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Process Approach to the Analysis of Management Efficiency at Transport Enterprises

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ABSTRACT

The article discusses theoretical and practical issues of the effectiveness of process management at transport sector enterprises in the Russian Federation. The comparative characteristics of management functions and business process functions are given, the importance of implementing individual business processes and subprocesses and their impact on management efficiency is emphasized. **The purpose** of the study is to expand the methodological tools that make it possible to form the most optimal model of business processes, which allows to increase the overall efficiency of management, to explore process-oriented management tools and their role in a dynamically changing market environment, as well as to outline a number of planning and preventive measures. The objectives of the study are to describe the methods of implementing the process approach at the enterprises of the transport sector, which contributes to improving the effectiveness of management in general. **The methodological basis** of the research is the concepts of management theory, the theory of evolutionary economics. The article used an instrumental and methodological apparatus based on synthesis and analysis, management engineering, classification and identification. The author presents a developed toolkit that allows you to determine the most optimal set of business processes at enterprises in the transport sector in order to increase efficiency.

The practical significance of the study lies in the presented typology of business processes for enterprises of the transport sector, which allows to significantly reduce the costs of the management apparatus, as well as indirectly prevent the occurrence of damage. In addition, the authors have clarified the concept of the process approach in relation to the functioning of transport firms and companies.

Keywords: process approach; management efficiency; business processes; subprocesses; transport companies; process characteristic

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INTRODUCTION

One of the most optimal and rational methods of considering management problems is the process approach. A number of authoritative experts are of the opinion that the basis of a productive management process is its composite decomposition into proportional components according to the relevant criteria [1, p. 83]. In this case, a specific list of management processes is compiled, the list of owners (those who perform management), as well as process performers (those who are oriented towards consumers at the output) is determined.

Thus, in order to build effective operations, any enterprise, including transport, should segment in its work management processes aimed at specific customers. In the framework of the process approach business processes are considered as business management processes [2, p. 40], which are often associated with the emergence of transaction costs and direct production of goods and services.

The main task is the correctness and expediency of determining the owners of business processes, who are fully responsible not only for the quality of their implementation, but also for the control of certain performance indicators (these indicators are calculated separately for specific areas of activity and compared with critical normative values) [3, p. 20].

This allows managers in most cases to "keep their finger on the pulse", i.e., to adequately react to market outflows and take necessary corrective measures.

Russia's large industrial cities already have a traditionally established sustainable network of transport enterprises, which has its own specifics depending on the region, specifics of pricing in terms of transport tariffs, and the ability to interact with other industrial infrastructure.

However, any change in the market environment (increase in energy tariffs, fuel tariffs) imposes rather strict requirements on the owners of processes at the enterprise (availability of qualified personnel, advanced training). Also, process owners must take into account external negative factors: increased competition, higher taxes, border closures, force majeure circumstances.

In this regard, the scrupulous development and application of an effective process approach is a large-scale multidimensional task. The main problem lies in the fact that transport companies existing on the market for more than 15 years are not able to competently describe and visualise business processes for their owners [4, p. 150].

The effectiveness of the management process consists in competent and efficient response to the emerging situation, correct application of standard algorithms, detection of "narrow", problematic sides.

The application of the general concept of the process approach at the enterprise allows not only to outline and designate in detail the processes themselves, but also to find the existing formal and informal links between them, to adjust the control vector of influence and to determine the necessary amount of resources to achieve the result. All this contributes to the emergence and formation of an optimal managerial organisational structure of the enterprise, which will be created on the basis of clear regulations, guidelines, algorithms and developed measures of a planned preventive nature.

The specificity of transport sector enterprises is precisely in the rational construction of such a passenger transport system, which would meet all the requirements of comfort, safety and convenience of moving passengers and cargo in the minimum time to the destination point.

METHODOLOGY. FEATURES OF IDEF0 MODELLING

IDEF0 methodology was developed by Douglas T. Ross in the early 70s of the last century

and was called SADT (Structured Analysis & Design Technique) [5, p. 2]. It is based on a graphical language for describing (modelling) systems, which has the following properties [6, p. 100]:

- the ability to break down the main production process as completely as possible into sub-processes that reflect the smallest financial and economic relationships and their importance in relation to process owners;
- convenient visualisation of sub-processes to which econometric modelling methods can be applied;
- user-friendly interface that facilitates the perception of the graphical language;
- accessibility and comprehensibility of terms for analysts, experts, and managers, which serves as a tool of necessary interaction for successful teamwork.

