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FUNCTIONING OF OPERATIONAL SYSTEMS IN ROAD TRANSPORT COMPANIES: DIRECTIONS OF EVALUATION

Abstract

The operational system, the heart of every company, requires constant evaluation through appropriate indicators. Measuring them allows evaluation of the level of efficiency and productivity of transport services performed by road transport companies, supporting the management process in this way.

Keywords: transport, indicators, measure, operational systems

Introduction

Operational activity, the essence of production processes of transport companies, comprises organization and performance of material services, which consist in relocation of cargo or passengers. This activity requires involving an indispensable quantity of material, human, financial and information stock in such a way so as to perform transport services efficiently. Operational systems consist in transformation of input components into output products. It is the area where all concepts, processes and ideas gain a real form. This is why it is so important to define through various indicators the directions of evaluation of operational activity and stock invested in it.

1. Operational system specificity in road transport companies

Operational activity, also called productivity, is directly related to the production of goods or provision of services. It is the basic component of economic activity of a company and it cannot be conducted in an arbitrary way; it has

to be directed appropriately in time and space as well as conducted in specified technical-production and organizational conditions (Mytlewski, Nowosielski, Schomburg, 2010). The operational area is multi-faceted and strategic. This multi-faceted nature concerns various technical-organizational dimensions of the production process, as well as it relates to the correlation between production and other areas of a company's activity. The central position of the operational function stems from the fact that other functions e.g. marketing, financial, accountancy, research-development, etc., become pointless without efficient performance of this function (Kasiewicz, 2002).

In production processes, employees, through their labour, influence the object of labour and the result of these activities is production of goods/provision of services. Thus, all production factors: human, material and non-material should be involved to enable the performance of any operational activity (Żurek, 2007). Omission of any of these factors means that the conditions for the production are not met because production processes can only be performed with the presence of all the three production factors (Marszałek, 2001).

Transport is an "activity which consists in intentional relocation of cargo and people" "with the use of appropriate objects of labour, called means of transport, travelling the way from the sender to the recipient of a transport operation" (Piskozub, 1975, p. 18). If transport is defined as a process of production, then its final product is the transport service. Transport production creates services the intentional effect and core aim of which is translocation: change of the location of things and people. The performed service is consumed instantly at the moment of its provision, so there is no time gap between the provision of the transport service and its consumption (Burnewicz, 2009). The essence of this production process is relocation of cargo (people), performed through transport services accepted by the client. Thus, the intended aim of transport production is changing the location, so the production process consists in influencing the space, contrary to material production, where the technical influence of labour on objects is used. Road transport is undertaking and performing the economic activity of relocation of people or things with trucks and cars registered nationally. Trucks/cars also include chains made of vehicles and trailers and semitrailers in the Republic of Poland and outside) (Road Transport Act of 6 September 2001, Journal of Laws, No. 125, item 1371).

The service activity which consists in chargeable transport with the effect of relocation of passengers and cargo is performed by road transport companies. The economic activity which is the subject of production processes in road transport companies includes a chain of organization and performance activities resulting in relocation of cargo and people. The operational activity of road transport companies requires involving determined resources in order to perform the transport service in an efficient way (Rześny-Cieplińska, 2013).

Operational activity has to be characterized by a universal model solution. Specified, homogenous elements need to be distinguished for all the companies involved. Thus, it can be said that operational activity is based on a system. Five basic elements are distinguished in the structure of the operational system of a transport company (Jasiński, 2005):

- input elements (materials, fleet, infrastructure, energy, human resources, capital, information);
- output elements (transport services, waste);
- transformation processes (transport operations, inspections, storage);
- information and material relations;
- management.

The operational system of a road transport company is responsible for the production factors and their processing. This is where decisions about establishing the proportions of factors (i.e. financial structure, involvement of human and financial resources) are made in order to perform the transport service efficiently. The functioning of operational activities requires taking decisions about input elements (input of production factors), transformation operations/processes and output services.

