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The Railway Transport Sustainable Development: Economic Evaluating And Future Growth Trends.

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ABSTRACT

The article contains the concept of sustainable development of economic systems. The approach to the interpretation of the concept of sustainability is given. The concept of sustainability of the transport system is also proposed. On the basis of the chosen methodology of sustainability assessment, statistical indicators of its assessment in the field of economy, social development and transport ecology are proposed. They indicate for a few years are calculated. It is revealed that the development of railway transport is sustainable, as well as close to sustainable. Tendencies of decrease of stability indicators mainly in the economic area are designated. The results of the study can be used as a basis for management decisions, and also reflection the necessary key indicators of sustainable development of rail transport at the program and planning documents.

Keywords: sustainable development, transport system stability; economic stability, social stability, ecological stability, the stability indicates.

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INTRODUCTION

Problems of sustainable development of economic systems are reflected in the works of D. Meadows, J. Forrester, V.I. Vernadsky, V.I. Danilov-Danilyana, N.N. Moiseeva, N.P. Vaschekina and others [3, 4, 6, 10]. The theory of sustainability is at the stage of formation and development. We emphasize that the scientific studies of the stability of systems is an interdisciplinary field that synthesizes the knowledge of philosophy, mathematics, biology, and economics. From the standpoint of a systems approach and systems theory, resistance to external and internal negative impacts is laid down by the very nature of systems as an inherent property. Stability means that the system performs its functions under the conditions of the destabilizing effects of the external environment and changes in conditions and factors within the system.

Currently, there are many definitions of sustainability in the theory, which is associated with the multidimensionality of the category "system". Let us dwell on some approaches to the interpretation of the stability of the economic system.

A number of authors (A.L. Gaponenko [5], S.M. Ilyasov [8], and others) attribute stability to a certain stability, invariance, and state in which the basic parameters and indicators of the functioning of the system do not deteriorate. Some scientists (L.I. Abalkin [1], A.L. Bobrov, D.V. Gordienko [14]) by stability understand the ability of a system to remain reliable, stable, complete, strong. L.I. Abalkin [1] notes that the stability of the national economy is determined on the basis of the criteria of its security, stability, ability to continuously update and improve.

More accurate, in our opinion, is an approach based on interpreting the stability of the system as its ability to develop, to ensure movement along the intended upward trajectory [9]. By definition, J. Kornai [9], the sustainability of the economic system is its ability to simultaneously solve the problems of stabilization and development.

Thus, by the stability of the economic system, we will understand its ability to maintain its functions for a long time, to develop steadily in the conditions of changing external conditions and internal changes, to maintain balance in the transition to new states. To the inherent properties of sustainable systems include: self-development; the presence of strong ties and holistic interaction between the elements; ability to resist negative destabilizing effects; maintaining a state of equilibrium under the action of multidirectional forces.

The stability of any system is the most important condition for its functioning and development.

In our opinion, among the many different definitions of sustainable development, which has a deep philosophical and economic meaning, the most successful is the following [12]: sustainable development is a form of social and economic development as a continuous process of meeting the needs of present and future generations, eliminating the threat of potential to have benefits created by the system in the future. The main ultimate goal of sustainable development is to meet certain needs. The continuity of the process of meeting needs is considered as a non-decreasing growth rate of opportunities to meet needs in the long-term period with harmonious combination and interaction of all subsystems of the socio-economic system. At the same time, as the criteria for the sustainable development of the system, we denote: 1) a positive vector of the final indicators of the functioning of the system; 2) constant qualitative transformation, change of the system, its transition in time to a higher quality level.

Sustainable development is a type of development of the system, which ensures a minimum (non-decreasing) level of satisfaction of needs, increasing efficiency of resource use and saving, maintaining proper investment rates and returns, timely development and implementation of new technologies, social and environmental balance in the system itself. and in its external environment. Ultimately, following a system along a sustainability path leads to an increase in its social and economic potential.

Based on the complexity, multidimensionality of economic systems and the many components of their elements, we can distinguish several types of sustainability: industrial, financial, investment, personnel, innovation, environmental. At the same time, when assessing the sustainability of the system, selecting indicators - indicators of sustainability, it is necessary to consider groups of indicators: economic, social, environmental, technological, institutional.

