



Introduction of Digital Technologies in Organization And Management of Regional Passenger Transportation

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Abstract: Digital technologies from an unknown phenomenon in the hands of advanced scientists have passed into an urgent need with which most modern people can no longer part either at home or in the framework of their work processes. Huge robotic productions have already been created and are operating, and automation has become understandable and familiar to all citizens, regardless of their initial education and current age.

In our opinion, the key problem today, not so much in new technical systems, there are already quite a few of them, but in a completely different level of its use corresponding to the features and tasks of the digital environment of the fourth industrial revolution, which is primarily determined by new principles of organization and management.

German Gref [2] at the INCOSAI Congress, expressed the idea that the world is on the verge of the first revolution of state administration, since its prevailing technologies do not correspond to the realities of the fourth industrial revolution. Moreover, in the framework of the so-called four industrial revolutions of this kind, changes in managerial paradigms took place constantly and in parallel to these events.

It remains to add that if we go beyond the usual division of the processes of economic development into 4 industrial revolutions, and consider them more broadly as scientific and technical, then, for example, D. Shmihula [14] in his works identified 10-11 such periods in History, which correlates with our own research in the framework of the theory of social development (TOR V.V. Ivanova [4]), where the period starting from 2026 (social formation) will be the tenth since the Neolithic revolution - the beginning of the domination of the social development of mankind. And each is determined by its own circle of technological and other innovations, including new approaches to management. These approaches change at such a moment in the most natural way, in connection with the next change to this point at this point in a public (including economic) organization, which requires new management approaches.

Keywords: Digital technologies, robotic productions, digital environment, Neolithic revolution.

I. INTRODUCTION

Passenger transportation, like many other industries, is experiencing a lot of serious problems that, within the framework of the existing managerial paradigms and social frameworks, have not yet been solved. First of all, these are financial problems. According to independent experts, today the volume of revenue collected by all market participants from passenger transportation officially declared by transport companies is about 1 trillion rubles per year [11]. Of these, about half are the means of the passengers themselves, and the other half are the budgets that compensate the enterprises for preferential transportation.

The amount of funds at first glance is significant, but most transport enterprises are unprofitable and even maintaining transportation at the current level requires constant budget subsidies to keep these enterprises afloat. Tariffs are another way out, but their constant growth is limited by the social reaction of the population and its economic opportunities, which by now are almost at the limit.

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Table- I: The main indicators of passenger transportation in Russia by urban and suburban buses and electric vehicles (trams and trolleybuses) for 2016 according to Rosstat [12]

Passenger Traffic	buses ^a	trams	trolleybuses
Passengers transported per year, billion people	11,1	1,3	1,3
Number of vehicles, thousand units	896 (455) ^b	7,7	9,5
Age of vehicles over 10 years, %	48	80 ^c	55
Number of cities of presence (for electric transport)		61	87
Number of routes (for electric vehicles)		537	732
Fixed assets, billion rubles	299,5	66,2	18,6
The degree of depreciation of fixed assets, %	58,3	62,4	67,6

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Total financial performance, billion rubles	-7,4	-1,9 ^d	
The proportion of unprofitable companies, %	58,9	77,5 ^d	
Investments in fixed assets, billion rubles (2016)	18,1	^e	
Tariff indices for services, % (2017)	110,8 ^f	112,8	112,3

^a automobile (bus) passenger transport, subject to the schedule;

^b in parentheses indicate the number of passenger buses owned by citizens;

^c the share of trams older than 20 years is 67%;

^d data for urban electric transport in general, including the metro;

^e in urban electric transport (including the metro), investments in 2016 amounted to 123.6 billion rubles;

^f value for the city municipal bus.

Excluding replacement of rolling stock within the country, the volume of such subsidies and other assistance amounts to several hundred billion rubles annually. The task of replacing rolling stock, which is significantly worn out in many regions, is estimated by VEB's leadership, at another 2.1 trillion. rubles [11]. And there is also a critical transport infrastructure (bridges, roads, crossings, stops, contact systems, service parks, etc.), which also requires active restoration.

These figures allow us to conclude that it is impossible for most regions of the country to solve their transportation problems only at the expense of the finances of the regions. Moreover, without an integrated approach to the problem at the federal level, which includes a high share of import substitution in the industry, the cost of the issue for the economy as a whole will be even higher.

