PRODUCTIVITY RESOURCES: THE U.S. EXPERIENCE

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ABSTRACT

In the context of the dynamic changes in the volume of railway transportation its successful operation depends on the efficient use of all production resources involved in operational activities. Among them crucial importance is retained by human resources, their ability to achieve goals, high professional efficiency, and ultimately all that is collectively reflected in the index of labor productivity. The analysis in the article makes it possible to compare the experience of the United States and Russia in the field of railways, to identify development trends and means to improve the resource potential of transport companies.

ENGLISH SUMMARY

Background. *The structure of the staff of «Russian Railways' at the beginning of 2012 comprised: workers – 68.1%, specialists – 21.5% managers – 6.9%, employees – 3.5%. With a similar structure on the railways, the United States since 1979 reached by 2008 a significant reduction in 520 thousand staff to 166 thousand people, and increase in the proportion of workers directly involved in transportation of up to 81%. Labor productivity increased from 2.0 million to 10.8 million ton- miles, i. e. more than 5 times. The attention should be focused not only on this spectacular fact, but also in general, on the problems of human resource management.*

Objectives. *The objective of the study was to compare dynamics of labor productivity in the USA to the similar Russian statistics to reveal major impact factors of changes.*

Methods. *The authors use methods of comparative analysis of statistical data on productivity based on different methods relative to assessment of labor-related factors.*

Results. *The most important generalizing economic indicator of the effectiveness of any company – labor productivity is generally defined as the amount of useful products produced per time unit by one employee.*

In justification of management decisions regarding personnel may be used other indicators: labor intensity, factors and working conditions of workers, reserves and resources of increase in production, employment and staffing, turnover and expenditure indicators. However, unlike the productivity they reflect the efficiency of labor resources involved only in a limited perspective.

In a competitive environment, the company will not be able to reach significant success if it does not use available resources efficiently.

The global dynamics of labor productivity over the past 10 years is on the rise. This confirms the International Labor Organization (ILO), dealing with the regulation of labor relations.

Specialized institutions such as European Association of National Productivity Centers, American Productivity & Quality Center, Asian Productivity Organization, etc. contribute to the rise in labor productivity in foreign countries. The overall aim of programs of these organizations is to improve the performance of companies by increasing labor productivity.

In the European concept of productivity, developed in 1998–1999, «productivity» refers to the continuous improvement of the use of resources, promoting economic growth, innovation, employment and business dedication in various areas (Pic. 1).

From the standpoint of economic theory major, strategic resources to improve business performance have always been labor and capital. [6]

On the U. S. railways, efficiency is considered in two main aspects: technical and economic. The technical aspect is assessed on the basis of quality of the used raw materials, semi-finished products, progressiveness of applied technology, skill level of employees, etc. The economic aspect involves the efficient use of resources (resource or factorial efficiency) and overall performance. Resource efficiency is determined by one of the factors of production (labor, capital, materials, etc.). In the U.S., these factors are:

- *labor productivity;*
- *efficient use of fuel resources;*
- *productivity of the rolling stock;*
- *infrastructure productivity;*
- *operating efficiency;*
- *efficient use of capital;*
- *safety and environmental friendliness.*

Labor productivity is measured by the following indicators:

- ✓ *ton-miles / 1 man-hour;*
- ✓ *ton-miles / 1 man (number of personnel according to the working categories);*
- ✓ *operating income/ 1 dollar payroll.*

As for ton-miles per one man-hour (Pic. 2), on the U.S. railways this figure for three decades (1979 to 2009) increased by 4.3 times.

Analysis of changes in labor productivity over the same period, calculated through the volume of the railway work (million ton-miles) per one employee (Pic. 3) shows a significant growth (more than 5 times).

Labor productivity growth was carried out by improving the technology of traffic process and organizational measures that ultimately has significantly reduced operational contingent (Pic. 4).

On American railways remuneration of labor amounts to more than 35% of all operating expenses and is one of the most important elements of cost mechanism of the industry.

Impact of the main factors of resource efficiency on labor productivity is shown on Pic. 5.

Fuel productivity on the U.S. railways is measured by the following indicators:

- ✓ *ton-mile / 1 gallon of fuel consumed;*
- ✓ *car-mile / 1 gallon of fuel consumed.*

In order to reduce diesel consumption for traction different approaches are used – from encouraging relevant personnel to change of practices adopted in the daily operational work, and the introduction of new technologies. The efficiency of fuel resources has been growing steadily since 1979.

