in economic circulation in material form as goods. The transport products appear in the form of a beneficial effect from the operation of transport, which can be consumed only during the production process and does not exist as a commodity different from this process. The specifics of transport products are reflected in the formation of its value. So, the cost of transport products is determined in the form of operating expenses and includes expenses on labour remuneration and social insurance of personnel engaged in the transportation processes and their maintenance. The cost of transported goods on the transport process and transport costs has only an indirect effect.

The specific features are associated with the fact that in many cases the same economic entity provides both rail transport and network infrastructure. This defined the consideration of the rail companies as natural monopolies under a strict state regulation. In addition, this affects the financial model of these companies, namely (1) cross-financing of certain types of activities (for example, maintenance of infrastructure facilities, passenger transportation) at the expense of income received from freight transportation; (2) active government intervention in the distribution of profits by withdrawing part of it; (3) the state participation in determining strategic directions for the development of the rail infrastructure and, as a result, the dependence of the innovation intensity on the public funds. The result of using this model is a chronic lack of own financial resources due to the low level of return on assets and inefficient management of the rail companies.

In a relatively stable economy, financial planning in transport companies is carried out on the principles of corporate planning, taking into account the generation of their cash flows, the practice of state financing of investments in the modernization and development of transport infrastructure, as well as subsidizing transportation, especially passenger.

Now in European countries the separation of monopoly (rail infrastructure) and competitive (freight and passenger carriers) sectors is applied by actively creating a competitive environment in the field of the operational activities in accordance with the requirements of the EU package of the railway directives (Bruckmann, et al., 2015). At the same time, state regulation in the field of the rail transport should solve the following issues: (i) harmonious development of a unified transport system; (ii) ensuring national security, mobilization readiness of the rail transport and transportation safety; (iii) ensuring equitable access to infrastructure; (iv) promoting the formation of market relations based on the development of competition; prevention, restriction, and suppression of monopolistic activity and unfair competition. This affects the financial model of the rail companies (the elimination of cross-subsidization of passenger traffic), however, it retains a significant influence of the state on the innovation processes.

This determines the duality of the nature of the financial planning in the rail transport. Firstly, it should be considered as a component of macroeconomic financial planning, considering the priority areas of transport development in the country and the national economy. The key parameters and proportions of financial plans are determined on the basis of forecasts of the country's economic and social development for the long and short term, forecasts of the development of individual sectors of the economy, as well as economic, social development

programs and other state targeted programs. In addition, forecasts of volumes and directions of movement of goods, not only within the country, but international flows, as well as trends in the development of the continental transport systems, are considered.

On the other hand, the financial planning is microeconomic since the rail transport is seen as an industrial and technological complex of companies engaged in the transportation of goods and passengers. Then the financial planning should be aimed at ensuring the necessary financial resources for the uninterrupted operation of all structural elements related to the management of the rail company, balancing the available sources of the financial resources and the need for them to ensure continuous transportation activity in the short and long term.

Such duality, on the one hand, increases the complexity of the financial planning, and, on the other hand, strengthens the requirements for it. So, to ensure the financial stability of the rail companies in the financial planning process, it is necessary to (1) fully reflect all forms of financial relations, both existing and potentially possible in the future; (2) coordinate the efforts of all services and structural units of the rail company to ensure its effective development and increase the market value of capital; (3) transform the strategic goals of the industry into a system of specific targets for its individual divisions; (4) form the basis for the internal control of all the main aspects of the financial activities of the rail company, as well as the level of its financial stability and solvency; (5) create the necessary information base for subjects of the financial relations capable of providing external financing for the development of the company. In addition, in the planning process, implemented (reliable) plans should be developed, that is, the following functionality should be fulfilled:

$$E_{fp} = \sum (Y_f(t) - Y_{pl}(t))^2 \rightarrow \min \quad (4)$$

where, $Y_f(t)$, $Y_{pl}(t)$ the set of obtained results of financial and economic activity and planned values at time t , respectively.

The implementation of functional (4) is possible only with the most complete and correct consideration of the risks associated with the financial planning. This becomes possible only by studying the level of uncertainties in the internal and external environment of the rail transport.

Then, considering the above, in the process of financial planning the following tasks should be solved:

1. The identification of the reserves for increasing the organization's income and ways to mobilize them.
2. Efficient use of financial resources, determination of the most rational directions of development, which ensure the greatest profit in the planning period.
3. Providing the reproduction process with the necessary sources of financing.
4. Exercises control over the financial condition of the company.
5. Ensures the interests of investors, creditors, and the state.

3.3. Scenario forecasting as the basis of financial planning

3.3.1. Formation of the basis of scenarios for the development of the rail transport of Ukraine

The analysis of the results of the expert survey showed that the key uncertainties that will determine the development of Ukraine's rail transport in the future are the volumes of freight traffic

(environmental factor) and the investment strategy of Ukrainian Railways, JSC (internal environment factor). The predefined element is the size of the rail network. To a certain extent, this correlates with the results of an expert survey conducted in 2011. In it, the key factors for uncertainty were the demand for transportation and the strategy for reforming the rail transport of Ukraine, and the predefined element was the infrastructure of the rail transport (Kravchenko, 2013). Now there is a shift in emphasis on investment activity, as a factor determining the potential competitiveness and attractiveness of the rail transportation not only in domestic but also in foreign markets.

Key uncertainty 1. The financial results of the rail companies are mainly generated by the transport of goods and passengers. And if passenger transportation is often subsidized or subsidized by the state, then freight transportation is profitable. At the same time, there is a direct correlation between the industrial production index and the growth rate of freight transportation by rail transport. This dependence for Ukraine is presented in Figure 2. Thus, the size of rail freight transportation is derived from the volume of production in the national economy. This forms the demand for transportation. At the same time, the ability to meet demand is determined by the capacity of the infrastructure, transportation capabilities of rail companies, the presence of a sufficient number of fixed assets (for the transportation of certain types of cargo a specific type of wagon is used).

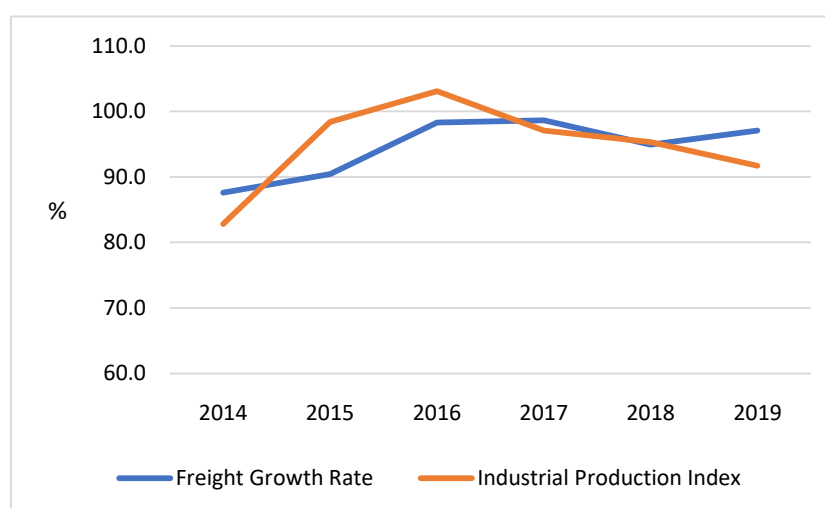


Figure 2. Dynamics of industrial production and freight transportation by railways of Ukraine for 2014–2019.

