

## PROCESS APPROACH IN MANAGING TRANSPORT IN MANUFACTURING ENTERPRISES

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**Abstract:** As part of an integrated flow of cargo in a manufacturing enterprise, transport is highly significant. Among functions such as planning, stockpiling, as well as inventory management and expediting, transport remains the function determining the physical flow of cargo. The aim of this article is to identify the actions undertaken by manufacturing enterprises in relation to process management. The analysis showed which processes and actions are undertaken in enterprises as part of process management, which methods were used to identify the processes, and what problems do enterprises come across when implementing it. Basing on the study, the methods and tools were also identified allowing to increase the effectiveness of the transport process. The survey also allowed identifying the problems most frequently encountered by manufacturing enterprises when implementing the transport process and thus finding a solution to improve it. Due to the specificity of the analyzed problem, implementing the posed empirical objectives was based on using the following research methods: a questionnaire and an expert survey. The empirical research was carried out on 15 enterprises operating in the Silesian Voivodeship in the fourth quarter of 2021 and the first quarter of 2022.

**Keywords:** Transport management, process management, transport processes

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### Introduction

The changing environment forces enterprises to change the manner of management. Enterprises are focused on finding new solutions to gain a competitive advantage while increasing the efficiency and effectiveness of their operations and improving the quality of their proposed products. The need to quickly adapt to the prevailing conditions requires an enterprise to use tools allowing to continuously improve its processes. Implementing process management is one way for an organisation to achieve success. Once an enterprise identifies the most important processes, it should prepare measures to develop process evaluation and improvement. Organisations are more and more often paying attention to the need to coordinate and integrate their internal processes. Processes should be assessed and coordinated across the entire supply chain in which the company participates. Constant technological advancements result in that organisations implement all possible IT solutions to help manage their processes.

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Changing the approach from functional to process also affects the way of transferring information in the enterprise. Process management is a broader concept, more mature and adapted not only to the times of revolutionary changes, but also to the evolutionary development of the enterprise. On this basis, the main goal of the conducted research was assumed, i.e. the identification of tools and methods of transport management in terms of the process.

On the basis of the objective defined in this way, a research hypothesis was formulated: the identification and analysis of the mechanisms of process implementation in the transport management system leads to an increase in the efficiency of the transport process in the company.

The aim and research hypothesis determine the layout of the article.

### **Literature Review**

One of the supporting processes of a manufacturing enterprise is transport, which should be understood as a set of activities that determine the movement of products from the point of shipment to the point of receipt at the right time, at an acceptable cost, and maintaining the good condition of the transported products using appropriate technical means (Kush et al., 2018). Transport is defined as a technological process of any movement over a distance, meaning, the movement of people, objects, and energy (Navarro, 2019). In subjective terms, transport constitutes the technical, organisational and economic, as well as planned movement of cargo (Potter, 2003). Commonly, transport is understood as a set of activities based on delivering material goods using proper technical means (Button, 2010). Properly delivering finished products to a customer constitutes the responsibility of the managers of the entire transport process (planners, forwarders, drivers, importers, exporters), whose main task is to ensure that the requirements of the operators and the loads transported are compatible with the available transport infrastructure and the capacity of the used transport fleet (Bentkowski and Pietrucha-Pacut, 2003).

Transport takes on particular significance when considering the high (up to 45%) share of transport costs in a manufacturing enterprise (Tracey 2004). Furthermore, transport may contribute to the competitive advantage of a production enterprise. Many organisations are now facing the necessity to make strategic decisions on how to implement their functions concerning product movement (Kabus, 2023). Between the phases of the manufacturing process and the final customer, various activities occur that can intensify the movement of raw materials for the manufacturing process, final products, and minimize delivery times (Vasyl and Vasyl, 2020). These activities combine with an increase in the number of tasks that are performed in the transport system (Kumar and Kumar, 2020). The changing distribution of company depots and plants is heavily influenced by the development of technological processes and an increasing use of different data flow options, which also has a significant impact on transport, which consequently undertakes to interact with the fields of supply, sales, and manufacturing (Rodrique

2020). The transport system links the production and consumption system, i.e. it integrates the elements of the production and service system and facilitates the flow of products between these elements. Taking into consideration the movement of materials, semi-finished and finished products, the aim of the transport process is to enable the movement of products through the sourcing, sales link in the supply chain, and to improve the management operations of the transport process (Karupiah et al., 2022). It is virtually impossible for enterprises to operate without transport on today's global markets (Ascani et al., 2021). The vast majority of businesses are remote from supply sources, making them dependent on transport to link the source of supply to the place of consumption (COM, 2020). Transport is necessary to bridge the spatial gap between buyer and seller, as the locations where products are produced do not coincide with the locations of their demand (Chład, 2020).