Research and development in the field of diesel-electric engines have reduced fuel consumption. This was made possible thanks to improved production technology of components (turbo compressors, injectors, lubricants reducing friction in the transmission, etc.), as well as innovations in locomotive engineering such as:

– Hybrid engines, which accumulate energy during braking in order to use it for speeding-up;

– Fuel consumption monitoring system (Leader), which provides real-time information about the operating conditions; the onboard computer calculates and displays the optimum speed obtained from data on road profile, the radius of curves, the length and weight of the trains etc.;

– The start-stop system that automatically transforms the locomotive engine in economy mode including standing time and instantly switching on the operating mode at the beginning of the movement.

Improved methods of lubrication of the rolling surface and the side faces of the rail head, especially in curves, also contribute to fuel economy by reducing the resistance to motion. In addition to the technological innovations, new methods of management were used.

When comparing the systems of resources productivity appraisal systems on rail transport of the Russian Federation and foreign countries, it is advisable to turn to specific indicators of efficient use of fuel and energy resources, following the example of the U.S. railways. Due to the fact that in Russian reports freight rate and passenger turnover are not separated by type of traction as a general indicator can be taken the indicator «gross ton-kilometers of freight and passenger traffic», respectively, in electric and heat energy traction. Their attitude to the cost of electricity and fuel for train traction will characterize the productivity of these resources [5].

Infrastructure productivity on the U.S. railways is measured by three indicators:

- ✓ *ton-miles per year / operational length of railway lines in miles;*
- ✓ *ton-miles per year / the total length of railways in miles;*
- ✓ *ton-miles per year / $ 1 spent on infrastructure maintenance.*

Evaluation of infrastructure productivity is based on technological (through indicators of traffic density), and cost approaches. There are following types of traffic density: traffic density of operational length of railways and traffic density of the total length of railways, which takes into account second tracks on the main lines, station tracks, and some others.

When assessing the dynamics of infrastructure productivity with different methods of calculating traffic density, there is no significant difference, because during the period under review length of railways has not changed much. The ratio between the total and operational length of railway lines is about 1.6–1.7 times.

Since evaluation of infrastructure productivity only by the intensity of its use does not disclose the nature of evaluated economic processes, infrastructure productivity is calculated as the productivity of each dollar spent on the maintenance of one mile track.

As for technical equipment and methods of track maintenance, the U.S. railways are extremely nonuniform. Along with the use of technologically backward and obsolete track designs and obviously imperfect methods of work, on some of the most profitable railways track facilities are at a high level.

Equipment productivity has its own indicators:

- ✓ *ton-mile / 1 locomotive, engaged in transportation;*
- ✓ *tons of shipped cargo / 1 car of exploited park;*
- ✓ *ton-mile / $ 1 spent on the maintenance of rolling stock.*

In the considered years, there are two main periods of locomotive productivity development:

– The first lasted since the early 1980s until the mid-1990s, when productivity increased by 2.2 times (from 32.53 million to 70.37 million ton-miles / 1 locomotive);

– The second period lasted from the mid-1990s until 2008, when the productivity was stable before the fall (up to 63.72 million ton-miles / 1 locomotive) noted in 2009.

Equipment productivity is also measured using the cost approach. It reflects the productivity of every dollar spent on maintenance of equipment, excluding labor costs. In 1979, equipment productivity with the use of this approach amounted to 143 ton-mile / $ 1. By 2009, it had grown to 376 ton-miles / $ 1, and the growth rate was 263%.

Equipment productivity (locomotives and cars) in the current system of statistical accounting is defined only in freight traffic. Thus volume indicators (ton-miles) correlate with exploited (working) park, respectively, of locomotives and cars. Equipment productivity can be best flexibly adjusted based on the improvement of technology and work organization.

Operations productivity on the U.S. railways is measured by operating income / operating expenses.

In practice, railways usually use «utilization ratio», i. e. the ratio of operating expenses to operating income. However, this attitude does not correspond to the definition of productivity, so for the evaluation of work an inverse relation is used.