Another factor determining the need to consider the volume of the industrial production when assessing future volumes of rail transportation is that the nomenclature of such transportation is quite stable. So, in Ukraine, the basis of the nomenclature of the rail transportation are ore (iron and manganese), coal, grain and milling products, building materials, oil and oil products, and ferrous metal. In 2018, they accounted for 78.3%, and in 2019—77.3% of all freight (calculated by the authors based on data of State Statistics Service of Ukraine, 2020).

When assessing future traffic volumes, it is necessary to consider the beginning global crisis due to the COVID-19 pandemic. The Brookings Institution and the Financial Times calculated the Composite Index of Global Economic Recovery (Financial Times, 2020). In accordance with this index, there is now a collapse of economic activity, financial markets, and the private sector. A quick economic recovery seems extremely unlikely. The demand collapses, large-scale disruptions occur in

the industrial production chains. In contrast to the crisis of 2008–2009, which was provoked by a shortage of liquidity in the financial markets, the COVID-19 crisis creates problems with the fundamental solvency of companies and industries outside the financial sector.

A consequence of this crisis is the uncertainty of the development trends of national economies (Lui and Drakeford, 2019; Sukharev, 2020). Thus, the forecast of the International Monetary Fund for Ukraine in 2020 assumed a GDP growth of 3%. In April 2020, the forecast was adjusted for a decrease in GDP of 7.7%. A decline in GDP in Europe is expected at 6.6% this year, after 1.6% growth in 2019. However, in 2021, the European economy will return to growth and increase by 4.5% of GDP, analysts predict the Fund. (International Monetary Fund, 2020a). The World Bank, previously forecasting a 3.7% increase in Ukrainian GDP, now speaks of a decrease of 3.5% with inflation of 8.9% (The World Bank, 2020). As noted earlier, changes will occur in the institutional environment, which will affect the volume of rail transport.

Due to the expected contraction of the global economy, falling prices on commodity markets, a decrease in foreign direct investment and other adverse factors, the government reviewed the previous macroeconomic forecast made in October 2019 to deterioration side. According to new estimates, the industry will fall by 6.9% instead previously projected growth of 2.6%. The exports of goods and services in value terms should decrease by 13.3% against the previously expected growth of 7.8% (Budget Revision, 2020). Then key uncertainty 1 will have two such alternatives.

Pessimistic—reduction of rail freight traffic in accordance with the global trend of declining industrial production.

Optimistic—maintaining the existing volume of freight traffic.

In this study, changes in rail freight volumes are estimated for 2020 and 2021. Experts demonstrate a certain optimism regarding the preservation of traffic volumes, which is associated with the high importance of rail transport for the Ukrainian economy. In addition, transit traffic is expected to persist. Then, taking into account the possibilities of overcoming the crisis, it was determined that the probability of implementing an optimistic alternative is 0.60, and a pessimistic one –0.40.

The Table 1 presents the forecast calculations of changes in the volume of freight traffic by the railways. When calculating the demand for transportation according to an optimistic alternative, from 2022 the forecast for Ukraine's GDP growth of 2% per year is considered.

Key uncertainty 2. Currently, the assets of the railways of Ukraine are in poor condition. There is not only a high physical depreciation of the fixed assets, but also a technological lag (for certain groups of assets, the lag is 1–2 generations), which negatively affects the speed and quality of freight and passenger transportation. The investment needs of Ukrainian Railways, JSC are \$6 billion, which should be mastered within 5 years. At the same time, the deficit of funds only for maintaining the current state for the next 5 years is estimated at \$2.5–3.0 billion (State Administration of Railway Transport of Ukraine “Ukrayins’ka zaliznytsya”, 2020).

The railways' development requires modern and innovative solutions. The acquisition of the modern rolling stock, the modernization of signalling and communication systems, security, the introduction of modern IT systems and other innovations will open opportunities for increased efficiency. The priority areas of investment are: (1) increasing the carrying capacity of the rail network of Ukraine, primarily transport corridors; (2) updating and modernization of the fixed assets (infrastructure facilities, rolling stock); and (3) increasing the investment attractiveness of the rail transport.

Table 1. Forecast estimates for rail freight transportation.

Indicators	Years	
	2020	2021
Optimistic alternative		
Demand for freight transportation, million tons	304.8	296.8
Satisfaction of demand for transportation, %	100.0	100.0
Profit, billion \$	1.55	1.50
Pessimistic alternative		
Demand for freight transportation, million tons	291.3	283.7
Satisfaction of demand for transportation, %	100.0	100.0
Profit, billion \$	1.47	1.45

Financing the capital investments in the development of the transport infrastructure, until recently, has traditionally been considered as the prerogative of the country. The state has played and is playing a significant role in the creation, maintenance of the functioning and development of infrastructure facilities. This is since the maintenance and development of infrastructure, including railways, requires exceptionally large budgets (Lid n, 2015). Therefore, this practice has been applied in developed and developing countries on all continents and has been substantiated. This is since the creation and modernization of the infrastructure facilities requires significant financial resources, which have low profitability and long payback periods (for rail transport up to 15–20 years). The consequence of this was preferential financing of the investments from the state budget and/or at the expense of own funds of the rail companies.

At the same time, in Ukraine, as in most countries, the development of the rail transport (primarily its infrastructure) is impossible only at the expense of its own financial resources. The shortage of the investment resources can be covered either by public funding or by external sources. The systemic crisis of the national economy is forcing Ukrainian Railways' management to raise funds in the foreign markets. So, in July 2019, Eurobonds were placed in the amount of \$ 500 million for 5 years at 8.25% per annum (Centre for Transport Strategies, 2020). Due to this, Ukrainian Railways, JSC significantly reduced the loan burden on refinancing expected payments in the amount of \$ 300 million in the second half of 2019 and subsequent payments in 2020–2021. At the end of the year, the deficit of own financial resources was estimated at \$ 845 million. At the same time, Standard & Poor's (S&P) rating agency upgraded the credit rating of the company from CCC+ to B- with a stable outlook, and Fitch Ratings raised its long-term and short-term credit rating of Ukrainian Railways, JSC in foreign and national currency from level "B-" to sovereign level "B".

