POLISH JOURNAL OF MANAGEMENT STUDIES
Chląd M.

2024
Vol.29 No.2

ANALYSIS AND EVALUATION OF THE EFFICIENCY OF THE TRANSPORT PROCESS IN A PRODUCTION COMPANY

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Abstract: The transport process is one of the key processes in a manufacturing company, therefore its measurement and assessment of effectiveness are very important. An important assumption of a manufacturing company should be to increase the efficiency of the process, and then maintaining efficiency at the established, acceptable level. The efficiency of transport processes is influenced by a number of factors that need to be analyzed to have an idea of the current effectiveness of the examined process. An increase in the level of efficiency of transport processes is possible by making decisions based on analyses. The article discusses the analysis of the efficiency of the transport process in the researched production company using comparative analysis of measures used to assess transport processes. The transport process was analyzed in the context of efficiency in the years 2013-2022 based on an interview with the owners of the surveyed enterprise and the person responsible for transport in the surveyed enterprise. The information obtained was the basis for calculating the indicators of the enterprise's transport process, and a formula for assessing the overall effectiveness of the transport process was proposed, which made it possible to outline benchmark indicators on the basis of which the enterprise could consider a given process as effective or ineffective. Thanks to the obtained results, it was possible to fully assess the effectiveness of the transport process from the point of view of the surveyed company, which is particularly important from the perspective of the transport costs incurred and the level of customer service.

Keywords: Transport management, process management, transport processes

DOI: 10.17512/pjms.2024.29.2.09

Article history:

Received January 12, 2024; *Revised* March 05, 2024*; Accepted* April 22, 2024

Introduction

Within the integrated flow of goods in a manufacturing company, transport is of vital importance. Among functions such as planning, stockpiling and warehouse management, and shipping, transportation remains the function that determines the physical flow of cargo. Transport includes a set of the following activities: movement (transporting, moving), transshipment (loading, unloading), other manipulations such as stacking, fastening, measuring, counting, checking (Anderson et al., 2019). Many types

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of transport are used in enterprises (Chląd, 2020). We can distinguish both external, close transport - between individual departments in one production plant, and internal - understood as transport between different branches of the company, also known as own transport of the company (Ziyadin et al., 2020). All types of transport in a company are extremely important, regardless of what the company does. Each of the ways of moving various goods is needed to carry out basic processes in a given company. Planning a transport strategy should be preceded by a detailed analysis of the company's own transport needs and the rolling stock at its disposal, as well as an analysis of the offers of external companies that provide comprehensive services in this area. Optimization of transport costs has become an important aspect in reducing the total costs of a manufacturing company. They depend not only on the volume of production to be transported to customers, but also on the choice between own transport and transport carried out by external entities. Every manufacturing company faces the need to make decisions about how to transport its products. It chooses between the following options: maintaining its own transport fleet and performing all transport on its own, outsourcing transport activities to external transport and forwarding companies, combining two variants, i.e. carrying out transport partly by its own means of transport and partly by external means. Making a decision on outsourcing transport services to an external entity should be preceded by a detailed economic analysis.

The aim of the article was to determine the actions taken by manufacturing companies in relation to process management. By means of an interview with the owners of the Surveyed Company and the person responsible for transport in the Company, a formula for assessing the overall effectiveness of the transport process was proposed, which made it possible to outline benchmark indicators, on the basis of which the company may consider a given process as effective or ineffective. The transport process was analyzed in the surveyed production company using meters in the years 2013-2022.

Literature Review

Due to the changing environment, as well as the increase in competition on the market, the company is required to prepare, improve and apply modern management concepts (Hussain et al., 2021). Process improvement in the company consists in constant control of the processes that take place in it, implementation of solutions to increase productivity and striving to improve the processes carried out in the daily operations of the company, taking into account the assumed method of solving problems, using the experience resulting from the mistakes made (Arnold, 1993). As a result of the improvement process, the company should eliminate existing problems, stop weaknesses, and specify new areas that will strengthen its competitive advantage (Ascani et al., 2021; Kollmann, Dobrovič, 2022). In almost every company, employees work on the possibility of improving the quality of activities and products (Vinodh et al, 2021; Łucjan et al., 2023).

In terms of management, an excellent company can be considered one that constantly develops its skills and is able to use its own capabilities in the challenges ahead. Therefore, an excellent company is one that is constantly prepared to identify threats and minimize risk (Neelam,2014).

The concept of excellence is also reflected in standards and norms, but it applies to individual areas of business management. For example, continuous improvement on the basis of the PN-EN ISO 9000 standard is understood as a cyclical activity aimed at expanding the ability to meet expectations understood as needs, requirements established customarily or obligatorily (Veselova, 2019). However, the overall requirements presented in the standards give the organization some freedom to adapt them to the actual situation and internal and external conditions of the company (Gorzeń -Mitka, 2013). The attitude to perfection and improvement has undoubtedly changed over the years, both in terms of the subject matter and the methods of improvement. Table 1 shows the variety of interpretations of the concept of excellence.