These properties predetermined the choice of IDEF0 methodology as a basic tool for analysing and synthesising business processes in production.

So, within the framework of the process approach at the transport enterprise it is convenient to apply IDEF0 methodology,[1] which allows to construct a layout and detailed description of all business processes existing at the enterprise, including the type of organisational (staff structure), description of information flows, controlling and verification systems.

Using a graphical language based on the IDEF0 method, a visualisation of the process model is created, including a full set of business, transport, and other links in close interaction with other market actors. First of all, layouts and diagrams of business processes are drawn up, subordinated to hierarchical principles, where at the top level the main management functions are represented; then their deciphering, detailing and classification are given. A set of business processes is an integral unified model based on certain regulations, circulars, information communication channels, etc.

In accordance with the IDEF0 methodology it is advisable to develop and propose a layout for transport sector enterprises [7, p. 110]. It will reflect the whole necessary list of business processes that make up the activity of any transport enterprise, which will allow to identify not only emerging problems, but also individual features and patterns of processes.

A separate place in the layout is given to the "top level" function, designed for managers and top-level managers. It is of key importance in the activities of transport sector enterprises. Also, within the framework of the general development of the management model layout, the modelling of the behaviour of the main clients of transport enterprises — passengers — is given.

The activities of transport sector enterprises can be subdivided into the following business processes:

- organisation and planning of passenger transportation;
- direct implementation of carriage by the carrier company;
- ensuring and guaranteeing passenger transport safety;
- control over the implementation of passenger carriage;
- passenger transport management;
- monitoring of passenger transportation [8, p. 125].

The degree of detailing of each transportation process is conditioned by its specific complexity and characteristic features, which are determined by the necessary performance indicators.

IDEF0 methodology is a multidimensional and large-scale task that includes a complete analysis of business processes of the entire enterprise considered as a single mechanism. This approach is more preferable for top

[1] IDFE 0 modelling methodology. Information Technology Reference Materials. URL: https://itteach.ru/bpwin/metodologiya-idef0 (accessed on 09.01.2023).