The development of the global economic crisis due to the COVID-19 pandemic will lead to a change in the structure of the global economy, key production locations, and logistics. This may have a negative impact on the ability of Ukrainian Railways, JSC to fulfil its financial obligations, which will also affect the ability to attract the necessary financial resources (State Administration of Railway Transport of Ukraine "Ukrayins'ka zaliznytsya", 2020).

The shortage of available financial resources makes the problem of creating accessible financial resources even more urgent, including through the involvement of private business in the development of infrastructure, through public and private partnerships. According to the World Bank, concessions are applied in more than 134 countries; 15–20% of all investments in infrastructure are

financed at their expense (World Bank Group, 2015). At the same time, the rail transport has a low attractiveness for private business and is in the penultimate position in terms of investment volume, inferior to aviation and road transport.

The shortage of available financial resources makes the development of an effective investment strategy very urgent. At the same time, choosing a financing path is an important strategic decision for companies (Gurău and Dana, 2020). The high importance of the rail transport for the national security, economic and social stability puts forward limitations on the possibility of applying public and private partnerships. These restrictions are associated with the need to maintain the state control over it to maintain the integrity of the national network, maintain its functionality and ensure free access for the carriers (Kravchenko, 2019). Based on this, it was determined that the WTO “build-transfer-operate” model is the most rational model. This model provides for the transfer to the state of the created or reconstructed object after the completion of work upon completion of construction. Then this object goes to the use of a private partner, but without transferring ownership to it. Then this key uncertainty will have two such alternatives.

Pessimistic—preservation of the existing practice of forming investment resources at the expense of own funds and placement of bonds.

Optimistic—development of an investment strategy that involves attracting private investors through the public and private partnership mechanism.

Experts note that the crisis in the global and national economies will not allow the implementation of fundamental structural reforms over the next two years. This is due to a shift in the priorities of public administration in overcoming the consequences of the crisis. The result of this is that the probability of an optimistic alternative is estimated at 0.05, and the pessimistic one at 0.95.

The Table 2 presents forecast calculations of investment needs and sources of financing. For a pessimistic and optimistic option, own resources are calculated in accordance with the statements of the management of Ukrainian Railways, JSC on investing 50% of the profit in updating fixed assets of the company. The forecast estimates of own funds consider the fact that, at the expense of profit from freight transportation, cross-subsidization of passenger transportation is also carried out.

A *predetermined element* is the size of the rail network, which includes main and station tracks, power supply systems for signalling and communications necessary to ensure transportation. An extensive network of the railways, which covers all regions of Ukraine, makes it possible to attract many goods and passengers for transportation. The presence of a developed system of an electrified rail network provides about 90% of freight traffic with lower cost compared to diesel traction. The presence of an extensive system of local electric networks ensures the transfer of electric energy both for the railways’ own needs and for third-party consumers. At the same time, the critical deterioration of the infrastructure facilities, primarily engineering structures, resulted in the limitation of the carrying capacity of certain areas. Thus, now and in the future, it is not necessary to expand the rail network, including that part of it along which the international transport corridors pass. However, there is a need for its innovative development.

The Table 3 presents the predicted calculation of the costs of maintaining the infrastructure of the rail transport of Ukraine. The forecast of the operating length of the railroads considers the plans of the Ukrainian Railways’ management to gradually decommission inactive sections with potential replacement by other modes of transport.

Table 2. Forecast estimates for investment activities, billion \$.

Indicators	Years	
	2020	2021
Optimistic alternative		
Investment needs	1.20	1.20
Own funds	0.41	0.38
Borrowed funds	0.79	0.82
Pessimistic alternative		
Investment needs	1.20	1.20
Own funds	0.32	0.32
Borrowed funds	0.88	0.88

Table 3. Forecast estimates of rail infrastructure maintenance costs.

Indicators	Years	
	2020	2021
Operational length of railways, thousand km	19.8	19.4
The cost of the main rail network, billion dollars	0.62	0.62

The number of developed baseline scenarios depends on the number of identified key uncertainties (Ringland, 2008). The determination of two key uncertainties allows to construct four scenarios. In Figure 3 shows the scenario formation scheme for Ukrainian Railways, JSC. Scenarios are developed through a consistent combination of optimistic and pessimistic alternatives for implementing key uncertainties. The predefined element is immutable and constitutes the basis for the development of all scenarios. Determining the probabilities of optimistic and pessimistic alternatives for key uncertainties allows us to determine the probabilities of individual scenarios. The identification and analysis of two key uncertainties made it possible to develop 4 scenarios—optimistic, pessimistic, probable, and negative.

Four scenarios are built for a correct description of a possible future of the rail transport—pessimistic, optimistic, negative, and probable. The pessimistic scenario assumes of a possible development of events under the least favourable conditions and the worst parameters characterizing the situation in the future, namely, that key uncertainties 1 and 2 will be realized by pessimistic alternatives (Figure 3). The construction of this scenario allows to identify critical points, the implementation of which will lead to a significant deterioration in production and the financial condition of the company. The optimistic scenario describes the events that can occur under the best of circumstances, the positive and most favourable dynamics of the main indicators and parameters of the situation. This scenario reflects potential reserves of the growth in the efficiency of the company. This scenario is based on the hypothesis of optimistic alternatives to key uncertainties. The negative and probable scenarios are based on the hypothesis that one of the key uncertainties will be realized according to the optimistic alternative, and the second—according to the pessimistic. Based on these scenarios, complexes of measures can be developed for levelling critical situations in the future, and the necessary amounts of financing for these events can be estimated.

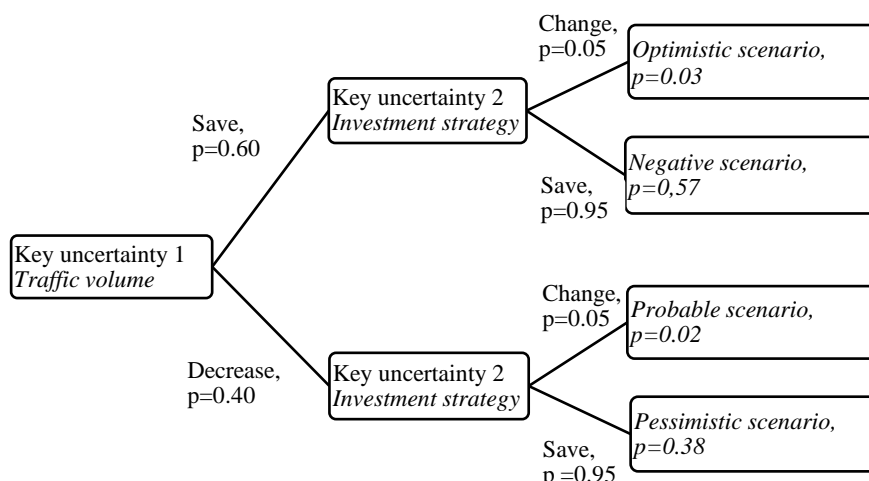


Figure 3. The scenario formation scheme for Ukrainian Railways, JSC.