As applied to the field of transport activities, under the stability of the transport system, we understand its ability to function stably and develop over a long period of time in conditions of rapidly changing conditions of the internal and external environment, achieving its development goals. In our opinion, such goals include: ensuring the satisfaction of the need for high-quality and safe transportation in accordance with the requirements of the population and the economy, as well as trends in world scientific and technological progress; aligning the technical, technological and resource potential of transport with requests from national and international consumers; implementation of requests from citizens and economic entities in the field of transport mobility.

The purpose of the research: understanding the concept of sustainable development of the transport system, conducting on this basis an assessment of the sustainability of rail transport, the development of a number of proposals to improve its economic sustainability.

MATERIAL AND METHODS

The study is based on a methodology for assessing statistical indicators of the functioning of the transport system, grouped into blocks: economic, social and environmental. The methods of aggregation, statistical rationing, the index method, the grouping method were used.

As criteria for the sustainability of the transport system, based on the results of studies [14], we select the following indicators available in the statistical reporting (Table 1).

1 group of indicators "Economic Sustainability":
dynamics of cargo turnover, passenger turnover;
level and dynamics of labor productivity;
level and dynamics of indicators of profitability of transportation;
the level and dynamics of capital productivity of fixed capital;
the level and dynamics of investments in fixed assets, the introduction of new capacities in transport, the degree of depreciation of fixed assets.

2 group of indicators "Social Sustainability":
the state of labor resources - the dynamics of training specialists for the industry;
standard of living of workers.
3 group of indicators "Environmental Sustainability":
level and dynamics of emissions of pollutants;
the level and dynamics of production waste from transport activities.

RESULTS AND DISCUSSION

To assess the level of sustainability of the transport system for each of the above indicators, it is necessary to take into account the degree of their proximity to the most optimal values, the best values of the corresponding indicators for the national and world economy. Therefore, the value of the relevant indicators are expressed in shares of indicators-standards by the formula:

$$ki = xi / \max(xi)$$ - for direct indicators;

$ki = \min(xi) / xi$ - for inverse indicators for which growth and excess over the standard worsen the state of stability;

xi - the value of the indicator i in a specific time period for the estimated transport system;

max(xi) andmin(xi) - values of indicators-standards, which are taken as the threshold, the optimal values.

In each of the three groups of indicators (economic, social and environmental sustainability), the values of various indicators are averaged. The calculation of the average group values is carried out according to the formula:

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$$I_{ekon(soc.,\ ekol.)} = \sqrt[n]{ki1 \cdot ki2 \cdot ki3 \cdot \ldots},$$

n - the number of indicators of sustainability in the relevant group of economic, social, environmental indicators;

ki1, ki2, ki3 etc. - unit values of sustainability indicators of the transport system for a specific time period.

The integral stability index of the transport system will be determined by the formula:

$$I_{ust} = \sqrt[3]{I_{ekon} \times I_{soc} \times I_{ekol}}$$

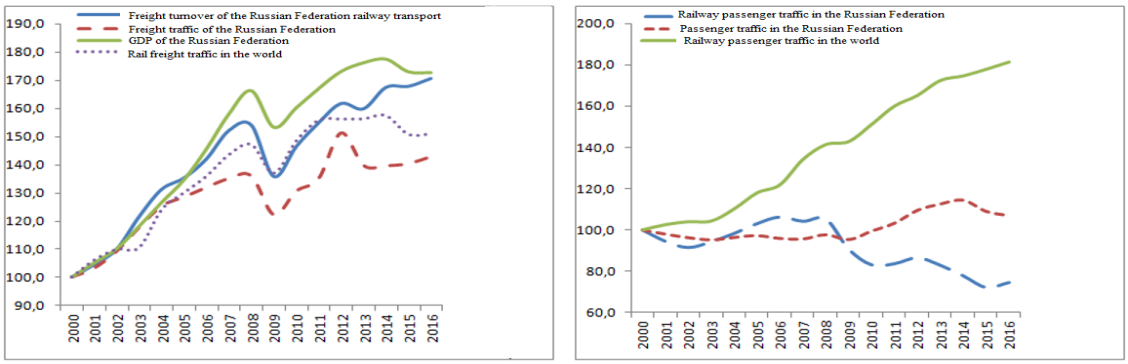
After the calculations, it is necessary to interpret the results of the stability of the transport system. Based on the study [14], we give the threshold values of the integral stability index of the transport system (Table 1).