Meanwhile, it is the solution of managerial tasks that allows us to achieve not only cost minimization within the framework of an integrated approach, but also in individual regions, and even for individual completely unprofitable carriers.

II. MATERIALS AND METHODS

Passenger transport services are present in each region and occupy one of the key places in its socio-economic development. The specificity of passenger transportation is associated with its special sensitivity as the social condition of society, and its production activities.

For this reason, regardless of the depth of economic problems, the problems of passenger transportation will be solved to the last possible opportunity with the involvement of all local, as well as possibly significant federal funds.

As a result of this, the specifics of the post-Soviet development of this industry led to a rigid dismemberment of the transport theme in all regions. At the same time, the division took place not so much by enterprises and personnel, but by service lines (for individual routes - and, accordingly, the separation of financial revenues - for private owners, and costs - for state-owned enterprises). As a result, in each region, in addition to private carriers, state-owned enterprises were necessarily preserved. However, if the loss-making and inefficiency of private carriers is often only on paper, government carriers initially work with the most complex, potentially loss-making transportation.

III. RESULT AND DISCUSSION

Against this background, socially demanded, but resource-intensive and requiring constant support of the electric transport network in many regions have either been

dismantled, or are on the verge of deterioration and forced termination of operation. Neither enterprises nor budgets have the means to restore them.

So, for example, a tram fleet transporting up to 4 million passengers a year in Lipetsk brings total revenue of about 159 million rubles a year, the networks are completely worn out and no funds were allocated to maintain them for twenty years, while the estimated costs of restoring the entire transport component with infrastructure and staff - more than 4 billion rubles, with the annual budget of the city of Lipetsk about 10 billion rubles.

In recent years, the President of the Russian Federation and the federal center have begun to pay increased attention to this problem and, whenever possible, have invested heavily in solving urgent problems, which noticeably affects the appearance and work of many Russian cities, but this is not a one-time problem. It is impossible to just fix it. It forms significant flows and interests of different groups, which create the current pros and cons in this work.

Where technological iterations account for tens of billions (passenger trips) per year. Where the number of vehicles that regularly work with passengers is measured in almost millions, and the geography of this movement is constantly changing, it is important not only to clearly determine the economy of the trip, but also to manage these flows in general, and in real time. Therefore, it is impossible to make the state sector of passenger transportation fully effective when allocating the most solvent and saturated routes in significant quantities to private owners in principle. However, it is possible to optimize costs and significantly increase the return on work of state enterprises, and private companies today. The development of digitalization and other innovative solutions in the field of passenger transportation has been active for several years. Moreover, in general, and especially in certain regions, the country does not look completely backward, applying in practice the most advanced solutions implemented by a large number of unrelated companies. From the analysis of the situation presented below, it follows that in the process of creating new automated and robotic systems at the design stage, several solutions can and should be considered (each of which can be quite expensive). This approach allows you to optimize the solution itself. And its effectiveness can be ensured by the widest possible subsequent distribution (replication), which will not greatly increase costs, but will significantly increase returns. Therefore, it is important to work out regional solutions together with the regions and take into account their specifics, but the basic one should be extended to the regions from a single center. That is, the transport task, primarily federal. Regardless of this, for any model, again at the federal level, it is necessary to provide for the standardization of tasks and information blocks, as well as reporting, so that in the case of even spontaneous automation the federal center does not face a closed door. At the same time, an effective way to influence the spontaneous process of industry automation in the regions themselves is to issue federal standards for data flows, their storage, processing and reporting forms, as well as establish requirements and functioning parameters of regional transport systems.

Until such work is done, all automation will be mainly aimed at the endless earning of funds by its participants, and increased efficiency will remain available only to individual enterprises or individual regions. For example, Nizhny Novgorod. Of the automation works currently being carried out in the Russian regions as the most promising and positive experience, our attention was drawn to a pilot project on the automation of payments in transport, which ended in the summer of 2019 in Nizhny Novgorod.

The region itself is the largest in the Volga region and one of the largest in the country in terms of passenger traffic. The work of all types of transport is represented on its territory, and its position in the region and within the framework of economic cooperation significantly increases transport activity.