Table 1. Excellence and Improvement in Management Theory

Direction	School	Excellence	Improvement as a process
Technological and physiological	Scientific management (F.W. Taylor, H.Gantt, L. Gilbreth)	Model Worker Model time	Search for one best way (one best way) to do the job by adjusting tools, streamlining work processes by breaking down into elementary movements
	K. Adamiecki	Excellence - harmony Law of optimal production (benchmark production)	Harmonious selection of individual organs. Harmonizing all activities. Striving for spiritual harmony. For each plant, machine or worker, there is always a strictly defined limit of efficiency, at which the cost per unit is the lowest. It sets the benchmark production.
Administrative	Administrative management (F.W. Fayol, M. Weber, Ch. Barnard)	The ideal bureaucracy	Distinguishing managerial functions: planning, organizing, leading and controlling. The ideal type of bureaucracy provides: division of labor within the organization, separation of position matters from personal property and personal matters, selection of employees based on qualifications, hierarchical

			structure. Ideal types of power. An ideal type of bureaucratic organization by M. Weber.
Humanistic	School of interpersonal relations (human relation) (E. Mayo, W.F Whyte, D.McGegor, M.P. Follett)	An excellent manager	The perfection of an organization lies in the common way of thinking, feeling and behaving shared by all members. The factor that determines the effectiveness of work is the psychological climate. D. McGregor's theory is the best philosophy for managers. Conditions of an excellent manager: -self-awareness of the conditions that a manager must meet helps improve one's own skills; - solid general education enabling understanding of the world and the changes taking place in it, building the most likely future scenarios.
Quantitative approach	Quantitative school	A model for presenting the perfect, ideal, and target state	Mathematical models used to determine the best (most perfect) way to design work.
Systemic approach	Systemic school (K. Boulding, G. Nadler)	The concept of an ideal system G. Nadlera	The concept of an ideal system, using a systemic approach, is based on the concept of synergy.

Source: Ejdys, 2011

Therefore, it can be considered that the subject of enterprise improvement is also a change in attitudes, perceptions, behaviors and expectations that operate in the organization. J. Ejdys believes that "excellence and improvement" are inherently related to the enterprise development process. The need for changes seems to be unquestionable, but the choice of how to implement the changes becomes a dilemma (Ejdys, 2011). Two types of changes can be distinguished (Driffin, 2022):

- radical, which involve a revolutionary change in the strategy and elements of the management system (e.g. Business Process Reengineering - BPR) (Nowicka, Szymczak, 2020),
- gradual, which involves evolutionary or continuous improvement (Business Process Improvement) (Lazarević, et al., 2022).

Taking into account two types of changes, we distinguish incremental and continuous improvement. Step improvement The subject of this change is a mega-process, the starting point is the process for the course as well as the formation of structures, short time, high degree of risk, limited employee involvement (Durlik, Pachura, 2014). Continuous improvement is a continuation change that mainly concerns qualitative changes and is initiated by employees at lower and middle levels. The subject of changes are sub-processes and functional processes, the starting point is the existing functions or sub-processes, long time, moderate degree of risk, employees included in the process are involved in creating new knowledge and evolutionary development of a new pattern of behavior (Trutti, et al., 2021). The approach to continuous improvement has been used in many organizational tools and solutions. It can be applied to various areas of the company, for example in the production of products, processes and connections between them, organizational structures, management systems, social and cultural aspects, work environment and technology, as well as relations with interested parties (Závadský et al., 2021; Mishchuk et al., 2023). The entire process improvement procedure in an enterprise can take place at various levels. Therefore, the maturity of individual companies within the excellence zone will be different. Figure 1 shows the maturity model of improvement processes adapted from the concept of quality management.