For the correct description of the scenarios, the causes, and consequences of the implementation of alternatives of key uncertainties were identified (Table 4).

Pessimistic scenario. The reduction in industrial production will lead to a decrease in the transportation of goods and passengers and, as a result, a decrease in the company's revenues. The result will be an increase in the deficit of own funds to finance not only investment, but also operational activities. This will lead to the need to attract bank loans to finance it. The process of innovative updating of infrastructure and rolling stock (locomotives, cars) will stop. Due to the increase in financial difficulties of the company, available credit resources will decrease, and their value will increase. The implementation of this scenario will result in a gradual violation of the integrity of the Ukrainian rail network and a decrease in its carrying capacity. The probability of this scenario is 0.38 (Figure 3).

Optimistic scenario. This scenario is the best option for the development of the company in the current circumstances. The crisis in the global and national economies will not significantly increase revenues due to tariff increases while maintaining the current volume of freight traffic. The development of an effective investment strategy will make it possible to attract the necessary financial resources for the development of the rail infrastructure, above all, that part of it through which transit transportation is carried out. Improving the quality of infrastructure will increase the attractiveness of transit traffic through Ukraine and, as a result, increase its volumes. This will lead to an increase in transportation revenue. The result of the implementation of this scenario will be a gradual stabilization of the company, increasing its financial stability and, as a result, investment attractiveness for the private investors. The probability of this scenario is 0.03 (Figure 3). Although the likelihood of an optimistic scenario is very low, excluding it from consideration is not rational.

Probable scenario. It is developed on the basis of two hypotheses: (1) the volume of traffic will be reduced in accordance with crisis trends in the national and world economies; (2) development of an investment strategy providing for the attraction of the private investors through the Public Private Partnership and Initial Public Offering mechanisms. An analysis of this scenario showed that the probability of its implementation is 0. This can be explained that with a steady trend towards a decrease in demand for products (services) with uncertain prospects, the company loses investment attractiveness for the private investors. And since rail transport around the world has an

exceptionally low investment attractiveness (discussed earlier in the analysis of key uncertainty 2), under such conditions there will be no private investment in its development in Ukraine. Therefore, this scenario is excluded from the further consideration. Although the probability of the optimistic scenario being realized was 0.02 (Figure 3), it is excluded from further consideration as unrealistic.

Table 4. Causes and consequences of implementing key uncertainty alternatives for Ukrainian Railways, JSC.

Implementations	Causes	Consequences
Key uncertainty 1—Traffic volume		
Optimistic— maintaining freight traffic	<ol style="list-style-type: none"> 1. The growth in production volumes of the main types of cargo. 2. Preservation of volumes of rail transit through the territory of Ukraine. 	Maintaining the production and financial efficiency of the rail company and, as a result, investment opportunities for it.
Pessimistic— reduction in rail freight	<ol style="list-style-type: none"> 1. Reduction in production volumes of the main types of cargo due to the crisis or measurement of market conditions. 2. Unreasonable increase in tariffs for transportation. 3. Political and social instability in the country. 	<ol style="list-style-type: none"> 1. Decrease in revenues from transportation and, therefore, a decrease in investment opportunities in the maintenance and development of the company. 2. Changing the rhythm of revenue and the implementation of the necessary costs associated with operating and investment activities, which will negatively affect the solvency and liquidity of the company.
Key uncertainty 2—Investment strategy		
Optimistic— investment strategy change	<ol style="list-style-type: none"> 1. The need for innovative development of the company. 2. Deficit of own investment resources. 	<ol style="list-style-type: none"> 1. Introduction of innovative equipment and technologies for rail transportation. 2. Maintaining or increasing the attractiveness of rail transportation. 3. The possibility of financing research and development in the field of rail transport.
Pessimistic— maintaining the practice of forming investment resources at the expense of own funds	<ol style="list-style-type: none"> 1. Excessive government interference in the activities of the company, especially in the processes of formation and distribution of revenue from transportation. 2. Low investment attractiveness of rail transport. 3. Lack of necessary regulatory documents. 	<ol style="list-style-type: none"> 1. Progressive deterioration of fixed assets and, as a consequence, the inability to transport with high quality. 2. A decrease in the volume of domestic and transit traffic due to a decrease in the share of the transport market.

Negative scenario. The implementation of this scenario is based on the following assumptions: increasing demand for the freight transportation while maintaining the current practice of financing investments from own funds. This scenario is considered negative, as the underfunding the renewal of the fixed assets (infrastructure facilities and rolling stock) will result in a decrease in the transportation capacity of the company (disposal of completely worn-out fixed assets) and, as a result,

the inability to satisfy demand for transportation. This will negatively affect the formation of financial results and will reduce the company's investment opportunities. The probability of a negative scenario is 0.57 (Figure 3).

Thus, pessimistic, and negative scenarios, which are based on a pessimistic alternative to key uncertainty 2, which preserves the existing investment strategy, are most likely to be realized in a crisis.

3.3.2. Scenario forecasting

Scenario forecasting in the financial planning is the process of identifying new trends and possible problems in the future, as well as determining their consequences for assessing future financial events (financial condition) or operating conditions of the production and economic system (rail company). The main purpose of forecasting is to obtain financial assessments of the functioning of the company. Therefore, it should be carried out taking into account the following provisions: (1) reflect the process of forming the financial resources as a result of various types of activities; (2) take into account the features of the production process and take into account the cash flow cycle; and (3) formulate the alternative options for the financial forecasts in accordance with the developed scenarios.

The basis for generating cash flows of rail companies is the cash flow that reflects the features of their operating activities: at each point in time t it will reflect income and expenses resulting from the transportation of goods and passengers, as well as the capital flows. The volume of the operating cash flow at time t will also largely determine the volume of investment cash flow at time $(t + 1)$. The investment cash flow, being a derivative of the operating one, will determine the features of its generation in terms of the formation of expenses and income associated with the transportation activities. The cash flow associated with the financial activities will include two groups of expenses and income: (1) arising from the investment activities when attracting external sources of financing (payment of interest and other payments related to raising borrowed capital); and (2) arising from the financial activities (expenses associated with the issuance, maintenance and circulation of own securities, interest accrual in accordance with loan agreements (except bank loans, financial leasing, etc.).

In the case of a rail company, scenario forecasting will be a process of the sequential forecasting of: (i) fixed and current assets; (ii) own financial resources; (iii) need for additional financial resources; and (iv) cash flows.