Transport in a manufacturing enterprise is of great significance especially within an integrated cargo flow, where between functions such as planning, stockpiling, warehouse management, or dispatching, it is transport that determines the physical flow of cargo. Transport consists of activities such as: carrying, handling, loading, unloading and manipulation, i.e. stacking, attaching, measuring, counting, and verifying (Božić et al., 2014). Due to the fact that transport is a supporting process in a manufacturing enterprise, its management requires integration and coordination with the other processes of the company, including the main one, production (Griffin, 2022). In this context, transport management in a manufacturing company should be considered from a process management perspective. Process management requires, among other things (Reijers, 2021):

- determining all processes in the organisation and their interrelationships,
- "translating" the general objectives of the organisation into process objectives,
- focusing on the processes that are most important for the organization from the point of view of added value,
- creating a system of measuring the effectiveness of processes and the organization,
- improving processes,
- building a process culture,
- creating a proper motivational system that promotes team work.

Measuring the results of transport processes constitutes an important part of managing transport processes in an enterprise (Wu et al., 2020). Depending on the enterprise's adopted operating strategy, the key factors for measuring the transport process are: quality, efficiency, profitability, timeliness, and productivity. Strategic objectives define the goals of the transport processes that determine effectiveness and form the starting point for defining measures to evaluate them (Ziyadin et al., 2020).

The process approach constitutes an important and distinctive element in transport management. Therefore, it is necessary to perceive the organisation of transport as performing specified sub-tasks in order to achieve effective planning of the

transport process (Łukasik et al., 2017). Transport process management is the deliberately interlinked succession of activities that transform an input state into an output state by delivering the product to the customer in a timely manner.

Transport process management can be defined as the holistic, continuous, and structured use of appropriate concepts that interact with all the processes taking place within a company in the area of transport, aiming at fulfilling objectives as well as satisfying customer needs (Morlok and Chang, 2004). Therefore, not only the company, but also contractors and customers must be considered in the transport process.

In narrow terms, transport process management constitutes the planning of changes to improve the entire process while being able to supervise the level of implementation. Process changes are focused on analyzing, evaluating, modelling, improving, directing, and monitoring the organization of transport (Anderson et al., 2019). Satisfying the customer's needs and constant improvement of the process organisation's effectiveness constitute the overriding objectives of transport process management. It should be borne in mind that the organisation of transport processes requires constant improvement (Pierisala and Miciuła, 2022). It is therefore necessary to continuously monitor the process flow, analyse, design, as well as effectively and efficiently manage the entire process flow while taking into account the needs of the customer. Hence, the need for continuous monitoring of the process flow, analysis, design, and optimization, as well as effective and efficient control of the process flow taking into account customer requirements (Zhao et al., 2010).

The transport process has its own purpose arising from the assumed strategies (Setamanit, 2019). There is a need for a close relationship between the company's transport process objectives and customer expectations, as the most important parameters of the transport process are (Łukasik et al., 2017):

- customer satisfaction,
- process time,
- timeliness of implementation,
- process quality,
- process cost.

Therefore, quality, time, and cost should be identified as the key attributes of a company's transport process, as it is these values that form the process evaluation criteria thanks to which the company's transport process gains an increase in flexibility and innovation. J. Niemczyk believes that the quality of the process requires continuous improvement of the service, while the best process is the one that takes the shortest time. Cost-oriented actions should result in reducing the costs associated with providing transport services. The flow of materials as well as information is about improving all processes. Taking into account elements such as space, time, cost, and efficiency, managers in enterprises are able to plan the transport process in a harmonious way in terms of both material and information flows.

The processes in an enterprise implementing transport can vary according to the size, type, and maturity level of the enterprise in question. It is important that the activities in terms of each process are defined and adapted to the size of the organisation. Introducing a process approach to the field of transport, which involves establishing processes, interrelationships, and constraints on shared resources, can make it easier for an enterprise to achieve its objectives. The process approach is characterized by many advantages, including (Jin et al, 2013):

- implementing a quality management system from the point of view of the organisation rather than the standard,
- good alignment with service organisations, including transport and logistics,
- high readability and comprehensibility of process maps for members of the organisation,
- considering the product in relation to both customers and the concept of the internal customer,
- the ability to react quickly if problems arise,
- the possibility of detecting bottlenecks in processes,
- making extensive use of teamwork,
- facilitating the analysis of even very complex issues.

Transport is a service, even if it is carried out in a manufacturing enterprise. It serves a supporting function for the production process, contributing to its effective and efficient implementation. Regularly monitoring processes allows to undertake the correct actions as part of process improvement. Process management should be considered in the context of a system, understood as a network of processes and a set of their interactions. Therefore, the process approach may be understood as a systemic approach to management (Choi et al., 2003), which can contribute to a company's market success.