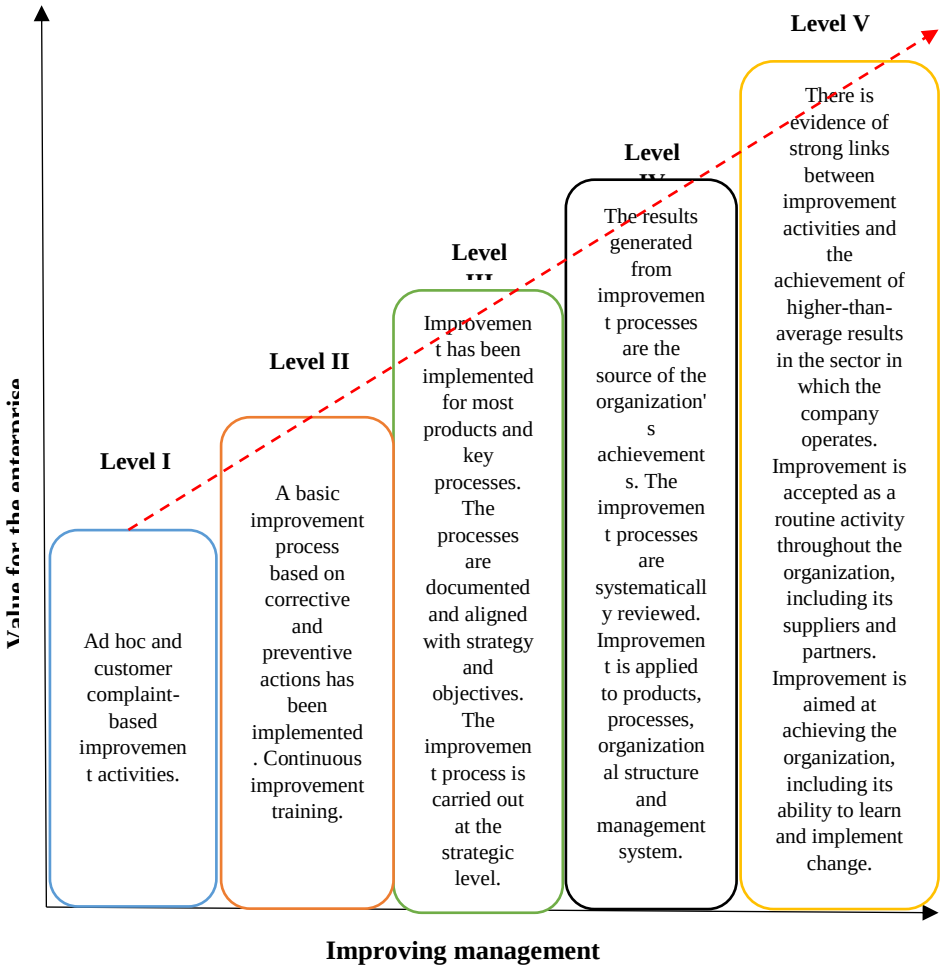

Figure 1: Maturity model of enterprise improvement processes
Source: Gorzeń- Mitka, 2013; Kush et al.,2018

The continuous management improvement model is a corrective tool that allows the company to adapt to changes in the environment and improve processes (Kabus, 2023). Implementing an improvement model allows you to achieve better results and contributes to the increase of the company's competitiveness. This model can be presented as a process of continuous implementation in the enterprise, depending on the organization's specifications (Navarro, 2019) Methods and tools are selected and

implemented depending on changes occurring within the enterprise and its environment (Reijers, 2021).

Enterprises that are well organized and able to adapt to the behavior of the free market system are able to keep up with the competition and at the same time survive on the market. The use of process management enables the improvement of processes that are important from the perspective of a given company's strategy, for example transport processes. In some companies, there is a lack of motivation to improve processes because they assume that everything has already been done in the past (Kot, Ojinji, 2023). However, by analyzing the processes in the enterprise on a continuous basis, in particular transport and organizational processes, it is possible to observe irregularities that affect the functioning of the entire enterprise. These irregularities arise as a result of constant changes in the immediate and distant environment of enterprises, which often cause instability of the market in which the enterprise operates (Karuppiah et al., 2022). The need to move loads in a manufacturing company occurs both at the supply, production and distribution stages. Loads can be moved using various means of transport, depending on the individual needs of the customer. Problems related to transport in the enterprise concern warehouse management, storage, transport of materials and finished products, the location of supply centers, the use of available means of transport, the use of appropriate transport technologies and problems related to its organization (Lisowska et al., 2022). Transport is a course of activities appropriately prepared and organized in such a way as to enable the proper functioning of the entire enterprise (Grzybowska, 2013). Skillful transport management in a production company on the supply and distribution side is one of the basic tasks of the manager of the transport department. Transport should be organized in such a way as to ensure the company's maximum increase in production and sales, generating the lowest possible transport costs. For this reason, a carefully prepared strategy aimed at constant improvement of the transport process is of great importance. Every organization should be aware that only a properly developed transport process, customer service and communication can lead to increased added value for a given production company and the end customer (Nowicka, Szymczak,2020). Taking into account the share and role that transport plays in the entire organization, the need for its continuous improvement is particularly important (Łukasik et al., 2017). Any conclusions from the analysis of the entire transport process can be the basis for defining emerging irregularities, as well as implementing changes to eliminate errors.

Research Methodology

The process of transport management and development is absolutely related to the concept of continuous improvement. Transport in a manufacturing company plays a key role, so it can be assumed that it is one of its main processes and should be constantly

improved. An important element of every functioning system are measurements that aim to increase the effectiveness and efficiency of processes. Streamlining processes and improving their results can be achieved by constructing an appropriate system of indicators to monitor and estimate the effectiveness of processes (Wojtynek, 2020). Requirements for process monitoring can be determined using a set of measures that will allow you to check the effectiveness, quality and timeliness of their implementation. By implementing this form of assessment of the course of specific processes, it is possible (Twaróg, 2005; Dąbrowska, et al., 2021):

- proving whether it is possible to achieve the goal,
- focusing on factors that are important in achieving goals
- motivating employees to improve their results,
- employee participation in process improvement,
- drawing conclusions about what will happen,
- highlighting quality problems, indicating areas that require significant attention,
- preparation of summaries that will allow for comparison of the achieved results in terms of time and type,
- long-term evaluation of activities,
- linking metrics with the company's strategy,
- encouraging continuous improvement (Kucińska-Landwójtowicz, 2014).

The metrics should have features that are completely valuable and useful to the company to identify the level of excellence and allow to assess the effectiveness, efficiency, timeliness and quality of activities performed. Therefore, the transport process was analyzed in the years 2013-2022 in a production company operating in the Częstochowa district. The company was established in 1998 as a family business with entirely Polish capital and employs 250 employees. From the beginning of its existence, it has specialized in the production of high-quality paving stones and concrete accessories.