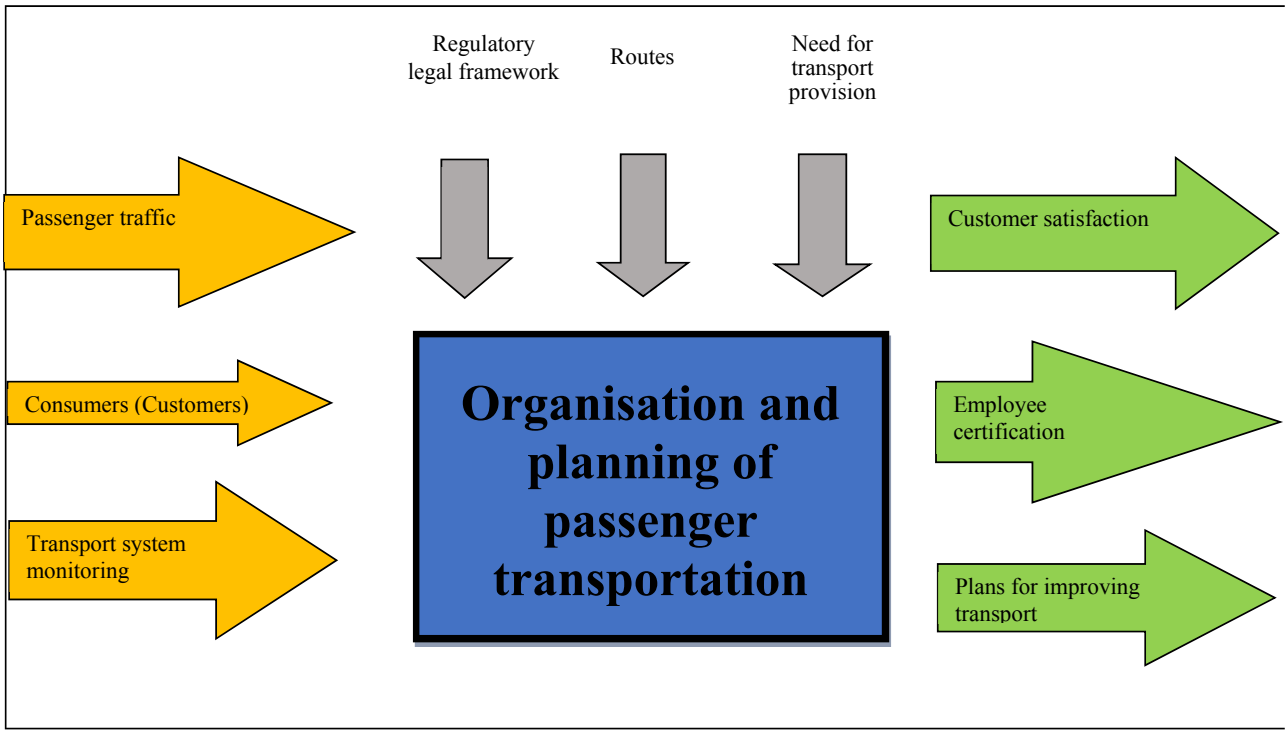

Fig. **The process of "Organization and planning of passenger transportation"**

Source: compiled by the authors.

managers of the company, who directly supervise business processes, as it implies a new method of control and analysis of management in transport [9, p. 200].

In essence, any management process at enterprises of the transport sector is divided into the following components:

- planning and design;
- implementation progress;
- tracking and monitoring;
- identification of reasons for deviations between actual and planned values by relevant performance indicators.

The IDEF0 model allows to obtain not only a detailed description of each business process at a transport enterprise, but also to determine the necessary amount of resources and capacities to ensure a targeted controlling influence on the performers [10, p. 75].

The description of the targeted impact is presented in the *Figure* below.

Within the IDEFO methodology, the following processes can be identified:

- management of transport activities;
- carriage of passengers;
- direct carriage;
- transport and carriage control;
- monitoring of customer satisfaction.

The "Vehicle Market" business process is also important, as it includes the analysis of the existing fleet, vehicle replacement plan, as well as the disposal of obsolete vehicles. In addition, the importance of the process "Provision of material resources" and "Quality control of material and technical support" can be separately emphasised.

The process "Planning and modernisation" of infrastructure includes analysis of the software market, planning for the introduction of licensed software, as well as obtaining information in the necessary amount for making management decisions.

An important role in the process approach is played by the so-called critical success factors (CSFs), which provide process owners with the necessary operational data on the

Table 1

The process of "Passenger transportation implementation"

No.	Name of processes	Key indicators by process	Critical Success Factors (CSFs)
1	Organisation and planning of transport	Monitoring of transport routes. Optimisation of routes and flights. Drawing up a preliminary transport plan. Adjustment of the transport plan. Preparation of the final transport plan in terms of time (week, month, year). Instruction of drivers and conductors	Availability of highly qualified personnel to support the transport process (drivers, conductors, repair workers, electricians, fitters, etc.). Availability of timely information about the traffic situation and transport workers. Ability to flexibly change routes and rearrange schedules in case of technical accidents or force majeure. Continuous monitoring of emerging problems on transport lines
2	Direct transportation of passengers	Optimal transport lines. Ensuring work is carried out in accordance with the schedule. Responsible work of dispatchers and dispatch services. Activities of control and revision services. Planning a certain scheduled number of alternative routes on transport lines	Degree of availability of vehicles directly ready for operation (fleet of cars, buses, trains, etc.). Introduction of innovative vehicles (e.g., new wagons, carriages, cars etc.). Availability of reserve capacity. Availability of effective online information dispatch and control. Degree of information support equipment for vehicles
3	Degree of customer satisfaction	Number of claims during the reporting period. Number of complaints and suggestions	No complaints or claims
4	Monitoring of quality indicators of the transport process	Ideas and suggestions for improving the quality of the transport process	Promptness and reliability of the information provided

Source: compiled by the authors.

key performance indicators of business processes. Based on this operational data, an action plan is drawn up for the execution and implementation of control procedures and processes. The next stage consists in clearly defining the list of process owners (POs) that correspond to the staff structure on the basis of the approved regulations of top management; then scrupulous work is carried out on the development of statutory and legal acts regulating the activities of the enterprise services on the basis of the Charter.

Let's consider the process "Management of transport sector enterprise functioning". Let us highlight the main sub-processes. The owner of this process is the director of the transport sector enterprise himself, while top managers are assigned to specific areas of activity.

Assigning process owners is one of the most difficult tasks. Here, managers and executives at all levels in the existing hierarchy must be considered. It is also important to constantly introduce new innovations, apply the latest

Table 2

The Process of "Direct transportation of passengers"

Provision of a resource base	Subdivisions of the transport company
1. Availability of an appropriate fleet of vehicles (vehicles are technically sound and ready for operation). 2. Fleet of vehicles to be written off. 3. new modernised machines/wagons	Technical Services, traffic safety department, occupational safety centre
1. Qualified drivers / engine drivers. 2. Drivers/engine drivers who have been re-qualified	Financial Services
Conductors to work on the line	Logistics services
Provision of electronic tickets	Accounting
Information support	Information services
Management tools	Technical Departments
Informational support	IT Departments

Source: compiled by the authors.

techniques to improve the management process.