Available fixed and current assets of the rail company determine its potential transportation opportunities in year t ($Q_p(t)$), which allows them to be represented as a function of the volume of assets, i.e.

$$Q_p(t) = f(\hat{H}(t), \hat{O}(t)) \quad (5)$$

where, $\hat{H}(t)$, $\hat{O}(t)$ forecasts of fixed and current assets at time t , respectively.

Forecast estimates of the financial results from operating activities will be determined by the formula:

$$FR(t) = FR_{fr}(t) + FR_{pas}(t) = (\hat{D}_{fr}(t) - \hat{E}_{fr}(t) - \hat{B}_{fr}(t)) + (\hat{D}_{pas}(t) - \hat{E}_{pas}(t) - \hat{B}_{pas}(t)) \quad (6)$$

where, $FR_{fr}(t)$, $FR_{pas}(t)$ the financial result from the implementation of freight and passenger transportation at time t , respectively; $\widehat{D}_{fr}(t)$, $\widehat{D}_{pas}(t)$ incomes received from freight and passenger transportation, respectively; $\widehat{E}_{fr}(t)$, $\widehat{E}_{pas}(t)$ forecast of operating costs associated with the implementation of freight and passenger transportation, respectively; $\widehat{B}_{fr}(t)$, $\widehat{B}_{pas}(t)$ forecasted amount of the mandatory payments to the budgets of all levels related to freight and passenger transportation, respectively; and t ($t = \overline{1, T}$) forecast period.

The determination of the need for additional financial resources for capital investments and innovations should be based on the forecast of transportation of the main types of cargo and categories of passengers by railways. Since the volume of transportation depends on demand (production volumes of the main types of cargo and the number of potential passengers) and existing tariffs, then the forecast model of transportation work of type j at time $(t + 1)$ can be described by the functional:

$$\widehat{Q}_j(t + 1) = f(V_j(t + 1), C_j(t + 1)) \quad (7)$$

where, $V_j(t + 1)$ demand for transportation work of type j at time $(t + 1)$.

Then the forecast demand for fixed and current assets at time $(t + 1)$ will be determined by the formulas:

$$\widehat{H}_p(t + 1) = f(\widehat{H}_{\widehat{Q}_1}(t + 1), \dots, \widehat{H}_{\widehat{Q}_j}(t + 1), \dots, \widehat{H}_{\widehat{Q}_N}(t + 1)) \quad (8)$$

$$\widehat{O}_p(t + 1) = f(\widehat{O}_{\widehat{Q}_1}(t + 1), \dots, \widehat{O}_{\widehat{Q}_j}(t + 1), \dots, \widehat{O}_{\widehat{Q}_N}(t + 1)) \quad (9)$$

where, $\widehat{H}_{\widehat{Q}_j}(t + 1)$, $\widehat{O}_{\widehat{Q}_j}(t + 1)$ the need for fixed and current assets at time $(t + 1)$, respectively.

The determination of the need for the capital investment will be carried out according to the formulas:

$$KI_H(t + 1) = \widehat{H}_p(t + 1) - \widehat{H}(t + 1) \quad (10)$$

$$KI_O(t + 1) = \widehat{O}_p(t + 1) - \widehat{O}(t + 1) \quad (11)$$

Prediction of the investment cash flow will be carried out considering forecasts of both the financial result from operating activities (6) and the need for capital. Then the forecast of the volume of investment cash flow for each moment in time t can be determined in the form of the following expression:

$$R_{IFP}(t) = \widehat{F}_N(t) + \widehat{F}_O(t) \quad (12)$$

where, $\widehat{F}_N(t)$, $\widehat{F}_O(t)$ forecast investment in fixed assets and current assets provided that

$$(KI_N(t) + KI_O(t)) \geq (\widehat{F}_N(t) + \widehat{F}_O(t)) \leq d(t) \cdot \widehat{P}(t - 1) \quad (13)$$

where, $KI_N(t)$, $KI_O(t)$ the need for capital investment in fixed assets and current assets; $d(t)$ the share of the financial result allocated for investment activities; and $d(t) \cdot \widehat{P}(t - 1)$ own investment resources at time t .

When forecasting the cash flow associated with the financial activities, it should be borne in mind that it will be generated only with the involvement of the external financial resources. It will include both the revenue (loans and borrowings received) and the expenditure parts (repayment and servicing of previously received loans). Then, in a general form, the forecasting of cash flow associated with the financial activities will be carried out according to the formulas:

$$\text{expenditure part:} \quad \hat{R}_{FFP}(t) = \hat{Z}_b(t) + \hat{Z}_\%(t) \quad (14)$$

$$\text{profitable part:} \quad \hat{D}_{FFP}(t) = \hat{K}_{D,FFP}(t) \quad (15)$$

where, $\hat{Z}_b(t)$, $\hat{Z}_\%(t)$ costs at time t related to the payment of interest and repayment of previously taken loans, respectively; and $\hat{K}_{D,FFP}(t)$ amount of capital raised from external sources at time t .

Then the forecast for the resulting cash flow is:

$$\text{expenditure part:} \quad \hat{D}(t) = \hat{D}_o(t) + \hat{D}_f(t) = \hat{D}_o(t) + \hat{K}_{D,FFP}(t) \quad (16)$$

$$\begin{aligned} \text{profitable part:} \quad \hat{R}(t) = \hat{R}_o(t) + \hat{R}_i(t) + \hat{R}_f(t) = [\hat{E}(t) + \hat{B}(t)] + \dots \\ + [\hat{F}_H(t) + \hat{F}_O(t)] + [\hat{Z}_b(t) + \hat{Z}_\%(t)] \end{aligned} \quad (17)$$

In accordance with the model (5)–(17) for the proposed scenarios, based on the performed calculations, cash flows are predicted for three scenarios for Ukrainian Railways, JSC (Table 5). The calculation of operating cash flow for various scenarios was carried out on the assumption of meeting the demand for transportation: (1) the optimistic scenario—full satisfaction of demand (a rational investment strategy will save the company's transportation capabilities by investing in updating fixed assets); (2) the pessimistic option—full satisfaction of demand (a consequence of the crisis in the global and Ukrainian economies will be a further decrease in demand for transportation, so there will be no shortage of fixed assets); (3) the negative scenario—the impossibility of full satisfaction of demand (this will result from a violation of the process of simple reproduction of fixed assets due to a shortage of available financial resources). This will apply to both freight and passenger traffic.

Analysis of the cash flows for the three scenarios showed that transportation activities will not allow generating enough funds to finance the investment activities. At the same time, the profit received will be enough for the financial costs of the obligations taken. The fact that the need for external financing exceeds the profit from operating activities is especially dangerous. The exception is 2020 for an optimistic scenario. A consequence of the increase in the deficit of own resources for investment activity was the increase in the required volumes of external lending to Ukrainian Railways, JSC activities.