The designated measures can constitute the basis for determining directions of improvement in areas that will need improvement. Measuring processes in an enterprise is intended to control and evaluate activities in the organization, allows for making rational decisions, and enables observation of the plan whether it is being implemented correctly. A comprehensive analysis of the effectiveness of transport processes enables the assessment of all factors that influence the implementation of the transport process, e.g.:

- the degree of effective operation of a given device, means of transport, etc.,
- the degree of utilization of the capacity of means of transport in the case of transport operations,
- the share of a given means of transport in the transport work performed or labour intensity due to the equipment, means of transport involved, etc.,

- reliability of delivery, i.e. the probability of meeting the agreed delivery dates and compliance of the delivery with the order,
- quality of delivery, i.e. completeness, correctness of documentation, compliance of packaging with regulations and wishes of the customer, avoidance of damage during transport and reloading,
- flexibility of supply, i.e. the ability to adapt to specific customer needs, etc.

Table 2 includes the measures that will constitute the basis for assessing effectiveness transport process in the surveyed enterprise.

Table 2. Measures thanks to which the examined company will be able to monitor and analyze the transport process

Description of the indicator	**Formula to calculate**	J.m.
Transport reliability	$\frac{\text{number of transports performed on time}}{\text{total number of transports}} \times 100\%$	%
Number of damages during transportation	$\frac{\text{number of damaged transport units}}{\text{total number of transport units}} \times 100\ \%$	%
Transport flexibility	$\frac{\text{number of transport requirements met}}{\text{total number of transport requirements}} \times 100\ \%$	%
Transport costs per km	$\frac{\text{transport costs}}{\text{number of kilometers}}$	PLN/km
Transportation costs per shipment	$\frac{\text{transport costs}}{\text{number of transports}}$	PLN/km
The degree of use of means of transport	$\frac{\text{Real payload (t)}}{\text{Payload possible (t)}} \times 100\%$	%
Use of working time	$\frac{\text{time used}}{\text{available working time}} \times 100\%$	%
Failure rate of means of transport	$\frac{\text{number of failures}}{\text{total number of trips}} \times 100\%$	%
Number of kilometers per means of transport	$\frac{\text{total number of kilometers}}{\text{number of transport units}}$	km
Delivery readiness	$\frac{\text{number of immediately completed orde}}{\text{number of transports}} \times 100\%$	%

Source: Own elaboration based on data from the surveyed enterprise

When building meters, it should be remembered that they should be an expression of real changes taking place in processes that result from the flow of materials, raw materials, and information. Improving transport processes should be a key goal of every company. It is important to control the results of transport processes using reliable measurements, as well as to evaluate the performance of these activities. As a result of properly functioning transport processes, the company is able to achieve its basic goals.

The timely use of indicator assessments makes it possible to identify positive and negative trends, which then allows for thoughtful management of the transport process.

Analysis and evaluation of the efficiency of the transport process

The transport process is one of the key processes in a manufacturing company, which is why it is very important to measure and evaluate its effectiveness. An important assumption of a manufacturing company should be to increase the efficiency of the process, and then to maintain efficiency at a fixed, acceptable level. The efficiency of transport processes is influenced by a number of factors that should be analyzed in order to have an overview of the current efficiency of the process under study. Increasing the level of efficiency of transport processes is possible thanks to decision-making based on analyses. The analysis of the efficiency of the transport process in the Audited Production Company is discussed below with the help of a comparative analysis of measures used to assess transport processes. The transport process in the Surveyed company begins with supply, where it is transport that enables the movement of goods related to supply from the place of obtaining or manufacturing raw materials needed to carry out the production process. The next stage is distribution, which enables the implementation of the process of selling goods resulting from the production process and delivery of finished goods to customers. In fact, it is transport that enables the sale and delivery of goods to destinations. The transport process will be analyzed in the context of efficiency in the years 2013-2022. The information obtained is the basis for calculating the indicators of the Company's transport process. The indicators that are the basis for assessing the effectiveness of the transport process in given settlement periods have been compiled. Efficiency assessments are geared towards process improvement in order to provide customers with the highest quality of service while balancing the costs incurred.

By means of an interview with the owners of the Surveyed Company and the person responsible for transport in the Company, a formula for assessing the overall effectiveness of the transport process was proposed, which made it possible to outline benchmark indicators, on the basis of which the company may consider a given process as effective or ineffective. Table 3 presents the benchmark indicators for the Surveyed Company.

Table 3. Benchmark indicators for assessing the effectiveness of the transport process in the surveyed enterprise

	Benchmark evaluation indicator									
Indicator	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Reliability of transport	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90
Number of damage during transport	max. 0,005	max. 0,005	max. 0,005	max. 0,005	max. 0,005	max. 0,005	max. 0,005	max. 0,005	max. 0,005	max. 0,005
Flexibility of transport	min. 85	min. 85	min. 85	min. 85	min. 85	min. 85	min. 85	min. 85	min. 85	min. 85
Transport costs per km	max. 2,18	max. 2,16	max. 2,16	max. 2,16	max. 2,16	max. 2,65	max. 2,70	max. 2,75	max. 2,80	max. 2,80
Transport costs for transport	max. 380	max. 380	max. 430	max. 430	max. 450	max. 450	max. 470	max. 470	max. 510	max. 510
Utilization rate of means of transport	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90
Use of working time	min. 95	min. 95	min. 95	min. 95	min. 95	min. 95	min. 95	min. 95	min. 95	min. 95
Failure rate of means of transport	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015	max. 0,0015
Number of kilometers per means of transport	max. 130 000	max. 130 000	max. 130 000	max. 130 000	max. 130 000	max. 130 000	max. 130 000	max. 130 000	max. 130 000	max. 130 000
Delivery readiness	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90	min. 90

Source: Own elaboration based on data from the surveyed enterprise

Table 4 presents the values of indicators from individual settlement periods, which clearly determine the extent to which individual tasks have been completed in the entire transport process.

