

# Improvement of Vehicles Maintenance Management Process Performance Through the Implementation of Controlling

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The article raises an important issue concerning the reporting systems which are used in transport companies. Research conducted by the author focused on the reporting system which functions in maintenance service station of one of the largest road transport operators in Poland. The goal of this article is to analyse the current reporting system in force in the audited company and to develop a model solution, supporting the management of vehicles maintenance performance. Prepared model should incorporate the concept of controlling.

**Keywords:** controlling, reporting, vehicle maintenance.

## 1. INTRODUCTION

The increasing level of competition on the regional and national passenger transport market makes road transport companies take into account the necessity of operational costs reduction during the development of their operational strategies. However, the performed actions should not base on seeking simple ways of cost reduction which bring quick results in the short term (e.g. workforce reduction, reduction of purchased materials quality). From the perspective of long-term strategy, such solutions bring more losses than benefits and ultimately they are usually evaluated negatively. Thus, it is necessary to seek solutions that base on the concept of continuous improvement and reduction of waste occurring in the organization. Only such a strategy would bring long-term benefits and expand the competitive position of the carrier.

The target of this article is to analyse the current reporting system implemented in the audited company and to develop a model solution, supporting the management of vehicles maintenance performance. The prepared model should incorporate the concept of controlling.

## 2. THE CONCEPT OF EXPLOITATION CONTROLLING

In both literature and practice, controlling is understood in diverse ways. Vollmuth defines it as a management tool which supports board of management and managers in decision-making process [1]. Horvath defines controlling as a substitute for management system that creates and coordinates the planning, control and supply of information processes, and as a result, supports adaptation and coordination of the entire system [2]. However, Nowosielski states that the perception of controlling as the management system is much arguable - so he includes this term to the notion of supporting management functions [3].

The idea of controlling is therefore to build a logical system that helps managers to make more accurate and reliable operational and strategic decisions. This is possible thanks to structured combination of different structural elements of the company being involved in the business performance expressed in financial, economic, organizational and technical fields [5].

For the purposes of this article, the author assumed that controlling is a specific system of support for the processes related to the company's maintenance management. This system combines the operations of coordination, control, information

and planning [4], that are directed at supporting managers in the area of vehicles maintenance decision making processes performance.

Controlling system deals with the prediction of the future based on a broad analysis of both present and past processes. It also verifies the activity of company's components, taking into account market requirements in the decision making process and creation of an appropriate competitive position [6]. It is a system that may enable to measure, measurable goals putting, analysing, comparison making, all the necessary elements of the company controlling, and thereby contribute to the creation of value. It should be pointed out another major feature of reliable controlling performance [7]: it reduces the level of uncertainty in the decision making process through the measurement, analysis and prediction of controlling parameters. In this aspect, controlling can be defined as a risk management tool.

In Polish literature, the vast majority of studies applies to financial controlling [8, 9, 10, 11, 12, 13, 14, 15, 16, 17]. Only a few books relate to the use of controlling in other functional areas [e.g. 18, 19, 20, 21, 22, 23, 24]. Meanwhile, controlling should also be oriented on functions and processes and activities, as refining their course is a prerequisite for achieving the goals [25]. Making functional decentralization of the controlling system and introducing controlling of exploitation, there should be taken into account that the controlling activities undertaken within the area of maintenance management contributed to the objectives and tasks being set before the entire controlling system.

Controlling system cannot perform without development of internal reporting and information system. This system largely determines the effectiveness of performed actions by providing the access to relevant data sources, enabling the current communication and cyclical delivery policy makers with information on the current state of the company [25].

In the literature, the attitude to the recipient is mentioned as a criterion for building information and reporting system. This means that the reports should be tailored to the expectations and needs of the recipient, thus the level of reporting must be appropriate to the level of management [26].

### 3. ANALYSIS OF CURRENT REPORTING SYSTEM BEING IMPLEMENTED IN MAINTENANCE SERVICE STATION

Investigated road passenger transport company has its own maintenance service station whose primary function is to provide services related to the repairs, inspection, and replacement of components in vehicles used in its business activity. Service station is located in a separate location situated at a distance of about 7 km from the main railway station, where all vehicles are stationed.