Table 5. Forecast cash flows for constructed scenarios of the rail transport of Ukraine, billions \$.

Indicators	Years	
	2020	2021
Optimistic scenario		
<i>Operating cash flow</i>		
Freight transportation profits	1.55	1.50
Passenger transportation profits	-0.19	-0.20
Profit from other activities	0.06	0.06
Infrastructure maintenance costs	0.62	0.61
Total	0.80	0.75
<i>Investment cash flow</i>		
Investment needs	1.20	1.20
Own funds	0.40	0.38
<i>Financial cash flow</i>		
Finance costs of commitments	0.17	0.17
Need for external lending	0.80	0.82
Pessimistic scenario		
<i>Operating cash flow</i>		
Freight transportation profits	1.47	1.45
Passenger transportation profits	-0.20	-0.20
Profit from other activities	0.03	0.02
Infrastructure maintenance costs	0.62	0.61
Total	0.68	0.66
<i>Investment cash flow</i>		
Investment needs	1.20	1.20
Own funds	0.34	0.33
<i>Financial cash flow</i>		
Finance costs of commitments	0.22	0.24
Need for external lending	0.86	0.87
Negative scenario		
<i>Operating cash flow</i>		
Freight transportation profits	1.49	1.46
Passenger transportation profits	-0.20	-0.20
Profit from other activities	0.04	0.03
Infrastructure maintenance costs	0.62	0.61
Total	0.71	0.68
<i>Investment cash flow</i>		
Investment needs	1.20	1.20
Own funds	0.36	0.34
<i>Financial cash flow</i>		
Finance costs of commitments	0.22	0.24
Need for external lending	0.84	0.86

Analysis of scenarios and their corresponding cash flows showed significant problems in the formation of financial resources in the implementation of all scenarios (Table 6). The assessment was based on the calculation of a three-component model of financial stability.

Table 6. Assessment of the financial condition of Ukrainian Railways, JSC in the implementation of various scenarios.

Scenarios	Implementation result	Financial strength level	Type of the financial condition
Optimistic	Gradual increase in operating and investment cash flows	$S(E^w, E^f, E^s) = \{0,0,1\}$	Unsustainable financial condition related to solvency violation
Pessimistic	Gradual and consistent decrease in cash flows	$S(E^w, E^f, E^s) = \{0,0,0\}$	Crisis financial condition
Negative	Gradual and consistent decrease in cash flows	$S(E^w, E^f, E^s) = \{0,0,0\}$	Crisis financial condition

Then, when implementing financial planning, special attention should be paid to planning indicators of both investment and financial cash flow for (1) the rational distribution of available investment resources in order to improve the quality characteristics of the rail network of Ukraine; and (2) minimizing the costs associated with attracting and servicing credit resources.

As can be seen from the data in Tables 4 and 5, the negative scenario is closer to the pessimistic scenario, both in cash flows and the financial consequences of implementation. Its further consideration in financial planning will not allow obtaining additional information about the future of the company, therefore it can be excluded from further analysis.

3.4. Financial planning based on scenario forecasts

Financial planning is a tool that companies use to create, implement, and evaluate short-term and long-term goals. It is also based on the company's development strategy. Then financial planning in Ukrainian Railways, JSC should focus on achieving the following goals: (i) meeting the needs of Ukraine in rail transportation and logistics in accordance with plans for economic development of the country and population mobility; (ii) achieving and maintaining a strong financial position of the Company, including by activating the necessary investments in core activities (State Administration of Railway Transport of Ukraine "Ukrayins'ka zaliznytsya", 2020).

The financial planning process is continuous and provides for a complete balancing of elements and mechanisms for its implementation (State Administration of Railway Transport of Ukraine "Ukrayins'ka zaliznytsya", 2020). Then the financial planning model can be represented as a system of interconnected planning models, including three interrelated models: (1) an operating cash flow planning model; (2) investment cash flow planning model; (3) a financial cash flow planning model. Such a representation is the most rational and effective in the current conditions, as it will help determine the sources of cash and evaluate their use, as well as identify the expected cash flows, and therefore the growth prospects of the organization and its future financial needs (Moiseeva, 2010).

Operating cash flow planning model. The effectiveness of the operating activities of any company implies an excess of income (positive operating cash flow) over expenses (negative cash flow), therefore, operating cash flow is generated in the process of operating rail company taking into

account existing or available fixed and current assets. Then, as the objective function of the model, we can take the maximization of the total operating cash flow in each planning period t , which will be described by a functional:

$$f_{OFP}(t) = NP(t) + A(t) + \Delta DZ(t) - \Delta KZ(t) \rightarrow \max \quad (18)$$

where, $NP(t)$ net profit from operating activities during the planning period t ; $A(t)$ depreciation deductions; $\Delta DZ(t)$, $\Delta KZ(t)$ change in receivables and payables, respectively.

The main factor in the formation of the operating cash flow of rail companies is the economic efficiency of the transportation of goods and passengers. Thus, the maximization of the functional (18) will be determined by the size of the profit from the transportation of goods and passengers in each planning period t . Because the profit rate for each type of transportation is determined separately, it is advisable to rewrite the functional (18) in the following form:

$$f_{OFP} = NP_{fr}(t) + NP_{pas}(t) = \sum_{\forall i_{fr}} NP_{fr, i_{fr}}(t) + \sum_{\forall i_{pas}} NP_{pas, i_{pas}}(t) \rightarrow \max \quad (19)$$

where, $NP_{fr}(t)$, $NP_{pas}(t)$ net profit from transportation of goods and passengers, respectively; i_{fr} ($i_{fr} = \overline{1, n_{fr}}$) goods transported by the company; and i_{pas} ($i_{pas} = \overline{1, n_{pas}}$) categories of passengers.