Table 4. Transport process evaluation indicators from subsequent settlement periods

	The resulting evaluation index									
Indicator	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Reliability of transport	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Number of damage during transport	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
Flexibility of transport	81%	78%	79%	81%	78%	80%	81%	81%	82%	80%
Transport costs per km	2,20 PLN /km	2,30 PLN /km	2,40 PLN /km	2,50 PLN /km	2,60 PLN /km	2,70 PLN /km	2,80 PLN /km	2,90 PLN /km	3,00 PLN /km	3,00 PLN /km
Transport costs for transport	381,33 PLN /km	398,66 PLN /km	445,09 PLN /km	433,33 PLN /km	477,33 PLN /km	468 PLN /km	493,33 PLN /km	503,96 PLN /km	528 PLN /km	538,67 PLN /km
Utilization rate of means of transport	92%	92%	94%	94%	98%	98%	94%	94%	98%	98%
Use of working time	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Failure rate of means of transport	0,0006%	0,0006%	0,0004%	0,0004%	0,0005%	0,0004%	0,0004%	0,0004%	0,0004%	0,0004%
Number of	130 000 km	130 000 km	137 838 km	128 030 km	135 606 km	128 169 km	130 280 km	128 618 km	130 263 km	132 894 km

kilometers per means of transport										
Delivery readiness	98%	98%	99%	99%	99%	99%	99%	99%	99%	99%

Source: Own elaboration based on data from the surveyed enterprise

Thanks to the obtained results, it is possible to fully assess the effectiveness of the transport process from the point of view of the examined enterprise. Therefore, this is particularly important from the perspective of transport costs and the level of customer service. Tables 5 and 6 compare the obtained results of the indicators with the model indicators in order to analyze the effectiveness of the transport process of the Surveyed Enterprise.

Table 5. Comparison of the obtained sets of indicators with the reference ones

Indicator	2013		2014		2015		2016		2017	
	Received	Standard	Received	Standard	Received	Standard	Received	Standard	Received	Standard
Reliability of transport	99	min. 90	99	min. 90	99	min. 90	99	min. 90	99	min. 90
Number of damage during transport	0,00	max. 0,005	0,00	max. 0,005	0,00	max. 0,005	0,00	max. 0,005	0,00	max. 0,005
Flexibility of transport	81	min. 85	78	min. 85	79	min. 85	81	min. 85	78	min. 85
Transport costs per km	2,20	max. 2,18	2,30	max. 2,16	2,40	max. 2,16	2,50	max. 2,16	2,60	max. 2,16
Transport costs for transport	381,33	max 380	398,66	max 380	445,09	max 430	433,33	max 430	477,33	max 450
Utilization rate of means of transport	92	min. 90	92	min. 90	94	min. 90	94	min. 90	98	min. 90

Use of working time	99	min. 95	99	min. 95	99	min. 95	99	min. 95	99	min. 95
Failure rate of means of transport	0,0006	max.0,0015	0,0006	max.0,0015	0,0004	max.0,0015	0,0004	max.0,0015	0,0005	max.0,0015
Number of kilometers per means of transport	130 000	max. 130 000	130 000	max. 130 000	137 838	max. 130 000	128 030	max. 130 000	135 606	max. 130 000
Delivery readiness	98	min. 90	98	min. 90	99	min. 90	99	min. 90	99	min. 90

Source: Own elaboration based on data from the surveyed enterprise

Table 6. Comparison of the obtained indicator values with the reference values

Indicator	2018		2019		2020		2021		2022	
	Received	Standard	Received	Standard	Received	Standard	Received	Standard	Received	Standard
Reliability of transport	99	min. 90	99	min. 90	99	min. 90	99	min. 90	99	min. 90
Number of damage during transport	0,00	max. 0,005	0,00	max. 0,005	0,00	max. 0,005	0,00	max. 0,005	0,00	max. 0,005
Flexibility of transport	80	min. 85	81	min. 85	81	min. 85	82	min. 85	80	min. 85
Transport costs per km	2,70	max. 2,65	2,80	max. 2,70	2,90	max. 2,75	3,00	max. 2,80	3,00	max. 2,80
Transport costs for transport	468	max. 450	493,33	max. 470	503,96	max. 470	528	max. 510	538,67	max. 510
Utilization rate of means of transport	98	min. 90	94	min. 90	94	min. 90	98	min. 90	98	min. 90
Use of working time	99	min. 95	99	min. 95	99	min. 95	99	min. 95	99	min. 95