2. Characteristics of resources of the operational system of a road transport company

The operational system of a road transport company requires involving specified resources to perform the transport service efficiently. The resources indispensable to perform the transport service are as follows:

- 1) material resources:
 - production means determining the transport potential of a transport company:
 - means of transport (fleet);
 - loading machinery and equipment;
 - loading units (e.g. pallets, containers);
 - infrastructure: land, buildings, engineering structures and facilities:
 - production buildings (depots, locomotive workshops, technical backup facilities);
 - non-production buildings (social buildings, offices);
 - structures (access roads, stations);
 - transport infrastructure (e.g. tracks, transport points and stations);
 - logistics infrastructure (warehouses and storage areas, tools);
 - natural means indispensable to start using the transport potential:
 - fuels;
 - electric energy;
 - supplementary materials (e.g. oils, lubricants);
- 2) financial resources – equity and borrowed capital;
- 3) human resources – people and their qualifications, skills, capabilities and motivation to act (Wojciechowski, 2006) or, in other words, the human potential of a company which reflects the quantity and quality of transport production and employees;
- 4) non-material resources (information) which are not physical or financial but they are an important element of the functioning of a transport company. They

can be used in various places at the same time and they do not lose their value throughout the process. Non-material resources can be classified as (Kozłak, 2008):

- assets: licences, concessions, patents, copyright, trademarks and their recognition in the market, reputation, information, databases, relationships, contacts with clients and suppliers.
- skills and competence: employee know-how, suppliers, sales and service policies, company procedures, information about the market and competition, company culture.

All these resources have an impact on the correct transport production process, thus, good knowledge of their features allows choosing them in an appropriate way. It highly influences the quality of services and the cost of transport (Marszałek, 2001). A right choice of production factors determines the possibility of effective management. Unsuitable employees and asset structure, especially in the scope of the fleet owned, which is the foundation of the assets, may impede the performance of transport tasks resulting from signed contracts, as well as it influences the functional efficiency (Letkiewicz, 2006).

“Collection of means and objects of labour and hiring people is a necessary condition to endeavour operational activity but it is insufficient” (Jasiński, 2005, p. 14–15). A road transport company has to have such a potential of human and material resources at its disposal so as to create transport production in accordance with the market expectations declared and learnt. If it is not the case, the company will be subject to lowered efficiency of activity caused by an excessive amount of resources and, resulting from this fact, the cost level will exceed the economic relevance or the company will lose revenue due to insufficient accessibility of resources (transport potential), impeding the delivery of services to all the declared demands from clients (Szafucki, 2017).

In order to conduct rational basic activities of a company, it is required that resources appropriate in terms of quantity and quality are collected and compared to the objective, they should also be interrelated in time and space, creating a whole in which each and every element helps the company succeed.

3. Evaluation of operational systems of road transport companies

Evaluation of a company’s activity is a set of interrelated and supplementary elements, with the help of which the level of realisation of aims determined for a given period of time for a company can be specified. Thanks to its cognitive values, evaluation is a valuable as well as indispensable tool of company management (Wersty, 2000).

Various measures and indicators will be helpful in such evaluation. Measures are economic categories which reflect occurrences and facts regarding management of the company’s resources and its relationships with the environment (Twaróg, 2005).

A measure is a numerical quantity indispensable to calculate indicators. Indicators are economic categories related to occurrences and facts of the material flow and information related to them. Economic indicators are considered to be a fundamental and most common form of economic information. They play an important role in the decision processes of companies. Indicators are a standard used to reflect the basic information resulting from calculation of all objects, processes and occurrences (Twaróg, 2005). The highly cognitive value of indicators depends on observing the rules laid out when they have been constructed. The important indicator construction rules include: the aim, correspondence, proportionality

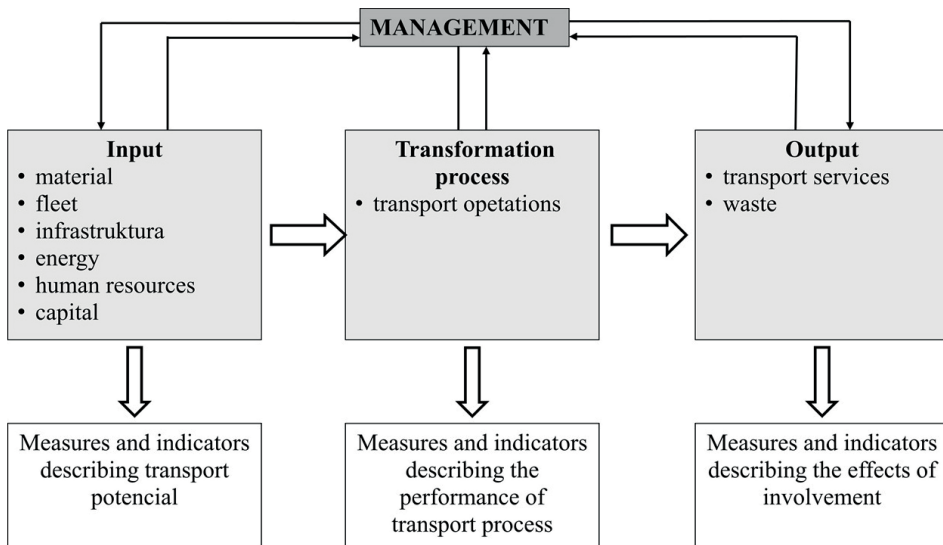


Figure 1. Diagram of the operational system of a transport company
Source: own work based on (Letkiewicz, 2006) and (Jasiński, 2005)