The system of limitations of the operating cash flow planning model will be as follows:

$$\sum_{\forall j_{FA}} r_{j_{FA}}(t) \leq FA(t) \quad (20)$$

$$\sum_{\forall j_{CA}} r_{j_{CA}}(t) \leq CA(t) \quad (21)$$

$$0 \leq x_{fr, i_{fr}}(t) \leq X_{fr, i_{fr}}(t) \text{ for } \forall i_{fr} \text{ (} i_{fr} = \overline{1, n_{fr}} \text{)} \quad (22)$$

$$0 \leq x_{pas, i_{pas}}(t) \leq X_{pas, i_{pas}}(t), \text{ for } \forall i_{pas} \text{ (} i_{pas} = \overline{1, n_{pas}} \text{)} \quad (23)$$

$$x_{pas, i_{pas}}^l(t) \geq X_{pas, i_{pas}}^l(t), \text{ for } \forall i_{pas} \text{ (} i_{pas} = \overline{1, n_{pas}} \text{)} \quad (24)$$

where, $r_{j_{FA}}(t)$, $r_{j_{CA}}(t)$ costs of fixed and current assets for operating activities in the planning period t , respectively; $FA(t)$, $CA(t)$ the amount of available fixed and current assets; $x_{fr, i_{fr}}(t)$, forecast volume of cargo transportation of the type i_{fr} ; $X_{fr, i_{fr}}(t)$ forecast demand for the transportation of goods of the type i_{fr} ; $x_{pas, i_{pas}}(t)$, forecast volume of passenger transportation of the type i_{pas} ; $X_{pas, i_{pas}}(t)$ forecast demand for the transportation of passengers of the type i_{pas} ; $x_{pas, i_{pas}}^l(t)$ forecast volume of preferential passenger transportation of the type i_{pas} ; and $X_{pas, i_{pas}}^l(t)$, ($X_{pas, i_{pas}}^l(t) \in X_{pas, i_{pas}}(t)$) forecast volume of preferential passenger transportation of the type i_{pas} .

To maximize the function (19) in each planning period t , the model should be supplemented with two restrictions on the possibilities of "satisfying" the needs for fixed and current assets:

$$\sum_{\forall i_{fr}} a_{fr, i_{fr}; j_{FA}}(t) x_{fr, i_{fr}}(t) + \sum_{\forall i_{pas}} a_{pas, i_{pas}; j_{FA}}(t) x_{pas, i_{pas}}(t) \leq r_{j_{FA}}(t) \quad (25)$$

$$\sum_{i_{fr}} a_{fr, i_{fr}; j_{CA}}(t) x_{fr, i_{fr}}(t) + \sum_{i_{pas}} a_{pas, i_{pas}; j_{CA}}(t) x_{pas, i_{pas}}(t) \leq r_{j_{CA}}(t) \quad (26)$$

where, $a_{fr, i_{fr}; j_{FA}}(t)$, $a_{fr, i_{fr}; j_{CA}}(t)$ the need for fixed assets of the type j_{FA} and current assets of the type j_{CA} for the transportation of cargo of the type i_{fr} ; respectively; and $a_{pas, i_{pas}; j_{FA}}(t)$, $a_{pas, i_{pas}; j_{CA}}(t)$ the need for fixed assets of the type j_{FA} and current assets of the type j_{CA} for passenger transportation of the type i_{pas} .

As a result of the implementation of this model, two sets will be obtained that form the optimal production plans for freight and passenger transportation for the planning period t , which will maximize the functionality (19). In addition, the implementation of the operational cash flow planning model (20)–(26) will maximize the efficiency of the company's operating activities and minimize possible losses from misallocation of existing assets.

Investment cash flow planning model. It should be based on available financial resources. In Ukrainian Railways, JSC, there is an objective difficulty in attracting borrowed funds from the external sources for updating fixed assets.

Peculiarities of investment activity in rail companies allow generating only negative cash flow associated with capital investments. An analysis of the scenarios showed that Ukrainian Railways, JSC will continue to have a trend of insufficient volume, primarily fixed assets in the form of fixed assets, so the main goal of investment activity under the current conditions should be the formation of a portfolio of capital investments that provides the greatest capital growth under the existing restrictions on the financial resources.

It seems appropriate to present the objective function of the model in the form of a criterion for obtaining the max-min effect from its implementation, which will minimize the risk of the significant losses:

$$E_{IFP}(t) = f \left\{ \max_{i=1, \dots, n} \min_{j=1, \dots, m} IP_{ij}, t \right\} \rightarrow opt \quad (27)$$

where, IP_{ij} investment project corresponding to the i -alternative to the j —direction of the capital investments; i ($i = \overline{1, n}$) investment alternatives; and j ($j = \overline{1, m}$) directions of investment activities of the company.

In addition, the maximin criterion, being a super-careful decision-making criterion, will help to reduce the riskiness of investment activity in the conditions of a shortage of available financial resources and increase the uncertainty of the external environment.

The main limitation of the investment cash flow planning model for the planning period t will be the amount of available financial resources. Then the investment opportunities of rail transport (the volume of investment cash flow) in the planning period t will be:

$$\sum KB(t) \leq FR_{inv}(t) = [0,5 \cdot NP(t-1) + A(t-1)] - KB_n(t) \quad (28)$$

where, $\sum KB(t)$ capital investment at time t ; $FR_{inv}(t)$ available investment resources; $NP(t-1)$ net profit at time $(t-1)$; $A(t-1)$ depreciation deductions at time $(t-1)$; $KB_n(t)$ the necessary volumes of the capital investments in the period at time t for the projects whose implementation was launched in previous years.

When selecting investment projects (IP_{ij}) it is necessary to focus on the values of two criteria, namely, the profitability index and the discounted payback period. This can be explained by the following

reasons (1) the profitability index shows how efficiently the financial resources (own and borrowed) invested in the project are used. It is especially important in the conditions of an acute shortage of available funds; (2) investments in rail transport due to their specificity have very long payback periods, therefore, in conditions of high uncertainty and risk, projects with shorter payback periods are priority.

The implementation of this approach to the planning of investment cash flow will maximize the expected economic effect of investment and minimize losses associated with decisions made.

Financial cash flow planning model. Financial activities in rail companies are mainly related to the attraction and servicing of external financial obligations. Attraction of the financial resources is carried out exclusively on a paid basis. In this case, a consequence of the financial problems of Ukrainian Railways, JSC is an increase in the cost of loans. Therefore, as an objective function of the financial cash flow planning model, it is advisable to use the minimization of the cost of their attraction:

$$F_{FFP}(t) = \sum_{k=1}^{K(t)} x_k(t) c_k(t) \rightarrow \min \quad (29)$$

where, k ($k = \overline{1, K(t)}$) available external sources of the financial resources at time t ; $x_k(t)$ volume of attracted financial resources from the source k ; and $c_k(t)$ cost of attracting financial resources from the source k .

The generation of financial cash flow in each period t should be carried out considering the insufficient volume of own financial resources of rail companies. Then the volume of necessary financial resources planned for a period t should be determined by the needs of both operating activities (the risk of a shortage of resources to finance operating activities) and the need for capital investments to improve fixed assets. That is

$$\begin{aligned} FR_n(t) = FR_o(t) + FR_i(t) + FR_f(t) = \\ \left[\sum_{i_{fr}} a_{fr, i_{fr}; j_{CA}}(t) x_{fr, i_{fr}}(t) + \sum_{i_{pas}} a_{pas, i_{pas}; j_{CA}}(t) x_{pas, i_{pas}}(t) \right] + \dots \\ + FR_{inv}(t) + [FR_{pr}(t) + FR_{pog}(t)] \end{aligned} \quad (30)$$

where, $FR_o(t)$, $FR_i(t)$, $FR_f(t)$ financial expenses associated with the implementation of operating, investment and financial activities for the period t , respectively; $FR_{pr}(t)$ the amount of attracted financial resources in the period t to finance the increase in fixed and current assets; and $FR_{pog}(t)$ financial resources necessary for the period t for servicing and repaying loans already taken.