Failure rate of means of transport	0,0004	max.0,0015	0,0004	max.0,0015	0,0004	max.0,0015	0,0004	max.0,0015	0,0004	max.0,0015
Number of kilometers per means of transport	128 169	max. 130 000	130 280	max. 130 000	128 618	max. 130 000	130 263	max. 130 000	132 894	max. 130 000
Delivery readiness	99	min. 90	99	min. 90	99	min. 90	99	min. 90	99	min. 90

Source: Own elaboration based on data from the surveyed enterprise

Considering the data contained in tables 5 and 6, conclusions can be drawn regarding the fulfillment of the requirements regarding the implementation of transport processes set by the owners of the surveyed enterprise. Green fields indicate the requirements met, red fields reflect the exceedance or failure to meet the requirements, while yellow fields indicate the adopted model indicators. Analyzing the first indicator, it can be concluded that the company has maintained transport reliability at a very high level for ten years. Transport reliability is a very important indicator from the customer's point of view, because its value may suggest customer satisfaction and thus inform whether the customer will use the company's offer again. Delivery time is therefore a key factor influencing the assessment of the efficiency of the transport process. Another analyzed indicator is the number of damages during transport.

The examined company belongs to production companies from the construction industry. The specificity of the delivered product means that the number of damages during transport of the product to the customer is very small, which can be seen from the above indicators. The company meets the established standards and does not record financial losses related to cargo damage during transport. Transport flexibility is the next indicator analyzed. The values of the flexibility indicators clearly show that the company did not achieve the intended results in the analyzed periods (figure 2). This is due to the large range of products offered and products tailored to individual customer proposals and needs. It is difficult to meet the requirements of customers, especially those with special expectations. Customer requirements are very important to ensure that the company's reputation does not lose, especially in the eyes of potential consumers.

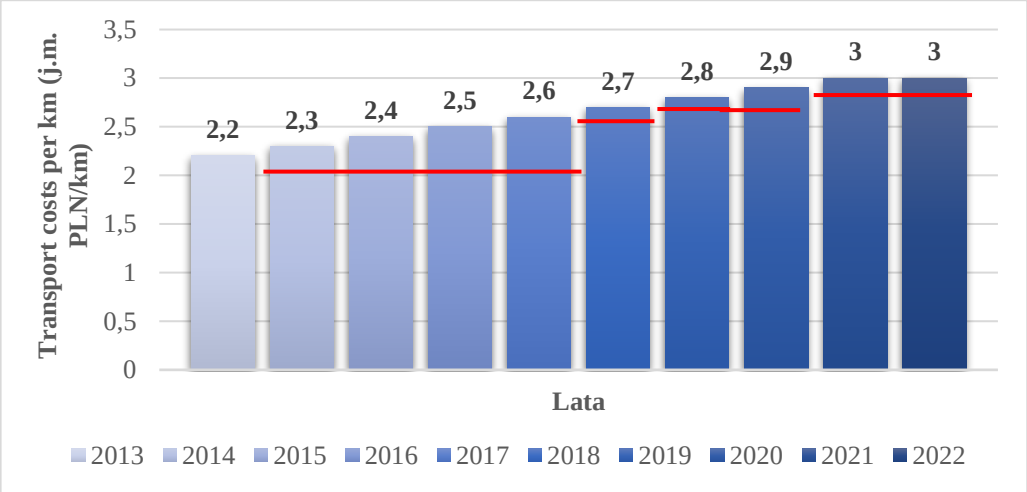

Figure 2: Transport flexibility indicators in the surveyed enterprise in the years 2013-2022
Source: Own elaboration based on data from the surveyed enterprise

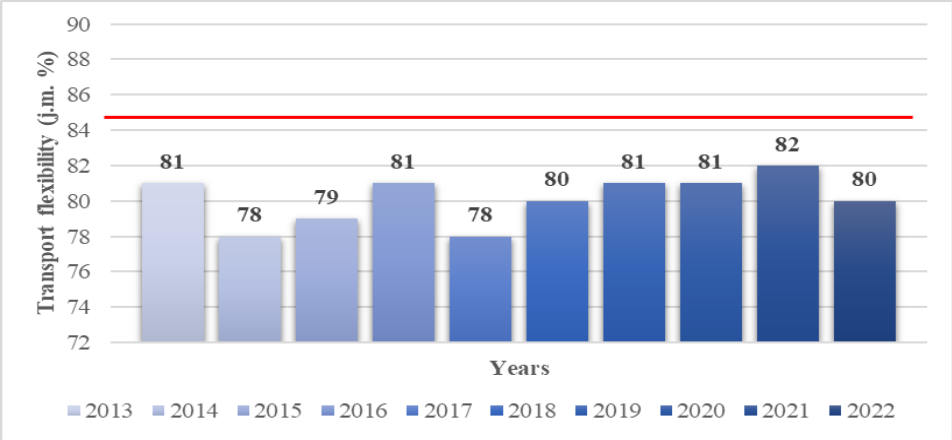

Figure 3: Transport cost index in PLN/km
Source: Own elaboration based on data from the surveyed enterprise)

Transport plays a big role in a manufacturing company, which is why a large part of the costs incurred are costs related to the consumption of materials and energy, including the price of fuels. In order to find savings, it is necessary to look for a solution in reducing fuel consumption by means of transport. Unfortunately, constantly changing market

prices of fuels have a significant impact on the cost of transport per 1 km. Staff responsible for setting benchmark indicators for transport costs and transport costs per 1 km are required to take into account all factors that affect the result. From the obtained values of the indicators, it can be observed that in the analysed period the means of transport did not meet the assumed conditions (figure 3 and 4).