Capital productivity on the U.S. railways is characterized by:

- ✓ *net income from transport activities / investments;*
- ✓ *ton-miles per year / investment.*

Return on investment (ROI) determines the extent to which the company uses capital for profit. Therefore, the ratio of net profit to investment will be an indicator of efficient use of capital. For railways ROI is the ratio of net operating income from transportation activities (NROI – Net railway operating income) and investment in the development of the network (rail infrastructure and rolling stock).

ROI during the period under review varies with strong fluctuations, but if the attention is focused on the trend line, there are several phases of development.

«Reduction phase». From 1979 to 1991, profitability increased as a result of continuing decline of key assets (equipment and tracks) which are owned by the railway. ROI increased from 2.93% in 1979 to 8.11% in 1990, then in 1991 the fall was to 1.3%;

«The investment phase». In 1992 and 2003, ROI has stabilized: 6.25% and 6.23%. This was due to increased investment (acquisition of rolling stock and modernization of the track) at a constant income base.

«Income phase». From 2004 to 2009 investment retained its dynamics, but higher profits caused improvement in ROI. Its value increased from 6.12 to 10.7% in 2008, although a decrease to 7.96% followed in 2009.

Improvements in safety and environmental impact on the U.S. railways are measured by the following indicators:

- ✓ *number of accidents / train-miles;*
- ✓ *number of injured and sick / number of employees;*
- ✓ *exhaust emission / ton-miles per year.*

Transport safety indicator considers the number of derailment and collision in relation to 1 million train-miles, excluding accidents at rail crossings. The United States managed to achieve a significant

reduction in accidents related to the movement of trains.

Particular attention is paid to training and advanced training of railway workers. There are special programs on the following topics:

- *works safety;*
- *human resources management;*
- *health surveillance of workers;*
- *monitoring lassitude of locomotive crews workers;*
- *remote control devices;*
- *training simulators;*
- *interactive teaching of staff;*
- *training videos on safety and first aid.*

The comparison of labor productivity in Russia and the United States under similar conditions shows that it is much lower on Russian railways (Pic.6).

In the USA, increase in labor productivity has been achieved largely through automation of technological and organizational processes, implementation of unmanned production technique, focusing on the most high-density traffic lines.

Pic. 6 shows that the growth rate of labor productivity on the railways of Russia (127.6%) is higher than on the U.S. railways (106.5%). However, it is not enough to approach in short-and medium-term to the figures of productivity overseas.

Conclusions. *Exploring labor productivity on the railways of the world, it can be noted that there are significant differences in the measurement system, and in the approaches to determine the impact of different factors.*

So, certain conclusions can be drawn:

1. Labor productivity is the most important integrated indicator of the effectiveness of a company, which shows the volume of services in kind or in monetary terms, which is produced by one worker per unit of time. Although there are different approaches to the estimation of productivity used in the USA and the Russian Federation, the methodology, based on the ratio of the results to the contributing costs, remains similar.

2. Labor productivity is affected by such factors as infrastructure productivity, equipment productivity, efficiency of fuel and energy resources, financial productivity, operational productivity, safety and environmental productivity, the rate of improvement of working conditions, the introduction of new technical systems and technologies.

3. On the U. S. railways substantial labor productivity growth was achieved by improving the technology of transportation process and organizational measures that eventually allowed significantly reducing transport equipment operatives.

4. When comparing the effectiveness of the U.S. and Russian railways, it is advisable to take into account a wide range of indicators characterizing the various aspects of activities. At the same time, Russian railways carry a huge social burden, tariffs in an infrastructural component in Russia are tightly regulated by the state. The level of the same tariffs in the USA is about 3.5 times higher. Different conditions of roads maintenance, natural factors caused by geographic, climatic, social, demographic, political and economic should be taken into account.

5. In order to increase production resources productivity on Russian railways and bringing them to the level of world standards, the implementation of technical and technological innovation, automation and mechanization of processes to enhance research capacity of the industry are required.

6. To create production resources management system, a comprehensive evaluation of the effectiveness of their use is needed, primarily with a focus on human resources and means of stimulating growth of labor productivity, modernization of equipment and technologies for achieving production characteristics corresponding to the best foreign analogues.

Keywords: rail transport, efficiency, labor productivity, human resources, personnel management, efficient use of fuel resources, equipment productivity, infrastructure productivity, operational efficiency, capital efficiency.

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