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Assessment of technical condition of vehicles in transport company

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ABSTRACT

The purpose of this article is to perform an assessment of technical condition of a transport company and to answer the question whether the nature and direction of changes in technical equipment and work organisation in road transport companies allows to acknowledge that they work and develop in the frameworks appropriate for self-learning company.

KEYWORDS: transport company, technical and organisational condition

1. Introduction

The scope of discussion includes the selection and depiction of technical and organisational aspects of transport company operations taking into account the changes in that regard and conducting an assessment of their nature.

Next, based on the analysis of transport company operations an attempt was made to establish to what degree the actual organisation decisions and actions correspond with the assumptions.

2. Strategic management

Market economy system created very different conditions for functioning of transport company. On one hand, it means the freedom of actions within the law, on the other, it created a rigorous requirements, which include striving for profits. Freedom of running a business activity created the necessity of concocting the management strategies for such companies. The strategic approach of managing the companies was shaped in a process of evolution, starting from financial planning, through long-term and strategic planning, to strategic management. There are many definitions of strategies, and it is stated in the literature [2,7] that a strategy is intentionally and purposefully devised plan of operations which anticipates the course of events.

The most developed form of a strategy is a model of, the so called, „self-learning" organisation [6]. It was created as a type of suggestion ensuring the ongoing drive to improve efficiency. „Self-learning" organisation can be defined as an organisation that learns through experience, which means that it analyses in time its own actions and draws conclusions from them. Since the process of learning is placed over a period of time, it must be an evolutionary process and the strategy formulated based on that process is called an evolutionary strategy. The notion of a strategy is understood as an action that aims at planning, completing and controlling the efficiency and the economic effectiveness in such manner that the costs of that process are lower and the business continuity is kept. As far as the transport company is concerned, forecasting demand is much simpler than when it comes to companies operating in different branches of economy, which is mainly caused by different principles of their functioning. Transport companies are the dispatchers of the fleet, which means that the number of vehicles in the fleet as well as its technical conditions are known or possible to anticipate. Additionally, the incorporated strategy of planned and preventing repairs clearly determines date and range of the inspection or repair for every vehicle, which allows company to prepare appropriate components in advance.

In order to take an advantage of existing potential and to develop it further, the company has to create proper organisation conditions. Nonetheless, it has to be remembered that every organisation

- especially the transport one - is unique, which means that every time an evolutionary strategy is created, it is necessary to correctly identify basic organisation features and external factors, as well as to determine their influence on its functioning. The correctness of such determination is essential for the quality of company strategy that was based on it. It means that there is no simple solution for the incorporation of these principles in practice and in particular situation.

3. Organisational and technical evolution of the transport companies' base

The assessment of technical condition of transport companies' base and subsystem acceptance requires to take a closer look at all the stages of its development. The organised exploitation of vehicles that are used in larger numbers created economical and technical need for their repairs, which means initialising preventive processes - delaying the process of functional properties loss and reparation processes - restoring those properties. In order to complete the above mentioned tasks a certain strategy needs to be developed to assess the technical condition of service vehicles, organise the reparation process as far as the organisation and workshop equipment bases are concerned, and prepare the organisational and technical processes of spare parts production and regeneration.

Since the purpose of such companies is to maintain the fleet in appropriate technical condition, it means that they cannot be limited to only service and reparation works. It is necessary to analyse the designs of the vehicles in order to conduct the reparation works in optimal manner. Currently, a very dynamic technological development as far as the means of transport are concerned can be observed. The important reasons for customers when deciding about the mean of transport are availability, price of the transport service, time of the transport and its conditions. The ability of carrier to offer those conditions is closely connected with features and properties of their fleet. The increase of these indicators can be ensured only through the use of fleet with modern and reliable design, which is more expensive to purchase and use. Thus, in order to allow fleet service costs to remain on reasonable level a new way for vehicle operation and service must be devised.

Each of the mentioned aspects is very important as far as the vehicle operation is concerned, but the most important technical issue is maintainability. It is a property of an object inferred from design and technological solutions, which characterises its level of preparation for use, detection and removal of inefficiencies and prevention against them in short period of time and in the most economical manner for the specific use. Maintainability can be described as the probability of restoring object's efficiency in a period of time or performed work, average service labour consumption, average time of a stop in service, average cost of service and technical availability factor.