Table 1: Interpretation of the threshold values of the integral stability index of the transport system

The values of the integral index of stability in the interval	The degree of stability of the transport system
$0,9 < I_{ust} \leq 1,0$	High level of sustainability
$0,75 < I_{ust} \leq 0,9$	Sustainable development
$0,5 < I_{ust} \leq 0,75$	Development close to sustainable
$0,25 < I_{ust} \leq 0,5$	Development with certain signs of sustainability
$0,1 < I_{ust} \leq 0,25$	Unsustainable, pre-crisis development
$0 \leq I_{ust} \leq 0,1$	Crisis, absolutely not sustainable development

Calculations using the above methodology should be performed for a considerable time period, since the assessment of the stability dynamics is possible when considering long-term changes in the system. At the same time, individual short-term deterioration of indicators can be compensated by the tendency for their improvement over long periods of time. The study on the assessment of the sustainability of the railway transport system in Russia was carried out for the period from 2001 to 2016, which for convenience of the formulation of conclusions is divided into intervals: from 2001 to 2004. (reforming of railways), from 2005 to 2008 (upward phase of macroeconomic growth); 2009-2012 (the period of implementation of the updated strategies); 2013-2016 (modern stage). 2000 as the base year is not included in the calculation.

Figure 1 shows the dynamics of effective indicators of railway transport activity. A high degree of sustainability is characterized by the rail freight sector. In recent years, the pace of its development in Russia is higher than the world. The sector also developed more dynamically than the transport sector in the country as a whole.



* Note: hereinafter, in subsequent figures, the authors in a graphic form are presented the time series of calculated indicators based on the data [13].

Figure 1: Dynamics of freight turnover and passenger turnover of the railway transport of the Russian Federation and comparable indicators (2000 = 100%) *

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The railway passenger complex is characterized by unsustainable development: the decline in passenger turnover for the period under review was 25%, while the increase in passenger traffic in the countries of the world as a whole was over 80%.

Evaluation of investment activity indicators for a number of indicators allows us to conclude that the development of the system as a whole is stable, but from 2010 the sustainability state from the positions of investment worsens (Fig. 2). The volume of investments per 1 working person by rail is almost 2 times higher than in the country as a whole (Fig. 3).

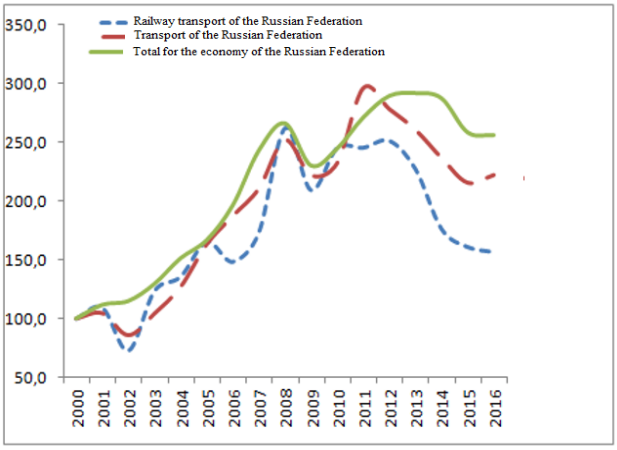

Figure 2: Dynamics of investments in fixed assets (2000 = 100%)

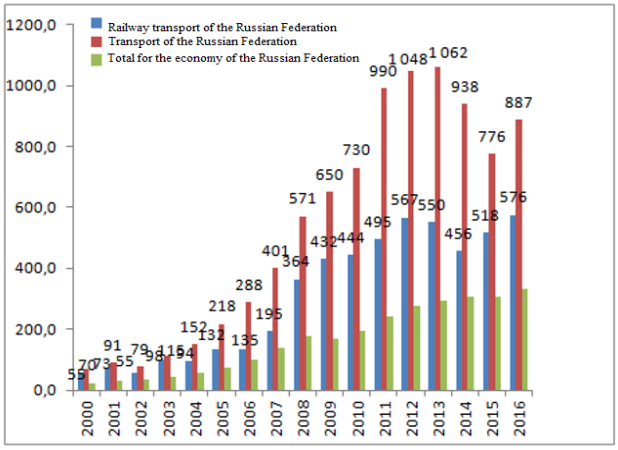

Figure 3: Dynamics of investments in fixed capital per 1 operating in current prices, thousand rubles