The current reporting system is a dual one - all records of ongoing work are carried out on paper, and then the selected data is entered into the computer system. One person is responsible for entering the data into the system, and registration of data is made periodically (when the responsible person has time to do that). Thus, there is no ongoing updates to data in an IT system. Such proceedings cause a situation in which managers of other departments and Board members have limited access to information on tasks performed by maintenance service station. Any attempt to verify the correctness of the performed actions, or to carry out the application process, requires access to paper books and their reading is time-consuming. This reduces significantly the possibility of conducting verification analyses, inspection actions, and analyses for planning purposes in a systematic way. It also causes a significant waste associated with doubling the performance of the same activities related to the required accounting.

It should also be noted that the nomenclature used in registration system is not subject to any standards. This means that the same operation can be recorded under different names (e.g. repair of lighting, replacement of lighting, replacement of light bulbs). On the other hand, the implemented general terminology may refer to the various tasks carried out in the area of one system (e.g. repair of compressed air system), which significantly impedes the identification of actions performed. This lack of standardization of the recording data makes it impossible to carry out a statistical analysis of failure indicators for individual components that could be used in process control and planning. Such analyses are, however, very desirable today by the Management Board and selected managers. Moreover, the partial analysis carried out for the needs of the author's research performance showed that some operations in the

use of selected vehicles are realized with very high repeatability. Examples of such operations are shown in Table 1.

Table 1. Analysis of maintenance operations performer in chosen vehicles in time period of August-November, 2013.

Vehicle number	Type of performed maintenance action	Time of performer maintenance action
Bus B1	Repair of cooling system	13.09.13
		14.10.13
Bus B2	Repair of compressed air system	29.08.13
		19.09.13
		30.10.13
Bus B3	Repair of heating	11.09.13
		19.09.13
		03.10.13
		17.10.13
	Repair of cooling system	19.09.13
		03.10.13

Source: Company's own internal sources

Lack of current registration of performed maintenance tasks makes it impossible to efficiently manage works based on the integration of maintenance service system of individual vehicles. Process analysis of this operational area showed a clear lack of a comprehensive system for planning of repairs, replacements and other maintenance actions. As a result, there can be observable a multiple substitution of vehicle on maintenance service station at short time intervals to perform single actions that could be linked with each other. An example here may be the bus A1, which was in January handed over to the maintenance service station up to 8 times. Table 2 shows a list of repairs carried out during this time period.

Table 2. Maintenance operations performed for bus A1 in January, 2013.

Start Date	End Date	Type of performed maintenance action
07.01.2013	07.01.2013	repair of heating, repair of lighting, repair of door lock, repair of bellows, repair of tailgate
08.01.2013	08.01.2013	assembly of water tank, dryer cartridge replacement
10.01.2013	10.01.2013	repair and assembly of gear box
14.01.2013	14.01.2013	repair of filler tank lock, repair of lighting, repair of passenger seat, repair of wiper arm
18.01.2013	18.01.2013	track rod end replacement, repair of supply system, repair of lower guard for silencer
21.01.2013	21.01.2013	road assistance, repair of rear door, wiper repair
28.01.2013	28.01.2013	disassembly of the front wheel, disassembly of the clamp, front left side
30.01.2013	30.01.2013	Repair of front door, repair of supply system

Source: Company's own internal sources

In the presented table there can be distinguished maintenance actions that could be linked which would reduce the number of days that the vehicle is not in use, and reduce the costs associated with each time passing between the service station and the bus station.

Another important irregularity identified in the course of maintenance frequency analysis is extended (unjustified) keeping the vehicle at a maintenance service station. As a result, bus is temporarily excluded from the transport service performance, which generates increased demand for the operation of other vehicles. At the same time "stored" bus covers an area at a maintenance service station making it difficult to provide services to other vehicles. An example of such a vehicle is a bus detained A2, which was substituted at maintenance service station 02/09/2013, left it on 09/16/2013, after which he returned for a period of 19-28<sup>th</sup> September, 2013. During this time there were carried out minor repairs, replacements and assemblies, which definitely could be grouped in and performed in a shorter period of time. Type of performed maintenance actions and dates for their implementation are presented in Table 3.

Table 3. Maintenance operations performed for bus A2 in September, 2013.

Maintenance service date	Performed maintenance action type
02.09.2013	repair of lighting
16.09.2013	rear wheels air pumping
19.09.2013	fuel filter replacement. Front and back brake disc replacement
20.09.2013	installation of ticket vending machine
23.09.2013	repair of rear brake, right side
28.09.2013	replacing the battery.