Object properties that influence maintainability include, among others, the accessibility of object elements, the ease of disassembling, assembling, diagnosing, measuring and research, the ease of replacing elements, subassemblies and assemblies, etc. Maintainability ensures the most effective manner of usage, but it is also connected with high financial expenses that are necessary at the beginning. These outlays are mainly allotted for adaptation of the fleet vehicles and companies to their new repair organisation. However, as the studies show [5], the incurred costs are quickly recompensed as a result of shorter repair time and lower costs. The additional benefit resulting from streamlining reparation process and shortening time of decommissioning is the possibility of decreasing the fleet reserve for those vehicles that are being repaired. It needs to be acknowledged that covering the fleet of vehicles with that form of service allows to accomplish - in long-distance perspective - significant savings in many aspects of usage. Full compensation of incurred expenses with the steady demand for transport services occurs in five to seven years. [5]

Technical base of the vehicle fleet allows company to quickly locate the damage, determine the proper scope of service and their completion in the shortest time possible and with lowest financial expenses possible. Fulfilling these terms allows technical and organisational development of diagnostic methods. Striving towards the improvement of reparation efficiency is connected with the design of vehicles, which allows company to quickly locate and repair damages and facilitate the planning of control and repair works. Vehicle technical diagnostics is not a new issue in the service process. When more complicated vehicles were introduced, there were attempts to determine the causes of their inappropriate functioning. The defects were identified based on the experience. Observed benefits, resulting from different types of methods, such as shorter time needed to locate the defect or the lack of need for disassembling vehicle while locating the defect, triggered the beginning of a research on diagnostics in order to obtain reliable and most accurate information. It enables not only to determine the current vehicle technical condition but also to predict condition in the future.

Since the equipment impairment is of random nature and is not dependant on the external factors, the prediction of damage occurrence is based on probability and on a certain classification of the equipment efficiency and inefficiency conditions. The basis for such classification is to determinate the time in which the equipment remains in efficient condition. However, the main difficulty in creating such classification is the need for a series of tests that determine the impairment of particular elements and define external features of equipment, which accompany particular defects. Equipment conditions might be differentiated at any moment. Their recognition must be done through the analysis of external signs and the description of condition they resemble. Modern technical diagnostics is based on the assumption that equipment is of determined nature. It means that every possible equipment condition manifests very specific external signs and the other way around - every diagnostic sign is paired with completely defined (clear) technical condition of the equipment. Diagnostics is general and systematised method for the recognition of different conditions. It is not a set of separated practical undertakings, which try to define the usefulness of particular equipment parts for further operating. Basic difficulty linked with completion of diagnostic tests is their high labour-intensiveness. The solution to this problem is automation of the process. It allows users to conduct the diagnostic tests in an integrated manner, utilising

previous experience as far as the diagnostic signal interpretation and the strategy (sequence) of conducted tests are concerned. It also introduces significant modifications when it comes to testing and recording different parameters and their presentation. Usage of this technique is connected with proper preparation of the vehicle for particular test type by fitting it with appropriate fixtures, such as sensors and measurement wiring.

New possibilities in diagnostic techniques and the requirements for economic efficiency improvement of vehicle reparation created the need for new service methods. The idea of these new diagnostic methods is their division into on-board diagnostics and stationary diagnostics. The purpose of on-board diagnostics (inspection) is to detect vehicle malfunctions or signal to the vehicle operator during their operation that some of the parameters approach critical values. The consequence of such signal is to send vehicle for stationary diagnostics. Testing of the vehicle at stationary diagnostic station allows operator to observe it in simulated work conditions. It offers an opportunity to conduct the tests that could not be performed in normal work conditions. It is even more valuable when the station allows to recreate almost all work conditions and test vehicle reactions in those conditions. Diagnostic process is managed by a computer that selects the optimal option and scope of diagnostics, oversees the measurements and collects data for processing. Data processing is done in two stages. Firstly, the computer collects and identifies individual diagnostic signals and then evaluates the degree to which particular equipment is destroyed. It is compared with new model. Computer then determines the optimal time of commencing and range of repairs. Any deviations and changes in the process of wearing out elements - if they are not random - are recorded via statistical tests and instantly adjusted in already existing model.

Diagnostic system allows user to maintain the vehicle in good technical condition and provides better use of their operational capacity. The reason for putting the vehicle forward for reparation is its actual technical condition and not the knowledge of particular elements impairment statistics. Consequently, it means that the mentioned method replaced previous strategy of repair planning in time. Currently, one of the basic standards in periodical service planning of vehicles is service cycle. This cycle is the period between two major services. The range of service cycle includes reparation operations and prevention operations. Reparation operations consist of planned and non-planned repairs. Non-planned repairs are divided into immediate (current) repairs - covering the works linked with the restoration of vehicle technical properties lost in random manner and the emergency repairs - conducted in situation, when the vehicle had been damaged in, for instance, an accident. The planned (periodical) repairs are technical operations aiming at the restoration of the vehicle technical condition lost to the course of usage. They are divided into revision repairs - which cover the inspection of elements and sub-elements, including their partial disassembling and replacement of worn out elements for new or regenerated ones, and major repairs - covering partial disassembling of vehicle, which is accompanied by an inspection and service of all equipment and the evaluation of vehicle technical condition.