The best periods of investment activity of the national railway complex - 2008-2012. Nevertheless, the growth rate of investments in the development of rail transport over the entire period is lower than in the country and in the transport sector as a whole. The introduction of new infrastructure capacity was more significant in the early 2000s (Fig. 4). The peak of the introduction of new railways accounted for 2004-2008. (on average 105 km per year), for the same period - the maximum volumes of entering the second track (on average 110 km per year), the highest rates of electrification were achieved in 2000-2003. (about 530 km per year).

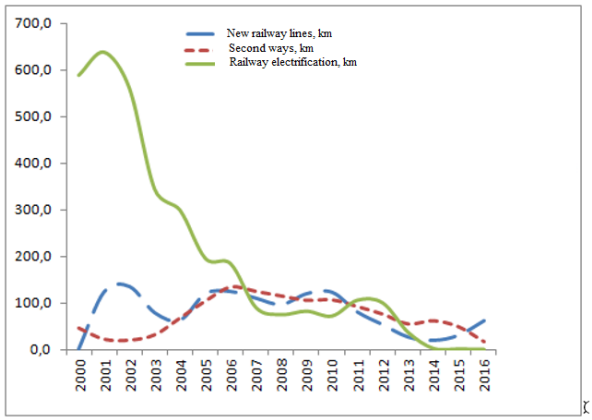

Figure 4: Dynamics of commissioning of new capacities transport km

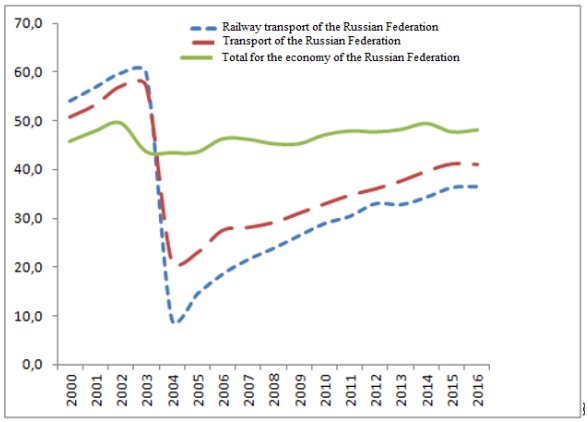

Figure 5: Dynamics of fixed assets depreciation,%

According to the degree of depreciation of fixed assets, Russian Railways is characterized by one of the best values among other sectors of the Russian economy (Fig. 5). But objectively, the low rates of depreciation of fixed assets of railways are not due to the rate of their renewal, but because since 2003 they have been depreciated based on the market value at the time of transfer of fixed assets from the Ministry of Railways, excluding previously accrued depreciation. Therefore, it should be borne in mind that in this case the depreciation of funds does not give an accurate picture of the sustainability of rail transport in a particular area (the state of funds).

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Consider the financial indicators of sustainability. According to the profitability of sales, calculated on the net profit, the stability of railway. transport is not significant. Every year, the level of profitability is lower than in the economy as a whole (Fig. 7). Since 2013, the profitability of traffic drops, inferior to the average values for transport. In 2014, a negative financial result was noted. Lack of sustainability is noted in relation to productivity. Since 2009, there has been a growing lag in the production of railway lines. traffic from the average for the economy (Fig. 6).