When constructing indicators evaluating the operational system of a transport company, one should follow the right choice of production factors that will provide a possibility of efficient management and performance of transport tasks. The result is that a fundamental indicator evaluating the operational activity of this kind of a company is the transport potential. There are two possible approaches to this indicator.

Firstly, it is formed by: the number of owned vehicles, inventory vehicle-days and total inventory capacity. The number of vehicles owned is a measure which is the total of all individual items of the company's fleet during one day. When calculating this measure, the fleet which did not operate during a given day should be excluded. An inventory vehicle-day is a measure which depends on the number of fleet vehicles owned and the period of ownership measured in days. The ability to deliver services is an indicator which consists of the number of fleet vehicles owned and their capacity (Letkiewicz, 2006).

Secondly, it is the ratio of the following measures and indicators: the inventory stock of the means of transport, the technical readiness of the means of transport, the use of the technically operating fleet, the average operation time of the means of transport, the average operating speed, the use of mileage, maximum capacity, the use of capacity. The inventory stock of the means of transport is a measure which informs about the size of the fleet owned by the company. The technical readiness of the means of transport is an indicator which demonstrates what proportion of the fleet has to operate in a given calculating period. The use of technically operating fleet is an indicator which demonstrates what proportion of the means of transport with the ability to operate will actually operate in a given period. The average time of operation during 24 hours is a measure expressed in natural units. The average operating speed obtained by the means of transport in a given period is also a natural measure. The use of mileage is an indicator demonstrating what proportion of operation was performed with cargo or passengers. Maximum capacity of the means of transport in operation is a quantity indicator. The use of the capacity of the means of transport in operation is also a quantity indicator (Szałucki, 2017).

The performance of a transport process requires covering space, thus it should be formed by the following indicators: the mileage and the quantity of the transported tonnes. When forming the transport measure, mileage with cargo or passengers (the quantity of kilometres with cargo or passengers) and empty mileage (without cargo or passengers) should be taken into account. From the point of view of the transport process performance, the time measure comprises: the time of the fleet in motion resulting from relocation of cargo or passengers, and the time related to fleet stoppage. The quantity of transported tonnes is called the capacity use indicator and it consists in comparing the weight of cargo and the capacity of the vehicle performing its transportation (Letkiewicz, 2006).

The effects of venture are measured by transport work, the distance of transport, the average dynamic capacity of the means of transport and the use of capacity. Transport work is an indicator expressed in tonne-kilometres (passenger-kilometre) and it means transportation of cargo/passenger per 1 km. The transport distance relates to the average transport distance of one tonne of cargo. The indicator of average dynamic capacity of the means of transport depends on the participation of individual fleet groups in the overall mileage. The dynamic indicator of the use of capacity determines the relation between the transport work and the possible potential work to perform, should the capacity be entirely used (Letkiewicz, 2006).

4. Directions of evaluation of operational systems of road transport companies

When determining the directions for evaluation of operational systems of road transport companies, it should be stated that the most essential resources which are indispensable to perform transport services are: the fleet along with the machinery

and equipment, materials and human resources. They play an important role on the three stages of this system: input, transformation and output. There is information flow between elements of the operational system; it enables predicting the results of the undertaken activities as well as evaluation of the company's operational activity from the point of view of the determined aims and then taking measures to improve whatever needs improving. This information is an indispensable factor in the management processes, which are related to decision-making on the basis of the obtained information. Access to information enables making the decision about the method of processing of a given transport order, the choice of the input elements and the performance of operations indispensable to transform them into planned output services. Efficient management of an operational system requires that appropriate measures and indicators are developed. The basic measures and indicators in the evaluation of an operation system are presented in table 1.