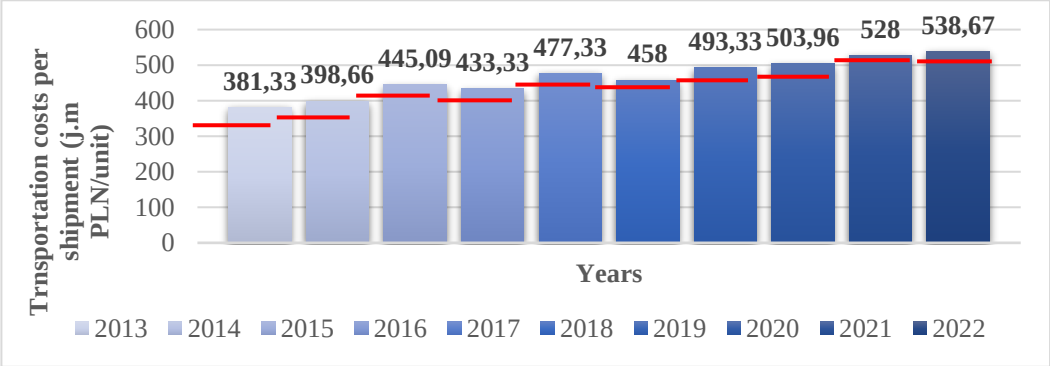

Figure 4. Transport cost per transport index
Source: Own elaboration based on data from the surveyed enterprise

Another indicator is the degree of use of means of transport, the result of which in the case of the Surveyed Company in all the years under consideration was achieved, moreover, above the assumed level. The company fully uses the entire load capacity of the vehicle, which directly translates into such a good result of the indicator. Thanks to the well-used load capacity of the vehicle, the company does not record a financial loss. The next indicator analyzed is the use of employees' working time. The surveyed company requires a very high level of use of working time from employees. Despite such a high level of exemplary use of working time, the Company implemented it at a high level and achieved the intended value. This may be due to the lack of vehicle downtime and the lack of technical problems related to unloading.

Another indicator is the failure rate of means of transport. In the case of the analyzed process, the Company in each of the periods was within the assumed maximum. This may mainly involve replacing the means of transport with new ones and investing in the maintenance and technical inspections of vehicles. Thanks to continuous checking of the technical condition, the vehicles are kept in proper condition, which translates into their failure-free operation.

The penultimate indicator analysed is the number of kilometres per means of transport. The obtained values of the indicators show that in 2015, 2017 and 2019 the vehicles did not perform the mileage within the assumed limit (figure 5). In 2014, 2016, 2018 and 2022, the vehicles exceeded the mileage of the assumed standard. In the remaining

periods, the vehicles met the assumed standards. Achieving the indicator at a good level by using modern GPS navigation can result in achieving low mileage and reducing fuel consumption.

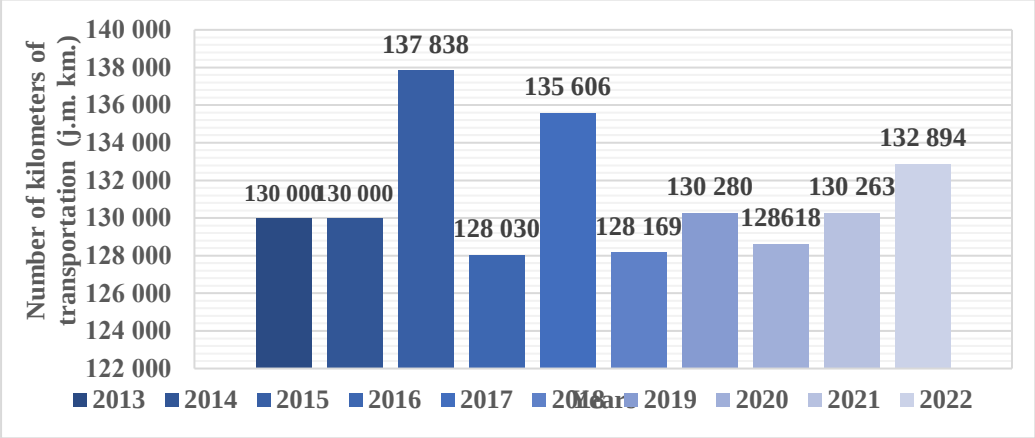

Figure 5. number of kilometers per means of transport
Source: Own elaboration based on data from the surveyed enterprise

The last indicator is delivery readiness. This indicator tells you how many orders were fulfilled immediately. According to the study, the required level was achieved in all periods. Achieving such a good indicator result was due to the owners' emphasis on the speed of order execution to increase customer satisfaction, which contributed to customers using the company's offer again.