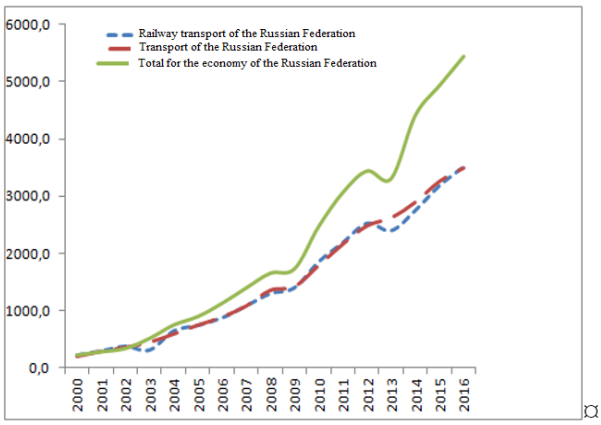

Figure 6: Dynamics of production - revenue per 1 operating in current prices, thousand rubles / person

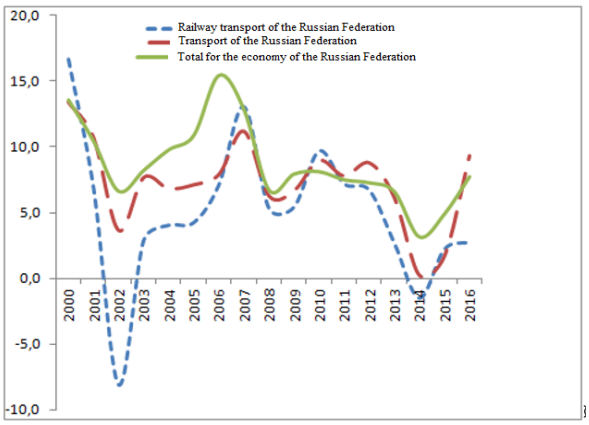

Figure 7: Dynamics of sales profitability by net profit,%

The return of fixed assets remains one of the lowest among other sectors of the economy (Fig. 8). As a result, the renewal of funds is limited due to the lack of own funds due to low turnover per ruble of funds.

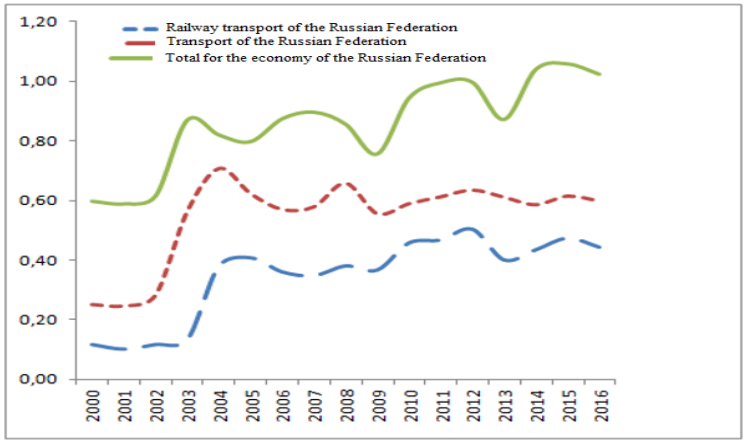

Figure 8: The dynamics of the indicator of capital productivity, RUB/RUB.

Close to sustainable, the social position of the industry can be characterized [11]. Training for the transport industry is sustainable; the output of specialists, according to statistics, has tripled compared with the beginning of the 2000s (Fig. 9). The average wage is higher than the Russian and industry. Since 2014, it has been declining, but remains generally high (Fig. 10).

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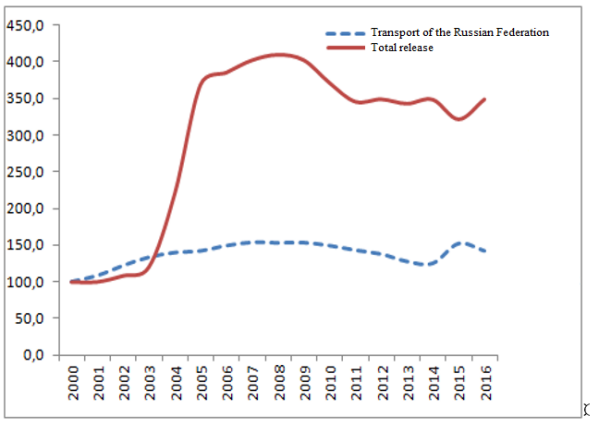

Figure 9: Dynamics of the number of graduates from state and municipal universities and institutions of secondary vocational education (2000 = 100%)