The input stage is related to the investigation of the transport potential and its planning. It is important to answer the questions: what to transport, how, and to whom; when, where to transport and to whom; transport with what. At this stage, it is intrinsic to collect the measures of a natural and technical-economic nature. When evaluating the fleet, machinery and equipment, it is important to know the quantity, structure and age of the fleet owned, its technical readiness and capacity. Thanks to these measures it will be easy to plan which and how many vehicles are indispensable to transport a determined quantity of cargo or people to the destination in a given time. An important problem is also to conduct an optimal policy for the purchase of new vehicles as well as upgrading and modernization of vehicles owned. And road transport cannot be efficient without access to materials i.e. fuel, tyres, spare parts. The condition and the level of wear of these factors need to be evaluated on an on-going basis, as their shortages may cause stoppages and the lack of a possibility to perform transport services. It is also crucial to evaluate the human resources. The most important natural measures are the status and structure of employment (the number of drivers and service employees) and their qualifications. When evaluating the input stage, the market demand and the possibilities created by the technical development need to be taken into account. Thus, the transport potential ought to be planned in a flexible way, taking into consideration changes in the environment, keeping up with them, and ideally, being ahead of them.

The evaluation of the input stage will influence the second stage: transformation and performance of the actual transport service. Measures used to evaluate this stage will be: natural (quantity), quality, space and value measures. The basic question at this stage is: how long does it take? how is it performed? are there breaks and stoppages in the transport process? are repairs of the fleet frequent? Measures evaluating the fleet should be coupled with indicators presenting the use of consumable materials and spare parts, as well as measures evaluating the performance of employees e.g. the time of work or the number of travelled kilometres.

The last stage, output, will answer the following question: what are the effects of the performed transport work for the entire company? Mostly, complex,

Table 1. Indicators to evaluate operating system functioning

Specification	Fleet, machinery and equipment	Materials	People
Input	<p>FLEET STRUCTURE</p> <ul style="list-style-type: none"> - measure of the quantity of vehicles - measures of the company's asset structure with particular consideration of vehicles owned (type structure, age, depreciation level, territorial distribution of the fleet, vehicle brand and type, fleet group, cargo capacity, etc.) - measures describing operation and technical features of vehicles - indicator of cargo capacity of vehicles - indicator of technical readiness - indicator of vehicle-workdays inventory - indicator of entire inventory capacity - inventory capacity average - measures related to planning of revisions and repairs - measures related to investment activities (purchase/modernization of vehicles) - measures of tasks to be performed by the crew and vehicles - indicator of how time-consuming given works are - indicators showing the how intense, extensive and technicized the works are 	<p>MATERIAL STOCK</p> <ul style="list-style-type: none"> - measures of stock and turnover of consumable materials (fuels, tyres) and additional materials - measures of stock and turnover of spare parts - indicators of wear of material - statistic standards - indicators of standard stock - reserves - contracts in material management subsystem - measures of spare parts - stock and stock of materials - indispensable for fleet repairs - in planning and balancing repairs - contracts with suppliers - of materials 	<p>EMPLOYMENT STRUCTURE</p> <ul style="list-style-type: none"> - measure of employment status - measures of employment structure (rank categories) - measures investigating vocational qualifications and licenses of employees - measures investigating work practices - measures related to holiday planning and recording
Transformation Process	<p>TRANSPORT PERFORMANCE</p> <ul style="list-style-type: none"> - indicator of the quantity of transported passengers/cargo by a vehicle - measure of vehicle operation days - measure of vehicle downtime - measure of vehicle operation downtime days - measure vehicle technical downtime days - measure of total downtime vehicle-days - measure of time and quantity of repairs - measure of time of delays of vehicles - measure of vehicle speed - measure of transport regularity - measures of fleet performance in various sections 	<p>WEAR OF MATERIAL</p> <ul style="list-style-type: none"> - indicator of fuel consumption and wear of tyres (by vehicles, drivers, routes) - indicator of wear of spare parts (by vehicles) - deviations from standard wear - indicator of materials which do not demonstrate motion 	<p>WORK PERFORMANCE</p> <ul style="list-style-type: none"> - measure of worktime of drivers and technical service employees - indicator of the quantity of drives/services performed by a given employee - indicator of the quantity of kilometres driven by an employee (with and without cargo)