It also seems appropriate to add to the planning model restrictions on the correspondence of the volumes of attracted financial resources and the need for them. This restriction can be represented as the following expression:

$$FR(t-1) - FR_n(t) \cong FR_{pr}(t) \quad (31)$$

where, $FR(t-1)$ financial result obtained by the company for the period t .

The restriction (31) will be valid only in case of insufficient volume of own financial resources, i.e. $FR(t-1) - FR_n(t) < 0$.

As it was clarified earlier, Ukrainian Railways, JSC needs significant financial resources for updating fixed assets. The consequence may be excessive costs associated with their repayment.

Therefore, it is necessary to supplement the expression (31) with a restriction on the cost of servicing previously taken financial obligations:

$$FR_{pog}(t) \leq d(t) \cdot FR(t) \quad (32)$$

where, $d(t)$ the share of the financial result obtained in the period t , which can be used to pay off financial obligations.

The use of restrictions (31)–(32) will ensure rationality in determining the amount of attracted financial resources, preventing an ineffective increase in the long-term liabilities for bank loans. In addition, compliance with these restrictions can help reduce the cost of resources involved.

The limitations of the financial cash flow planning model must be supplemented by the following relationship:

$$0 \leq x_k(t) \leq N_k(t) \text{ for } \forall k \left(k = \overline{1, K(t)} \right) \quad (33)$$

where, $N_k(t)$ available amount of the financial resources that can be attracted from a source k at time t .

Table 6. Financial plans of Ukrainian Railways, JSC for 2020–2021.

Indicators	Years	
	2020	2021
<i>Sources of financial resources</i>		
Operating profits	1.36	1.30
Profits from other activities	0.06	0.06
Short-term loans	0.09	0.10
Long term loans	0.71	0.72
Total	2.22	2.18
<i>Use of financial resources</i>		
Calculations with the budget	0.43	0.41
Infrastructure maintenance costs	0.62	0.61
Renovation of fixed assets	0.42	0.38
Investments in the development of fixed assets	0.29	0.26
Repayment of financial liabilities	0.46	0.52
Total	2.22	2.18
<i>Sources of financial resources</i>		
Operating profits	1.27	1.25
Profits from other activities	0.03	0.02
Short-term loans	0.20	0.20
Long term loans	0.68	0.67
Total	2.18	2.14
<i>Use of financial resources</i>		
Calculations with the budget	0.38	0.37
Infrastructure maintenance costs	0.62	0.62
Renovation of fixed assets	0.36	0.34
Investments in the development of fixed assets	0.26	0.27
Repayment of financial liabilities	0.56	0.54
Total	2.18	2.14

The implementation of the model (29)–(33) will allow you to plan cash flow based on meeting the needs of the rail company in the lack of the financial resources while minimizing the costs of attracting them. Balancing financial plans calculated using this set of models will be carried out by adjusting the volume of cash flows associated with (1) investment activity (a decrease in the volume of capital investments, subject to the financing of mandatory investments in support of infrastructure and rolling stock in working condition) and (2) financial activities (the formation of an optimal portfolio of short-term and long-term loans). Such an approach will allow both financing the operating activities of the rail company in the required volumes and maintaining the level of its financial stability.

The proposed approach to financial planning, based on the implementation of a system of interrelated models for planning operational, financial and investment cash flows, will improve its quality by not only ensuring transparency of cash flow of the rail company during the planning period, but also by increasing the coherence and interdependence of the financial plans. In addition, the implementation of a set of interconnected models will contribute to a more accurate determination of the volume of funds received, as well as the validity of the directions of their use to prevent the occurrence of crises. Based on the proposed model of the financial planning, financial plans were built for two scenarios for the development of rail transport in Ukraine (Table 6). The financial plan is presented in the form of a balance of sources of the financial resources and directions for their use.

An analysis of the financial plans of Ukrainian Railways, JSC has shown that in the conditions of high uncertainty, it is possible not only to maintain its importance as a “locomotive” of the national economy, providing the necessary volumes of freight and passenger transportation (when implementing the pessimistic option), but also to purposefully develop it (when implementing the optimistic option).

In addition, the effective use of available fixed and current assets in the optimization of costs will allow not only to maintain positions in the transport market the pessimistic option), but also to strengthen them (the optimistic option).

4. Conclusions

This study focuses on the development of an approach to financial planning in the context of increased uncertainty functioning of companies. The study was conducted based on data on the functioning of Ukrainian Railways, JSC during the period 2014–2019. Financial planning was based on the hypothesis of the possibility of a targeted evolution of the company in accordance with changes in the external and internal environment through the forecasting and planning of cash flows.

As a tool for researching the future, a scenario approach was chosen. Based on the analysis of key uncertainties (traffic volume and investment strategy), four scenarios of the future (pessimistic, optimistic, negative, and probable) were developed. With a decrease in traffic, rail companies will become even more unattractive for private investors. Accordingly, the probability of attracting financial resources through the mechanisms of the Public Private Partnership and Initial Public Offering is extremely low (the exception is the probable scenario).

Scenario forecasting was carried out considering the peculiarities of cash flow generation in transport companies, including rail ones. It was carried out as a sequential process of forecasting the available volumes of fixed and current assets, own financial resources, the need for additional financial resources, the composition and volume of cash flows. For the three scenarios, forecast cash flows were calculated. Their analysis showed that in a crisis, transportation activity will not allow

generating enough funds to finance investment activities, and the need for external financing will exceed the profit from operating activities. The consequence of this will be an unsustainable financial condition (optimistic scenario) or a crisis financial condition (pessimistic and negative scenario).

The financial planning model was developed as a set of interconnected optimization models for planning operational, investment and financial cash flows. This will allow to develop the financial plans balanced by the sources of the financial resources and the directions of their use. For two scenarios (optimistic and pessimistic) financial plans were developed. An analysis of the financial plans for Ukrainian Railways, JSC showed that in conditions of high uncertainty, the company can provide the necessary volumes of freight and passenger transportation, as well as maintain its position in the transport market.

The further research for scenario-based financial planning should focus on the use of information technology and the use of artificial intelligence. Its implementation in planned activities will allow to accumulate and process large amounts of information and, as a result, timely identify quantitative and qualitative changes in the external and internal environment of the company.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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