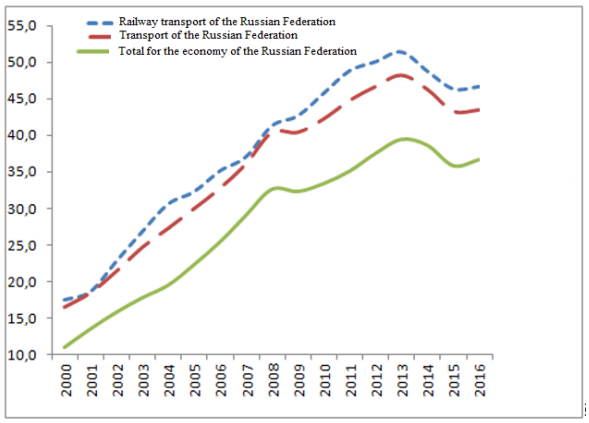

Figure 10: Dynamics of the average monthly wage of workers, thousand rubles (in comparable prices of 2016)

The vector of environmental sustainability of railway transport is not unique. Separate improvements are observed: for example, the amount of waste generated is reduced (Fig. 12). On the other hand, against the background of a significant reduction in emissions of air polluting substances in the country, there is no proportional reduction in transport (Fig. 11).

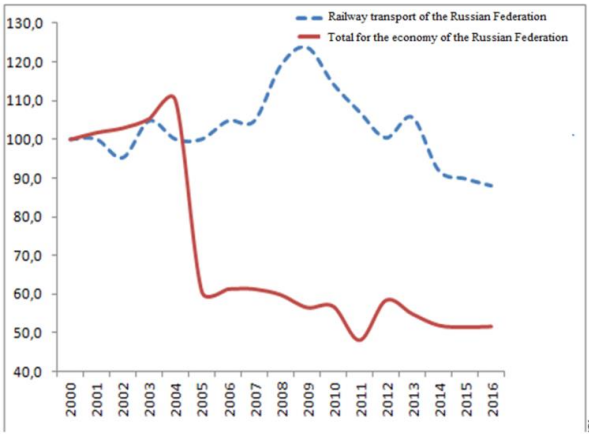

Figure 11: Dynamics of pollutant emissions into the atmosphere (2000 = 100%)

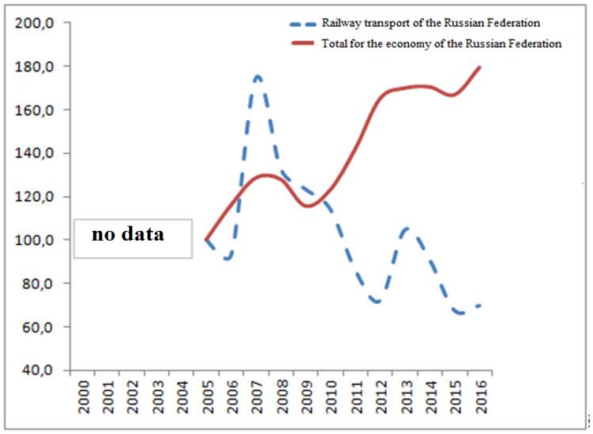

Figure 12: Waste generation dynamics (2000 = 100%)

The calculations carried out according to the above methodology made it possible to conclude that the development of railway transport remains sustainable (2001-2004), as well as close to sustainable (2005-2016) - Table 2.

Table 2: Results of calculations of the integral index of sustainability of railway transport in 2001-2016

Indicators	Periods			
	2001-2004	2005-2008	2009-2012	2013-2016
value of integral stability index	0,768	0,731	0,726	0,678

CONCLUSION

The main reason for the decline in the integral index is the decrease in the stability index in the field of economic indicators. By 2016, the value of the index for the “Economic Sustainability” group turned out to be the lowest for the period considered (0.553). Social and environmental sustainability remain high throughout the entire study period.

As the main recommendations for improving economic sustainability, it is proposed to use the advantages and increase the effect of the use of digital technologies in the activities of Russian Railways [7]. The main result of this work is to meet the needs of passengers and shippers at a new qualitative level. Due to the improved service for customers, operation of railway information-figures, reduction of operating costs, generation of new revenue streams will be provided. And on this basis - the progressive movement along the path of stability.

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