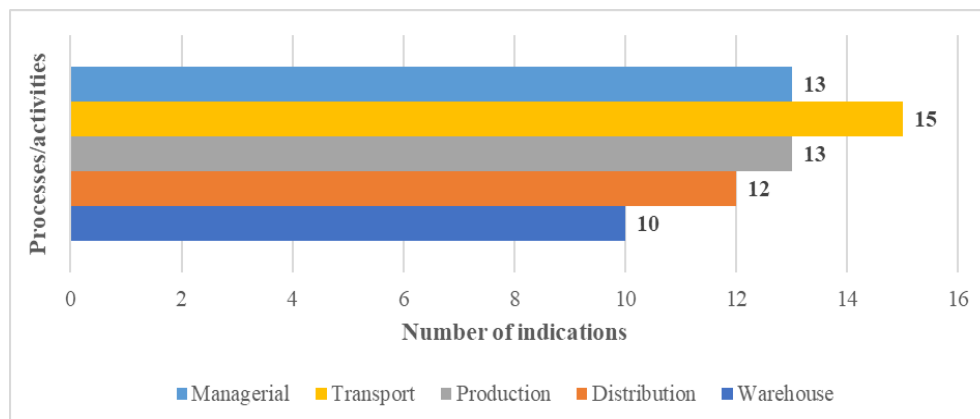
### **Research Methodology**

The subject of the conducted analysis consists in various activities undertaken by companies in relation to process management. The research process consisted of the following stages: constructing research tools (questionnaire), selecting organisations for research, reaching out to them, and conducting the proper research. In the empirical aspect, implementing the objectives included analyzing process management or elements of this concept in companies operating in Poland. Due to the specific nature of the analyzed problem, the implementation of the empirical objectives set was based on using research methods: questionnaire and expert survey. An expert survey is most often conducted on a small, purposively selected research sample. Respondents possess great knowledge about the subject of the study. The survey's participants consist in professionals and specialists in a specific industry. The empirical research was carried out on 15 enterprises operating in the Silesian Voivodeship in the fourth quarter of 2021 and the first quarter of 2022. The surveys were addressed to companies regardless of whether they use process management or not. The selection of research subjects was done

using the purposive method. The respondents to the survey were executives with relevant knowledge of process management. The survey was carried out using a questionnaire method and was anonymous. Respondents were assured that the data and information obtained would be confidential and analysed in aggregated form. The aim of the study was to identify the actions undertaken by manufacturing companies in relation to process management. The analysis showed which processes and actions are undertaken in enterprises as part of process management, which methods were used to identify the processes, and what problems enterprises come across when implementing it. Basing on the study, the methods and tools were also identified allowing to increase the effectiveness of the transport process. The study also made it possible to identify the problems most frequently encountered by manufacturing enterprises during the implementation of the transport process and thus find a solution having an impact on improving it.

**Process Orientation In Transport Management In Manufacturing Enterprises - Results Of Own Research**

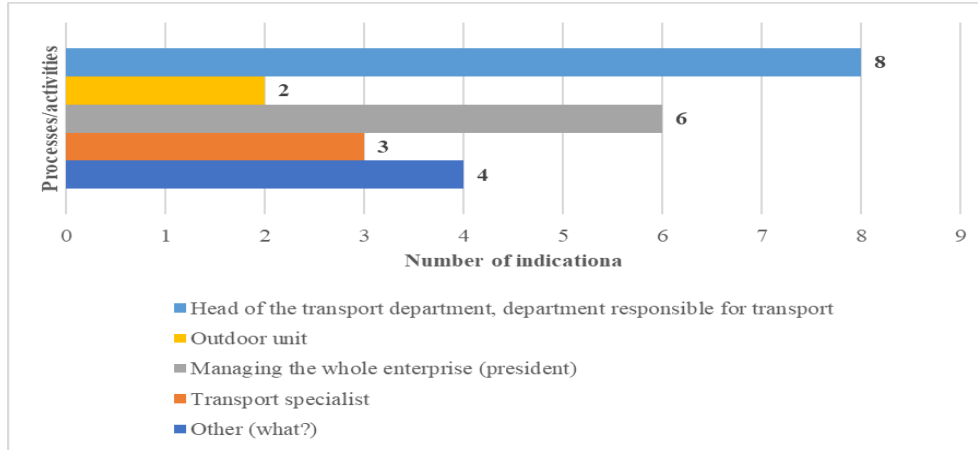
An important criterion taken into consideration in the survey consisted in identifying processes/activities within the company (Figure 1). Identification of transport processes was indicated in all surveyed companies. Thirteen enterprises indicated the presence of production and management processes and twelve of distribution processes. The fewest responses concerned warehousing processes, as these are identified in only ten companies.