Source: Company's own internal sources

It should be noted that in the time period 03<sup>rd</sup>-15<sup>th</sup> September, 2013 there were not carried out any maintenance operations, although according to the pursued registration, the bus remained at a maintenance service station. The indirect-depth interview carried out in March 2014 unfortunately did not allow to determine the causes of this incident.

The current performance of the reporting system is rated as inefficient. During the performance of cost analysis for this operational area, the attention was focused not only on standard costs associated with the reporting process, but primarily on the valuation of waste occurring in the system e.g. by:

- the cost of the dual recording (paper and electronic records),
- costs of vehicles multiple substitution for maintenance performance,
- increased costs of data sharing in situations of forced control connected with the necessity of collecting and verifying paper documentation.

The basic weakness of the current system is limited possibility of its use in planning and control processes. As shown indeed, the lack of current entries to the system makes impossible operational planning activities of the maintenance station and combining the emergency maintenance actions with the planned works. Incomplete system information recorded in the IT system and the lack of recording data standardization make it impossible to automate analytical and control works.

#### 4. MODEL OF REPORTING BASED ON THE IDEA OF CONTROLLING FOR MAINTENANCE PROCESSES PERFORMANCE

The problem defined on the example of the investigated company is not a separate case. Interviews conducted among other road carriers confirmed the weakness of existing reporting systems in the area of performance of the maintenance service station, which is an additional activity for these companies. Therefore, it seems reasonable to develop a reference solution tailored to the needs of road passenger transport. Effective reporting may in fact contribute to better planning and more effective control of work related to the maintenance and operation of vehicles.

The proposed reporting system should be based on the concept of controlling of operation. It is worth noting that reporting is one of the basic tools of controlling in the enterprise, because it is an important source of information supplying the controlling information system. In the case considered, the author focuses attention on the operational reporting, which is the process of data gathering with the greatest detail and their distribution in the form of information.

According to the idea of controlling of operation, operational reporting process should be carried out to support the direct control of business and operational planning. However, it should also form the basis for building strategies and business area. Operational reporting system should guarantee access to current analysis as a basis for the performance of knowledge base and determining directions of development. And most importantly, its structure needs to be integrated with its existing IT system, thus enabling the automation of most of the operational work.

The basic requirement for being built reporting system is the current database. This imposes an obligation to current registration of operations carried out by the staff of the maintenance service station and the resignation from double registering (elimination of paper documentation). Current information on the provided services will facilitate the control process and significantly will support operational planning throughout the entire organization. It will also enable the integration of corrective actions and emergency maintenance actions with planned maintenance works. With the support of IT systems, employee entering data about the vehicle being directed to the maintenance station for repair, will receive a hint about the dates of planned maintenance operations which could, if possible, be connected. As a result, it will reduce the cost of vehicles' multiple substitutions to maintenance service stations and eliminate repetition of maintenance actions performance.

The reporting system in order to meet the relevant requirements must be based on standardization of registered operations. It is therefore a necessity to clear indication of the type of operation performed and the type of damage occurring. Detailed describing the scope of performed works by employees, may, however, require excessive amount of time on the process of registering, which will translate into higher costs of the performance of reporting system. For this reason, it is advisable to introduce vocabulary for basic of operations (often repetitive) carried out by

a maintenance service station and symbolism for the type of work performed. Symbols should also indicate the location of the work under way: R - right, L - left, P - front, T - back.

Table 4. Symbols differentiating the type of performed maintenance operations.

Symbol	Type of maintenance operations
O	Technical maintenance
P	Planned maintenance (included in the maintenance schedule)
A	Emergency maintenance
N	Repair
K	Conservation
R	Refit
W	Replacement

Source: Own contribution

The use of the type of maintenance operation symbols will help in the control process determine the degree of failure of the vehicle and the cost of its basic operation. It will improve the process of identifying the nature of ongoing work and facilitate their grouping for analytical purposes.

The basic guideline of defined objectives for the proposed model of reporting is to allow

reporting of data as a basis for carrying out a multi-criteria analysis to support decision-making processes of managers. A well-functioning system should provide the management the results of statistical analysis of repeatability ongoing operations, failure indicators/durability of used parts/consumables and activities carried out by dedicated staff. As a result, managers get information to:

- evaluate the work done by individual employees of maintenance service stations;
- verify the quality of the acquired and used materials;
- monitor how suppliers meet the quality requirements;
- plan the number and frequency of renewal inventory levels of individual indexes;
- plan of operations on each vehicle with an engagement of this plan on the being prepared schedule of transportation services;
- verify the actual operating costs of individual vehicles.