Now let's consider the process "Implementation of passenger transport". It is entirely aimed at the end user — the client who uses a certain transport network (i.e., moves around the city on the appropriate type of urban transport: metro, bus, etc.). [11, p. 183]. The transport process itself concerns all types of categories of economically active population, which moves around the city due to business necessity, and therefore it requires the maximum provision of safety and comfort. Important features are also transport accessibility, the minimum waiting time for transport, the number of minutes spent on the road. Transport fares, the possibility of timely replenishment of transport cards, and the capacity of vehicles (including during the rush hour) are also important.

The Department of Metropolitan Transport itself can act as a customer for certain types of transport services and develop new optimal transport routes.

The process "Carriage and transportation of Passengers" includes a significant amount of information about all comments, wishes and suggestions of passengers to improve the effectiveness of the transport process, the degree of comfort and reduction of travel time, including cheap fares for a certain stratum of the economically active population [12, p. 70].

It turns out that the output of individual processes of the transport sector enterprise receives either a motivated customer who reached the destination with a certain comfort and spending minimal time, or a dissatisfied passenger who got into a traffic jam due to the traffic situation or breakdowns of a purely technical nature.

Table 1 illustrates a number of critical success factors (CSFs) that directly determine the state of performance indicators, which are then compared to the normative (planned) values.

Table 2 shows the relationship between the relevant services of the transport company and the resource base to ensure the reliability of vehicle operations.

Table 3 presents a specific set of management functions that relate to the current operational activities of transport sector enterprises. In general, this is justified by the need to respond to force majeure

Table 3

Management functions

Name of the process	Transport company services
1. General organisation and planning of passenger transportation	
1.1 Availability of existing/agreed new routes. 1.2 Modification of existing routes. 1.3 Availability of main timetable. 1.4 Availability of an alternate timetable. 1.4.1 Monitoring and adjustment of routes	Technical Services Maintenance department
2. Organisation and planning of transport routes for the month	Planning Division
2.1. Daily transport planning 2.1.1 Daily assignments. 2.1.2 Monitoring of daily AP assignments. 2.1.3 Reallocation of assignments	Traffic Service
3. Receipt of proceeds	Financial Services
4. Control of drivers' and conductors' work on the line	Control and Audit Department
4.1. Ensuring the reliability of passenger transport 4.1.1 Road monitoring 4.1.2 Consideration of the overall road situation. 4.1.3 Consideration of seasonal variations (urban and suburban routes). 4.1.4 Road surveys for child transportation	Traffic Safety Department
4.2. Monitoring of activities 4.2.1 Control and monitoring of transport safety. 4.2.2 Monitoring and analysing the condition of drivers/engine drivers. 4.2.3 Accounting of document turnover on transport safety	Traffic Safety Department
5. Reliability of route fulfilment (%) 5.1 Control of timetable closure. 5.2 Fixing accidents and analysing their causes. 5.3 Instructing dispatchers on the possibility of changing routes. 5.4 Modelling the transport situation on the route. 5.5 Attracting additional fleet of vehicles	Traffic Department
6. Transport monitoring	Information and Analytical Department
The volume of revenue received from passenger transport: – by flights; – according to the schedule; – by day of the week/month/quarter. Analysis and identification of inefficient routes. Change in revenue after adjustments in timetables. Identification of inefficient routes and time to adjust them. Measurement of passenger satisfaction. Development of an efficient timetables algorithm	Analytical Department

Source: compiled by the authors.

circumstances, which require rapid changes in transport routes or their partial cancellation.

Table 3 clearly demonstrates that the most important management functions are controlling traffic, taking into account the detection of inefficient problem routes and analysing the quality of customer service.