**Figure 1: Are processes identified in your company?**  
Source: Own work based on conducted research

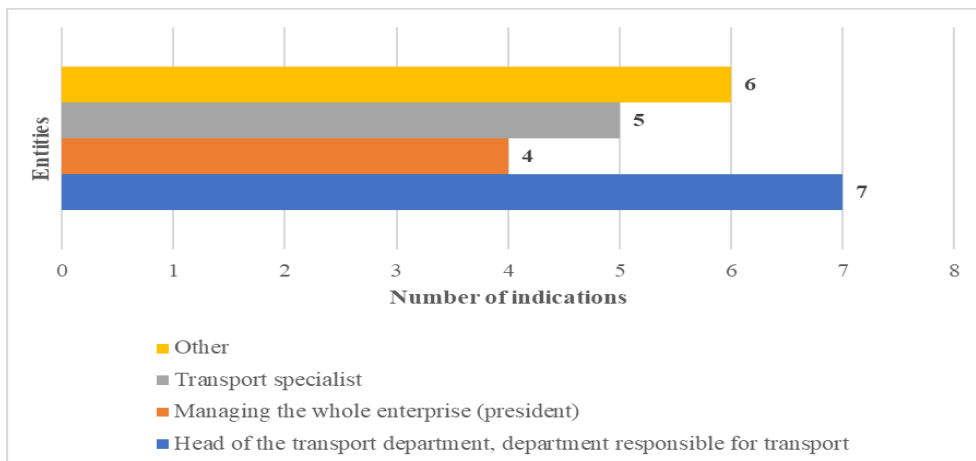
An important question was who is responsible for process identification within the enterprise (Figure 2). Identifying the processes and activities taking place in an enterprise requires a team of specialists. They may include external consultants. The studied enterprises indicated that the person responsible for identifying the processes in their company is the head of the transport department, the department

responsible for transport, and the manager of the entire enterprise. In the case of identifying responsibility for identifying processes within the company, respondents assigned the least role to external entities.



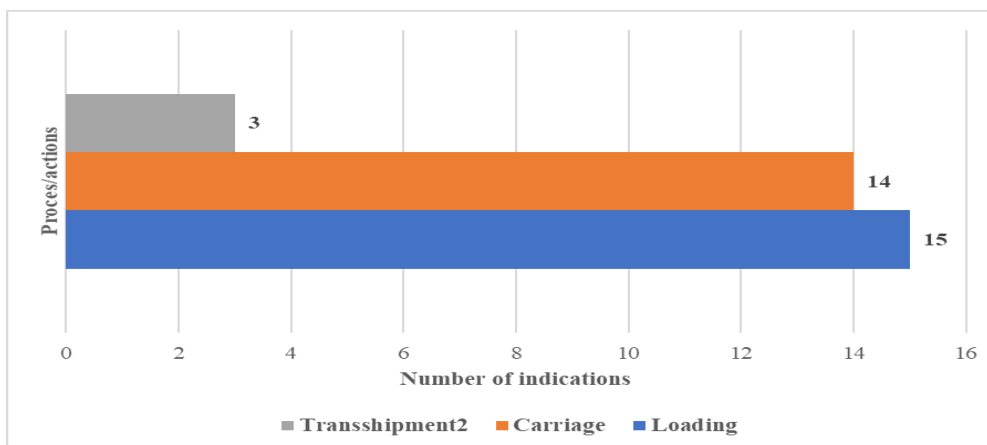
**Figure 2. Who is responsible for identifying the processes in your company?**  
Source: Own work based on conducted research

Basing on the survey it was also identified who in the company is responsible for implementing the processes (Figure 3). Taking advantage of the process approach requires the involvement of employees, who should be responsible for the activities carried out at their workplace. Most of the studied enterprises indicated that this responsibility was on the part of the head of the transport department, the department responsible for transport. The fewest number of companies pointed to the person managing the entire enterprise as the one responsible for process implementation.