Almost the entire range of transport problems discussed above is also characteristic of this region, which creates the need to search for not only individual, but also complex solutions, as in other major Russian cities, such as Moscow and St. Petersburg.

The solution of certain problems of automation in transport is not uncommon, especially to ensure the turnover of payments. Here you can get a good budget and there is something to provide for further comfortable support. Moreover, even such tasks are solved by most companies in different regions with big problems.

In this case, the pilot project brought quite expected positive results, since it actually grew out of the most successful projects of such a plan in Russia - Moscow payment systems for transport Troika, Strelka and Aeroexpress. The next planned step should be the one that interested us in a comprehensive plan for the reorganization of transport company management.

In addition to the "fare payment system", which forms the data stream on the characteristics of the fare payment in real time, linking to routes and requirements for the fiscalization of the process, in the basis of this proposal of the Technesis company, it is also proposed to use the Navigation automated control system, also generating a real-time data stream from vehicle sensors in its working environment, which makes it possible to judge not only the location of the vehicle, but also the parameters of its movement and work, and a set of accounting and accounting information on the operation of the enterprise as a whole, its individual employees and units of equipment.

A more detailed set of tasks for these elements of the overall architecture of the system is presented in the Table 2.

Table- II: The composition of the basic elements of the general architecture of the solution for automated control systems [9]

The main elements of the architecture of the PCS ACS and their functions	The composition of the main elements of the architecture of ACS FCD
IC (Accounting and planning)	Accounting and tax accounting Cadastral registration Accounting for repairs and maintenance of vehicles Inventory control Planning Parameters for PLC Fuels and lubricants Management and production accounting
Fare system (Revenue Control)	Cashless fare Transactional Income Accounting Accounting for passengers of preferential

	categories
	Revenue collection control
ACS "Navigation" Cost control	Transport Planning Dispatching Maintenance of electronic route passports Passenger information Personnel Cost Control Control of passenger traffic and fuel costs
ACS (Analysis of indicators)	Presentation of data in analytical formats Monitoring key performance indicators Obtaining operational reports on the activities of the enterprise

As a result of the fusion of systems and their elements [13] into a single complex, first of all it has a new synergistic effect - individual information elements from different systems, combining on the same data, form new integral information.

For example, the credentials for the storage and movement of fuel and lubricants delivered by the Navigation automated control system and a number of vehicle sensors, as well as due to the flow of information and payment systems, allow with high accuracy, in real time, to identify attempts to sell part of the fuel by drivers that were previously difficult to fix in practice by other methods.

The formation of this kind of data allows us to solve at a fundamentally different level the most urgent task - identifying the "lack of revenue" of revenue. Unfortunately, quite a lot of different ways of concealing funds have accumulated in practice and it is impossible to identify all approaches within just one technique.

IV. CONCLUSION

The combination of new tools opens up wide opportunities for the implementation of other traditional transport tasks. For example, revealing the real distribution in time and space of the passenger flow, taking into account the specifics of the days of the week and other repeating factors.

Previously, special meters were hired to solve such a problem, and on the selected day the whole city could work like that. The accuracy of such calculations left much to be desired. And significant costs made the effectiveness of such activities relative. In current conditions, this task is already being implemented in a constant background mode, with virtually no additional costs. The level of planning and organizing the work of the enterprise itself also becomes different. Monitoring the condition of the driver actually protects him from criminal activity, which not many decide to conduct under such a control system. Further expansion of data flows and automation of their processing allow us to optimize the work of internal services. It is interesting that a modern bus and installing a sensor system in it can collectively collect more information about passengers and their interests to a greater extent than individual Internet or mobile operators, which in turn can help solve not only directly transport problems, but also other urban issues. For example, placement of infrastructure, or trade pavilions. As well as crime prevention.

Inspection of the enterprise, identification of its specifics, accumulation of databases allows for each situation to form their own action plan aimed at the overall optimization of the enterprise. In the aggregate, such actions against the background of revenue growth by tens of percent annually, while reducing the costs of current activities, allow us to eliminate unprofitability, at least without taking into account the replacement of the fleet, and also reduce the burden on the budget and minimize the threat of tariff growth. Which, in addition to the economic sphere, leads to stabilization and of domestic political.

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