The group of prevention operations includes periodical inspections and controls. Periodical inspections aim at preventing damages and maintaining the vehicle in operational condition that guarantees road safety. One of the periodical inspection variations is seasonal service, the purpose of which is to prepare the vehicle for operation in spring or summer seasons, and autumn or winter seasons. It is conducted twice a year and most commonly included in periodical service. The second group of inspections are control services covering the operations and works that follow appropriate instructions and are conducted before the vehicle is sent on the road or during a break of its work. The example of such inspection is technical inspection. Created system of planned and prevention repairs allows users to create one structure of overhauls for each group of vehicles and gather previous experience. Information gained while upgrading inspection and repair cycles have proven that maintaining the system of repairs based on strict rules and with small tendency for modifications is ineffective and even harmful for repair efficiency. Natural direction for further system evolution is an attempt to determine the actual margin of fleet "usage potential". The most important and most carefully studied feature is durability of elements. This feature, tested through the appropriate sample, is the basic quantity parameter. It has to be determined for all selected basic elements of the studied vehicle types. It is a starting point for particular systems (variants) of technically correct repair cycle.

The study of normal physical wear aiming at durability determination of basic elements is an analysis of element sets with the same name included in all vehicles of particular type. It is not connected with the analysis of particular vehicle. Presented element durability determination method allows user to define critical mileage values for vehicle basic elements. Obtained results also allow to assume the quality of design (as signified by the level of elements reliability). Quoted terms were adapted to solve the problem of vehicles critical mileage values. With an increase in number of inspections the period between the inspections did not increase. Combined labour intensity of inspections in new system is not higher than labour intensity of inspections conducted in previous manner. The last aspect connected with providing planned and prevention repairs with final and the most rational shape was resolving the issue of vehicle usage period. Repair due to its physical wear seems uneconomical. It is not technically and economically justified. The exchange of old fleet for new one should occur before its physical wear. The factors limiting mileage are technical wear. It should be understood as mechanical wear resulting from physical and chemical processes. Markers of vehicle degradation and "moral wear" are understood as the inability of old vehicles to cope with new technical requirements resulting from technological development.

Even though it is difficult to determine the vehicle lifespan based on the "moral" wear, it is much easier to determine vehicle lifespan through progressing fleet degeneration. Up to date data are collected regarding wear processes, elements mutual impact, types of external impacts, etc. [3]. The most reliable indicator used to evaluate the existing technical and organisational solutions regarding maintenance and reparation of vehicles is economic calculation. It was considered only as assistance in dealing with current operation costs. It became necessary to introduce some unified economic indicators suggested by the World Bank, which should allow an objective evaluation of operational costs and a

selection of the best operation variant in terms of investments and modernisation. The most important fact, however, is that this method allows the efficiency verification of those solutions in the full period of time as a result of comparing calculated indicators. It is possible to select the most appropriate variant for long-term perspective. The process of economic analysis comes down to calculation of following indicators [4]:

- NPV – Net Present Value (updated value of undertaking),
- IRR – Internal Rate of Return (internal rate of capital return) – profit rate,
- B/C Ratio – Benefit – Cost Ratio (efficiency indicator of expenditures and costs),
- PP – Payback Period (period of share capital return).

Currently, the basic criterion for transport company operation efficiency evaluation is financial factor. In the assumed method, the efficient investment is considered to be the profitable one. The aim is to adjust vehicle design in order to make the reparation process easier, and at the same time organise that process at the highest quality. This system also assumes a significant "flattening" of transport company functional structure. It means that the management deals with company operational strategy and general supervision of processes, but the executive actions are covered by employees. Employees are encouraged to constantly improve their skills, develop their independence. They should be also responsible for the company. The benefit of introducing such system is, among other things, the increase in mutual trust, the ability to move employees to the busiest workstations and the increase in work quality. It also contributed to the increase in work efficiency and streamlined repair process, which led to elimination of vehicle deficit.

3. Conclusion

When summarising the discussion it needs to be stated that the characteristic features of transport companies are variability and ability to adjust to new work conditions, which is a trait of self-learning organisations.

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