**Figure 3. Who is responsible for implementing the processes in your company?**  
**Source:** Own work based on conducted research

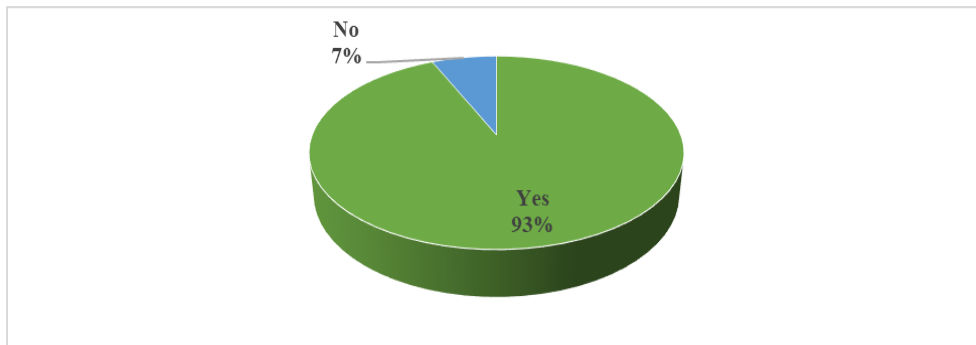
The following question concerned the activities that are carried out as part of the transport process (Figure 4). It was pointed out that enterprises are most often involved in the loading and transport processes and least often in the transshipment process.



**Figure Bład! W dokumencie nie ma tekstu o podanym stylu.. What activities are carried out as part of the transport process in your enterprise**  
**Source:** Own work based on the conducted research

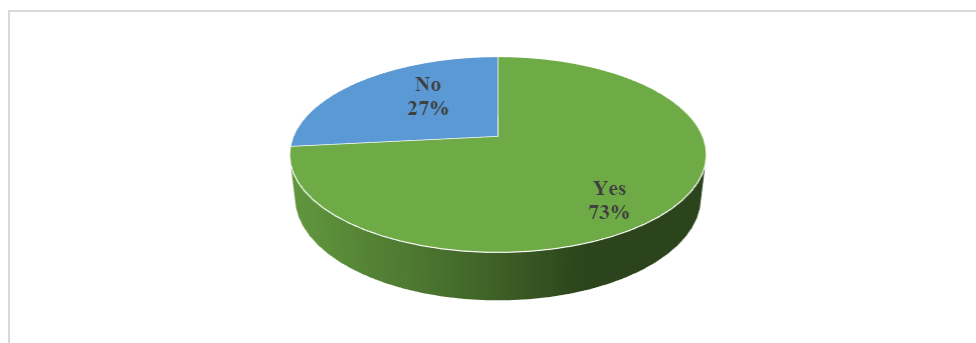
According to 93% of the studied enterprises, the manager of the entire enterprise demonstrates familiarity with the concept of process management (Figure 5), while implementing process management has been introduced in 73% of the studied enterprises (Figure 6).





**Figure 5. Is the manager of the enterprise familiar with the concept of process management?**

Source: Own work based on conducted research



**Figure 6. Was process management implemented in the enterprise?**

Source: own work based on conducted research

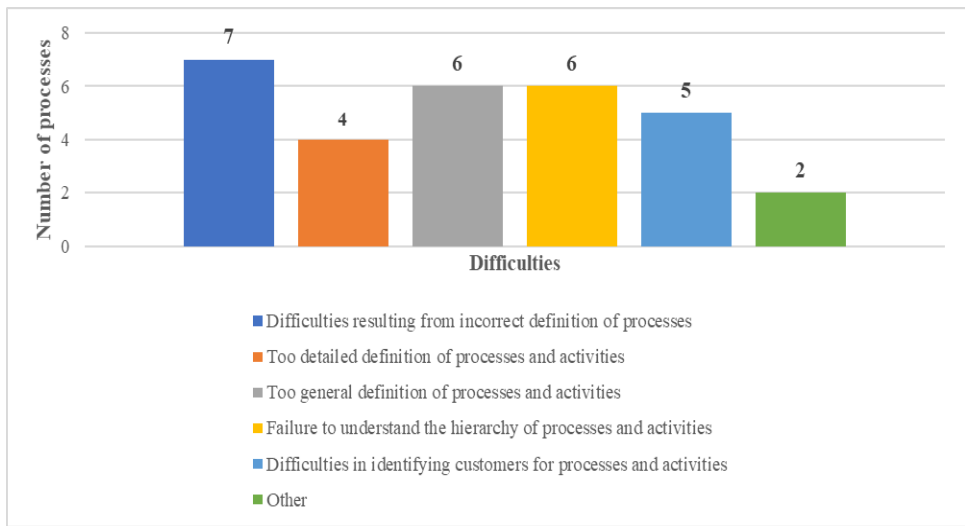
An important issue is to address the concept of process management itself. Respondents were asked which activities they associate process management with. In this case, the scale of provided answers ranged from 1 - least associated, to 10 - most associated. Most often, the concept of process management is associated with activities concerning the planning and monitoring of a particular process in an organisation and the focus of the enterprise on customer satisfaction, as shown in Table 1. Whereas, the concept of process management is least associated with creating standardized operating characteristics of an enterprise.