Type the reported data and sample scope of their use in the area of planning and control are shown in Figure 1.

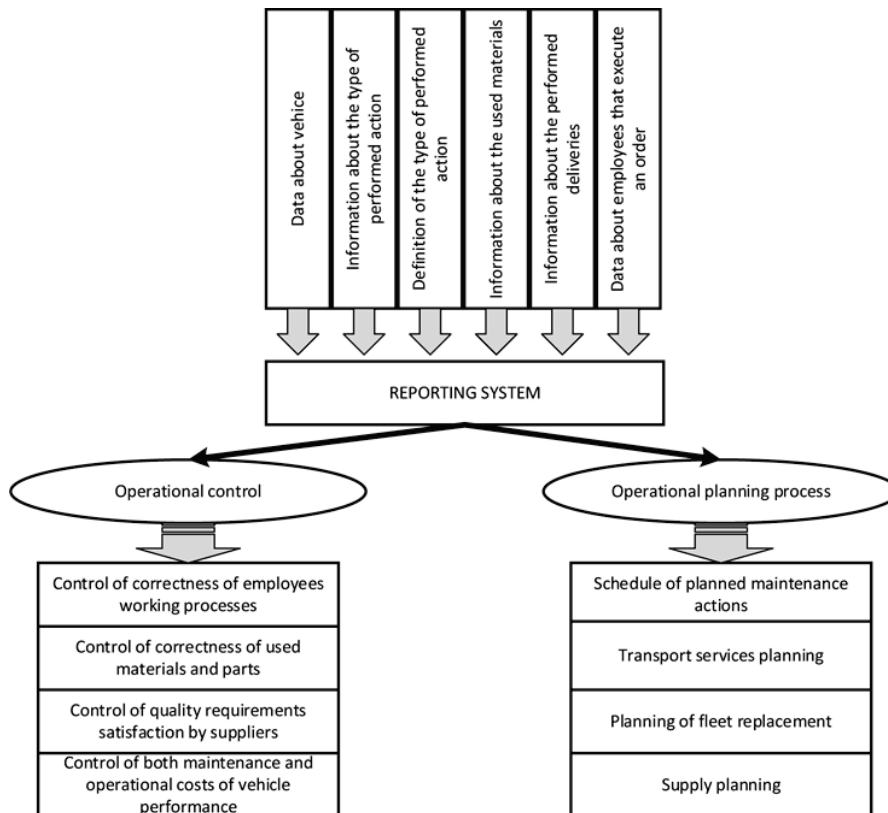


Fig. 1. New model of reporting system.

Using the concept of continuous improvement as part of controlling of operation, it is necessary to verify the effects of the implemented solution. In assessing the performance of the reporting system and determining its effectiveness, it is necessary to broader look at the incurred costs associated with this activity.

Focusing solely on the expenditure relating to the maintenance of the system may in fact lead to wrong conclusions that the proposed solution is more costly than the current process. For this reason, the assessment procedure must be focused on the analysis of global cost being a function of the following cost items:

$$GK=f(KI, KE, KP, KU)$$

where:

*GK* – global costs

*KI* – costs of IT system performance

*KE* – cost of data recording process performance (mostly connected with working time of employees responsible for maintenance and operational activities recording process)

*KP* – costs of vehicles moves (travelling costs of vehicle between maintenance service station and bus station, costs of vehicle being out of date)

*KU* – costs of sharing the information.

The sum of these costs show the actual effectiveness of analysed systems. It should be noted, however, that between distinguished positions can occur the trade-off relationship. For this reason, in the process of improving the system, the targeted actions should be to minimize the global cost functions rather than individual cost items.

## 5. SUMMARY

The example presented in the article concerns one transport company. On the basis of the performed analyses, there have been defined guidelines for reporting model dedicated to a selected group of companies. Author, during the definition of model assumptions mostly took into account the specificity of the analysed organization and information needs of managers of the analysed carrier. For this reason, the author's further study should aim to analyse and asses the performance of other carriers' reporting systems and universality of the prepared solution model.

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