	<ul style="list-style-type: none"> - indicator of technical readiness vehicle-days - indicator of use of technically ready fleet - indicator of use of fleet - indicator of total capacity of vehicles in operation - indicator of average capacity of vehicles in operation - measures of regularity of passenger transport - indicator of the use of work time - indicator of actual time of loading and unloading - measure of the number of services - indicator of average time of one service - measure of the number of repairs - indicator of average time of one repair 		<ul style="list-style-type: none"> - indicator of the quantity of transported tonnes of cargo/passengers during one day by an employee - measure of the types of performed transportation (e.g. transport by dumper) by an employee - measure of the types of vehicle driven by an employee - measure of the types of (e.g. mechanical, manual) work by an employee - measure of employee absence
<p>Output</p>	<p>FLEET OPERATION</p> <ul style="list-style-type: none"> - indicator of transport work (according to routes/ lines and assortment of transport) - indicator of maximum transport work - parameters of comparison of work of individual departments - indicator of the use of machinery and equipment (according to manufacturing cells) - productivity of the work of loading machines and loaders - indicator of an average overhauling period - indicator of average inter-service mileage - indicator of the number of loaded travels - indicator of empty travels - indicator of the total number of travels - indicator of the number of performed services (transports) - indicator of the size of transports - indicator of average capacity of all vehicles - indicator of average dynamic capacity of vehicles in operation - dynamic indicator of the use of capacity - statistic indicator of the use of capacity - indicator of the quantity of transported/reloaded cargo - indicator of the average distance of transport of one tonne 	<p>WEAR OF MATERIALS</p> <ul style="list-style-type: none"> - indicator of calculating fuel consumption according to drivers and vehicles - indicator of the wear of materials for a mileage unit - indicator of the average fuel consumption and wear of tyres by all vehicles - indicator of the average wear of spare parts by all vehicles - measure of over-burned fuel 	<p>WORK-TIME USE</p> <ul style="list-style-type: none"> - indicator of average time of work of drivers and technical service employees - indicator of average time of absence of employees - indicator of average overtime work in groups of drivers and helpers - indicator of the use of the time of work of employees at a service station - productivity of work

Specification	Fleet, machinery and equipment	Materials	People
	<ul style="list-style-type: none"> - indicator of the number of transported passengers/cargos by all vehicles - indicator of the average number of kilometres travelled by all vehicles - indicator of the average time of operation of vehicles - indicator of the average downtime of vehicles - indicator of the time of travel - indicator of the time of loading and unloading - indicator of the time of breaks in processes - indicator of stoppages - indicator of the time of work - indicator of the use of time of work - indicator of the average time of loading and unloading of one tonne - indicator of the average time of operation during 24 hours - indicator of the average time of one service - indicator of the average speed of vehicles - indicator of the average technical speed - indicator of average operating speed - indicator of loaded mileage - indicator of empty mileage - indicator of total mileage - indicator of the use of mileage 		
	<p>TECHNICAL INFRASTRUCTURE</p> <ul style="list-style-type: none"> - indicator of damage and losses in means of transport - indicator of the number of repairs and technical services in comparison to the standards (by vehicle) - measure of performed repairs - indicator of the average time of one repair - measure of failure frequency (according to vehicles and reasons) - indicators of the technical downtime of the fleet according to vehicles and reasons (e.g. the level of technical downtime in vehicle-days caused by services, repairs, lack of drivers, lack of documents) 		

	<ul style="list-style-type: none"> - measures of technical operation of vehicles (the level of performance of planned technical services and performed repairs of vehicles, regeneration of spare parts etc.) <p>SERVICE QUALITY</p> <ul style="list-style-type: none"> - measures of timeliness - measures of frequency of losses (losses of cargo in transport) as compared to the average) - measures of development tendencies (passenger flow, operating speed, delays, transport demand) 		
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Source: (own work)

comprehensive indicators are calculated here (even though partial measures may appear; they cannot be omitted, as they are indispensable to reflect the efficiency of the entire operational system). Indicators at this stage should relate to the fleet operation and the technical backup, as well as they should represent the quality of the performed services, the wear and tear of materials and the use of the employee work time. The analysed indicators may relate to numerous variables (time, revenue, number of travelled kilometres).

This stage is very important from the point of view of the operational system evaluation, as this is the point of return to the input stage and starting to plan transport services anew. The operational system should be planned on the basis of the optimal technical and economic standards which determine a feasible, maximal use of the fleet, machinery and equipment, as well as with the consideration of the best use of the employee work time.

Conclusions

Transport of cargo and passengers is considered as one of the most important systems of market economy. Road transport companies do not operate in a vacuum. They are subject to various micro- and macro-economic factors which determine their efficient functioning. They have to manage their means of transport in an efficient way, investigate the availability of human resources and competition. This is why it is important to constantly measure and evaluate operational systems of road transport companies.

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