**Table 1. What do you associate the term process management with?**

	1	2	3	4	5	6	7	8	9	10
Activities concerning the planning and monitoring of a particular process in the enterprise							2	3	3	7
Creating a unified enterprise performance profile	1		1	2	3	1	3		2	2
Focusing the enterprise on customer satisfaction	3	1	1	1	1	1	1	1		5
Defining the perfect enterprise plan	3				2		4	4	1	1
Identifying and ordering areas for improvement			1		2		2	4	3	3
Other										

Source: Own work based on conducted research

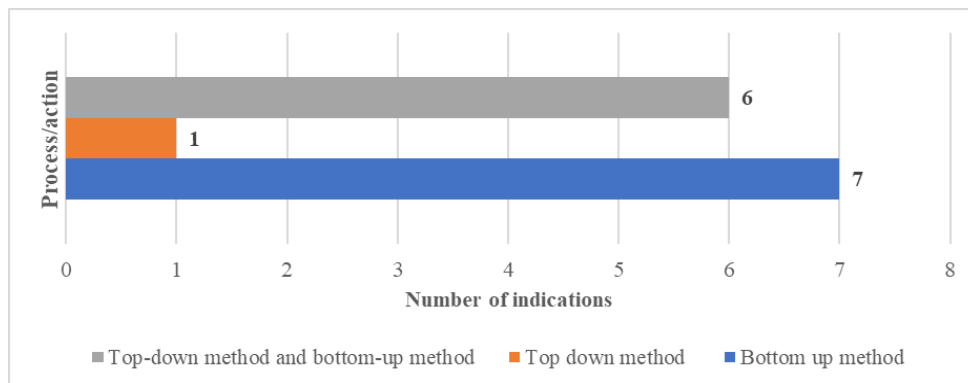
The following question concerned the occurrence of difficulties when identifying processes and activities in the enterprise (Figure 7). Enterprises pointed to several factors that weaken the operation of the enterprise. Most often these are difficulties arising from inadequate process identification, defining the process too generally, as well as not understanding the hierarchy of processes and activities.



**Figure 7. What difficulties were encountered when identifying the processes and activities in the enterprise?**

Source: Own work based on conducted research

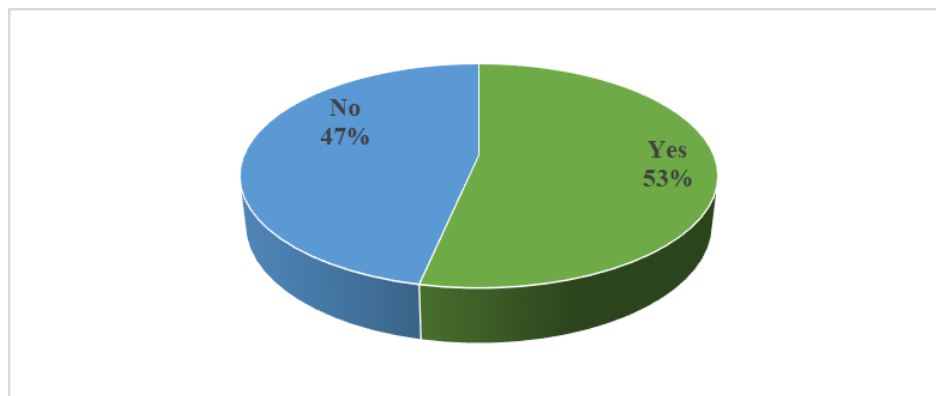
The enterprises also indicated the methods that are used in their organisations to identify processes (Figure 8). The most common method indicated by enterprises that was used when identifying processes and activities consisted in the top-down and bottom-up method as well as the bottom-up method itself.



**Figure 8. What methods were used to identify the processes and activities taking place in your enterprise?**

Source: Own work based on conducted research

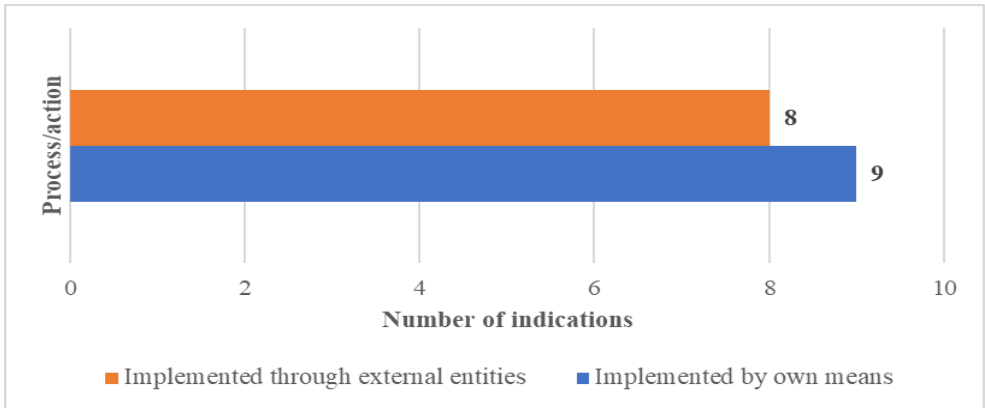
53% of enterprises indicated that revenue from transport activities exceeds the costs incurred for these activities, as shown in Figure 9.