For the successful realisation of any process, it is important to a large extent to possess the necessary resources, that the key success

Table 4

Characteristics of the "Resource availability" process

No.	Processes	Critical Success Factors (CSFs)	Information monitoring	Performance indicators for the fulfilment of objectives
1	Provision of qualified personnel	Creation of attractive working conditions. Availability of social guarantees, system of employee incentives and bonuses	Availability of highly qualified personnel. Professional development and retraining of personnel. Improvement of labour legislation and local regulations on labour improvement	Indicator of full staffing of employees in various categories (drivers, machinists, conductors, etc.). Staff turnover rate
2	Provision of rolling stock ready for operation with technological equipment and energy carriers	Availability of innovative equipment units in the transport company's fleet of vehicles. Availability of reserve capacities. Availability of repair workshops. Optimal consumption of Electricity and energy resources	Immediately ready for operation units of equipment/machines/wagons Analysis of causes of technical failures of machinery and equipment. Number of defective machines. Availability of spare parts for repair of machines. Accounting of emergency shutdowns of necessary energy resources	Full technical readiness indicator by transport equipment fleet segments. Fleet utilisation rate (%). MTBF (Mean Time Between Failures) indicator. Availability of operational information on reserve capacities

Source: compiled by the authors.

factor in any activity predetermines [13, p. 400]. The process "Availability of resources" is a typical example of how efficiency depends on the quantity and quality of machines. The availability of repair shops and skilled craftsmen is also important [14, p. 55].

The process "Resource endowment (availability)" includes the availability of workable machines (wagons), including innovative ones, as well as skilled labour and energy resources, the cost of which can vary depending on market conditions.

The characteristics of the respective processes are given in *Tables 4 and 5*.

The process of "High-tech information support" is important, which acts as a link between the other processes, because the quality of management decision-making depends on the speed of information transmission and processing. At the same time, there is a requirement to the information itself, which should be as meaningful, prompt, and reliable as possible [15, p. 27], and most importantly — accessible to managers at all levels.

The output of this process is a satisfied customer, whose needs have already been taken into account due to the timely exchange of data.

Within the framework of information support is the technological infrastructure, as well as structural units of the transport company (services, departments, management) [16, p. 790].

Thus, the consideration of processes as integrated components of the whole allows not only to scrutinise the features of subprocesses, but also to find "bottlenecks", which generally contributes to improving the quality of management.

Based on the presented methodology, we can conclude that the process approach is an integrated set of methods and procedures of

Table 5

The Process of "Availability of material and technical resources"

No.	Processes	Critical Success Factors (CSFs)	Information monitoring	Performance indicators for the fulfilment of objectives
1	Organisation of logistics supply	Planning of the procurement process in the planning period. Approval of prioritised list of inventory items according to technical specification. Securing funding in accordance with emerging needs in the required volume. Informatisation of stock control and bid collection system	Control over the minimum permissible level of reserve capacity in warehouses according to the specifications of the relevant equipment. Determining the shortage of necessary repair spare parts and determining the possibility of their immediate acquisition	Updating purchase requisitions for relevant equipment. Monitoring of regular suppliers and subcontractors. Management cost accounting
2	Implementation of the logistics plan	Market monitoring to determine the most attractive supplier. Compliance with delivery dates	Reduction of reserve capacities at warehouses below the normative values	Availability of an irreducible stock of spare parts in warehouses. Determination of vehicle downtime due to shortage of required spare parts

Source: compiled by the authors.

managerial functioning of the enterprise to improve the effective management of business processes. In this case, the developed system of performance indicators for each business process, which are compared with the planned (normative) ones for given time intervals, is of great importance.

RESULTS OF THE RESEARCH

1. The introduction and integration of the process approach in transport sector enterprises allows to improve the overall management efficiency; at the same time, individual sub-processes set local performance indicators, which result in aggregate generalised indicators at the output, which allows to create a convenient platform for control.

2. The use of the process approach eliminates administrative and information barriers between individual services of a transport company; it improves its competitiveness and the quality of transport services.

3. The application of the process approach is beneficial in order to increase overall labour productivity, reduce costs, and continuously improve management functions.

4. The process approach in transport sector enterprises contributes to the overall harmonisation of business procedures, increasing dynamism, flexibility and prompt response to market downturns and upswings.

CONCLUSIONS

Within the framework of this study, the authors have proposed a process toolkit that specifies the division of the management system into sub-processes at enterprises of the transport sector. The application of the proposed concept of process procedures for transport enterprises will minimise the loss of resources in the short and medium term, reduce financial costs, and optimally modernise the fleet of necessary machinery equipment. In this case, it is important to rely on the principle of rational distribution of competences, powers, and joint responsibility within the functioning management structure,

according to which the owners of processes are able to improve them, based on breakthrough and innovative technologies.

Further improvement in the efficiency of transport companies' business processes may require additional optimisation and the application of new technologies, which would enable a tighter procedural interaction between the processes of core and auxiliary activities, taking into account the emerging synergy effect.

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