Conclusion

To sum up, it should be stated that the transport process was effective because the audited company managed to achieve results that were at least 50% within the assumed standards. This result was achieved by the examined company thanks to the implementation of modern fleet and personnel management technologies. The company uses, among others, ERP Optima software, which supports key business processes in the organization such as: sales - trade, finance and accounting, production, warehouse, payroll and human resources. These modules help you make key decisions through reporting and analysis. The trucks are equipped with GPS and an on-board computer such as CarCube, which enables analysis of each stage of the transport process, thanks to which it is possible to comprehensively and on an ongoing basis plan and then implement regional and long-distance transport services. This is a technology that provides the fleet manager with the collection and access to information in real time,

while making it easier for drivers to do their daily work by receiving departure orders, tracking driving style, the ability to navigate the vehicle, identify fuel consumption, parking and rest time. In addition to the CarCube on-board computers, the company also uses FleetCockpit, FleetWorks. FleetCocpit is an application that allows the planner to monitor the fleet and view all information provided by Car Cube computers directly from the trucks, including: the current position of the vehicles and activities performed, detailed information about the order, the driver's used and unused working time, reports activities performed and rest settlement, vehicle activity reports and trailers. Access to information on execution in real time allows employees to take quick actions in the event of unforeseen events and efficiently issue instructions to drivers. FleetWorks is an application that is used to manage your fleet. It provides real-time access to information and performed transport tasks. This device provides, among others, information about driving time, fuel consumption, route covered, and downloads data from the tachograph. FleetWorks helps to effectively motivate drivers to follow recommendations, which results in reducing the frequency of damage to rolling stock and increasing security. The company has been using Integra 7 software for a year. The company uses it to record costs related to the use and repair of vehicles and to store necessary parts and other goods needed for the operation of the company.

The biggest problem of the Company and its transport process is transport flexibility, transport cost per km and transport cost per transport and, to a lesser extent, the number of kilometers per means of transport. The visible problem with transport flexibility in the surveyed company may be caused by the large range of products offered and products tailored to individual customer proposals and needs. Transport flexibility is an important criterion for assessing efficiency. In order to become a competitive organization, a company should offer flexible services, adapting to customer requirements. Thanks to this approach, the company can gain a high position and the trust of customers who will use its offer again in the future. The direction of development of the Researched Company is constant investment in new technologies and management systems so as to conduct the transport process at the expected level.

Another indicator with a high information load is the cost indicator in PLN/km, which unfortunately was not achieved below the assumed maximum. Perhaps it is necessary to invest in economic driving training for drivers, which would directly translate into the final result, as the company has no influence on changing market prices of fuels. The last indicator that the company did not achieve within the assumed limit in 2015, 2017 and 2019 is the number of kilometers per means of transport. The reason could be a large number of orders and too few vehicles. Therefore, the vehicles did not cover the mileage within the assumed limit. The above data shows an increase in the number of vehicles in the company over the last ten years.

The conducted ratio analysis presents the level of performance of activities in the transport process in a production company, which have a significant impact on the level of costs incurred. Therefore, in order to reduce the ratios to an acceptable level, managers should gradually improve the results to be within acceptable assumptions. The direction of development of the Researched Company is continuous investment in new technologies and management systems so as to implement the transport process in accordance with the assumed patterns. Modernity in business management involves the use of new ideas, concepts and methods of managing and operating the organization, as well as all information from the industry and its environment.

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ANALIZA I OCENA EFEKTYWNOŚCI PROCESU TRANSPORTOWEGO W PRZEDSIĘBIORSTWIE PRODUKCYJNYM

Streszczenie: Proces transportowy jest jednym z kluczowych procesów w przedsiębiorstwie produkcyjnym dlatego też bardzo ważny jest jego pomiar i ocena efektywności. Istotnym założeniem przedsiębiorstwa produkcyjnego powinien być wzrost efektywności procesu, a w następnej kolejności utrzymanie efektywności na ustalonym, dopuszczalnym poziomie. Na efektywność procesów transportowych wpływ ma szereg czynników, które należy przeanalizować, aby mieć pogląd na obecną efektywność badanego procesu. Wzrost poziomu efektywności procesów transportowych jest możliwy dzięki podejmowaniu decyzji na podstawie analiz. W artykule omówiona została analiza efektywności procesu transportowego w Badanym Przedsiębiorstwie produkcyjnym przy pomocy analizy porównawczej mierników służących do oceny procesów transportowych. Przeanalizowany został proces transportowy w kontekście efektywności w latach 2013-2022 w oparciu o wywiad z właścicielami Badanego Przedsiębiorstwa oraz osobą odpowiedzialną za transport w Badanym Przedsiębiorstwie. Otrzymane informacje były podstawą do obliczenia wskaźników procesu transportowego Przedsiębiorstwa oraz została zaproponowana formuła oceny całościowej efektywności procesu transportowego, która dała możliwość nakreślenia wskaźników wzorcowych, na podstawie których przedsiębiorstwo może dany proces uznać za efektywny lub nieefektywny. Dzięki otrzymanym wynikom można było dokonać pełnej oceny efektywność procesu transportowego z punktu widzenia Badanego Przedsiębiorstwa co jest szczególnie ważne z perspektywy ponoszonych kosztów transportu oraz poziomu obsługi klienta.

Słowa kluczowe: zarządzanie transportem, zarządzanie procesowe, procesy transportowe