**Figure 9. Do the revenues from transport activities exceed the costs incurred for these activities?**

Source: Own work based on conducted research

According to the studied enterprises concerning determining the impact on the proper functioning of the processes, the processes carried out through external entities are as important as those carried out with their own means of transport (Figure 10).



**Figure 10. Which transport has a greater impact on the proper functioning of processes in your enterprise?**

**Source:** Own work based on conducted research

Problems such as unnecessary deliveries, empty runs, deliveries inconsistent with the order, lack of parking space for vehicles, and inflexible deliveries are most common during the company's transport process (Table 2). The studied enterprises responded on a scale of 1 to 10 where 1 is the least frequent and 10 is the most frequent.

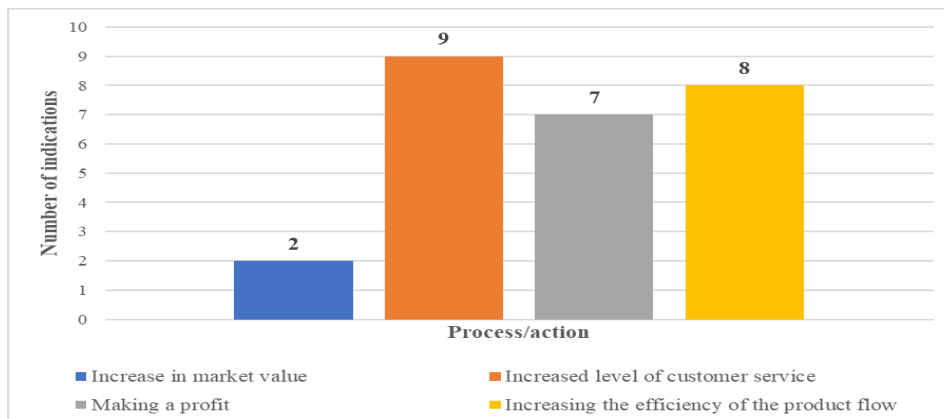
**Table 2. What transport-related problems are most common in your enterprise?**

	1	2	3	4	5	6	7	8	9	10
Unnecessary deliveries			1	1			9		2	2
Deliveries not in line with schedules		1	2		1		2	5	2	2
Deliveries inconsistent with the order			1		4	1	8		1	
Inflexible deliveries			1		1	1		1	6	4
No Just-in-Time (JIT) in terms of deliveries			1		4	6		1	1	2
No parking space for vehicles	1	1	2	1				1		8
Empty runs	1					1	1	1	1	9
Other										

**Source:** Own work based on conducted research

Enterprises that carry out transport processes have identified the significance of the transport process in relation to achieving their respective objectives (Figure 11). An increase in customer service levels was identified by companies as the factor that most influences achieving their goals. Whereas, the increase in market value of the

enterprise was indicated as the factor that least influences the value of the objectives pursued.



**Figure 11. With what strength do transport processes contribute to your enterprise's objectives?**

**Source:** Own work based on conducted research

The conducted research shows that a greater proportion of manufacturing enterprises apply a process approach to management. Taking advantage of the process approach requires identifying the processes and activities taking place in the company, which is not an easy task. This is because a thorough analysis of the processes that take place within the enterprise is necessary. Mostly at this stage, enterprises encounter difficulties that are related to incorrectly defining processes, misunderstanding the sequence of processes and the activities carried out in the enterprise.

### Conclusion

The results of the expert study concerning the transport processes of manufacturing enterprises point to fundamental problems experienced by enterprises and directly concerning transport. The research shows that, in the case of transport processes in manufacturing companies, the first and foremost thing to do is to streamline inflexible deliveries and to maintain the Just-in-Time (JiT) principle concerning deliveries. Under the JiT principle, warehousing and transport should form an efficient "just-in-time" delivery system, which consists in supplying and stocking raw materials, semi-finished or finished products in exactly the right quantity, at exactly the right time, and in exactly the right place, so that the correct quantity of products can be manufactured or delivered. Therefore, Just In Time can be described as a method based on a planned elimination of all waste and the continuous improvement of productivity. Transport of materials, finished goods should take place to the correct location at the last possible moment, which is emphasized in the very name of this solution.

The problems identified on the basis of the expert study relate to driver time planning, as well as loading and unloading time planning. Most of the problems arising in the production enterprise-carrier relationship concern the timeliness of deliveries. This aspect is very important as it affects the quality of customer service. Delayed delivery can be divided into:

- a short delay of up to several hours in relation to the time stated on the transport order,
- long delays, exceeding 24 hours.

The main causes of missed deadlines and delivery times in terms of short delays include traffic jams in cities, road accidents, road detours, and bad weather conditions. While the main reasons for failing to meet delivery dates and times in terms of delays longer than 24 hours include breakdowns of means of transport, lack of a proper fleet, restrictions concerning the driver's working/driving time, late loading at the client's premises, late unloading of a previous delivery, and cancelling deliveries. In summary, the main causes of delivery delays include inadequate road infrastructure and a lack of specialized, fault-free means of transport. Therefore, improvements in this area constitute a major challenge for the staff in charge, managing, or organizing transport.

Based on the study results it is possible to propose example changes improving the transport process in a manufacturing enterprise. Delays in loading can be mitigated by planning deliveries evenly over a period of time, e.g. within a month, thus achieving a higher level of punctuality in loading and preventing problems associated with not having the right means of transport on time. This will translate directly into timeliness of orders/deliveries and improve cooperation with carriers. The following change should concern the possibility of extending the driver's time accounting program, making it possible to locate the vehicle, review the route history, and download the driver and vehicle card record at any time. Thanks to clear record data presented in a diagram, it is difficult to make an incorrect interpretation. Such an analysis of the driver's work card records takes into account daily and weekly rests as well as driving and working time. When we select the time range we are interested in, we get totals for specific activities. Another area for improvement consists in the monitoring of the transport process, the effects of which have a direct impact on the flow of information. Using GPS, the problem of information flow can be solved. Such a system is able to improve the relationship with final product buyers. The person responsible for organizing a shipment to a customer can keep track of exactly where the vehicle with the load is and anticipate a potential delay in delivery. This allows that person to inform the customer about a possible delay in advance. Moreover, that person can inform the storage department about the delay, which can organize its work so that there are no collisions with subsequent scheduled loads. An element of improving the transport process is also implementing improvements in pallet circulation. In most cases, the transported goods are packed and delivered on pallets. After unloading at the buyer's premises, the driver should collect the empty pallets. Such a situation can

significantly increase transport times and cause delays in subsequent deliveries because they have to wait until the goods are physically removed from the pallets. For this purpose, in order to improve timeliness, a system related to the circulation of empty pallets would have to be implemented. A convenient and good improvement is an agreement with the customer who commits to store empty pallets, which are then collected when all pallets are empty. Such a system will undoubtedly shorten and streamline the transport process. Another good solution to improve the level of reliability and on-time delivery is to increase the number of trusted, reliable carriers.

In the event of a refusal to carry out an order or significant delays, the entrepreneur can take advantage of the offer of another proven transport company with a suitable fleet for transporting the products. The next proposed change to improve the transport process, is an increase in production levels and finished goods storage space, which will reduce loading delays. As a result, completing the cargo for transport in advance and placing it on the loading ramp can prevent delays at the beginning of the route. A following change that is independent of the enterprise, but which would certainly improve the timeliness of deliveries consists in the improvement of the road infrastructure.

On the basis of an expert study, methods and tools were identified that allow to increase the efficiency of the transport process. The study also showed what problems most often occur in production companies during the implementation of the transport process, which allowed the development of solutions that can improve this process. The assumed hypothesis was confirmed that the identification and analysis of the mechanisms for the implementation of processes in the transport management system leads to an increase in the efficiency of the transport process in the company because:

- the process of transport management and development is strictly related to the concept of continuous improvement,
- an important element of any functioning system are measurements that support the improvement of processes in order to increase their effectiveness and efficiency,
- identification of processes allows for the determination of quality problems and the indication of areas that require significant attention,
- the introduction of a process approach to the transport area, which includes the establishment of processes, interconnections and limits of shared resources, makes it easier for the company to achieve its goals,
- transport management in a manufacturing company should be considered from the point of view of process management,
- measurement of the results of transport processes is an important element of transport process management in the company,
- strategic goals define the goals of transport processes that are decisive about effectiveness and create a starting point for determining the measures allowing for their assessment,

- the process approach is an important and characteristic element in transport management.

Further directions of research should refer to the process of transport management and development, which is absolutely related to the concept of continuous improvement. Transport plays a key role in a manufacturing enterprise, so it can be assumed that it constitutes one of its main processes and should be constantly improved. An essential element of any functioning system is measurement, which seeks to increase the efficiency and effectiveness of processes.

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## PODEJŚCIE PROCESOWE W ZARZĄDZANIU TRANSPORTEM W PRZEDSIĘBIORSTWACH PRODUKCYJNYCH

**Streszczenie:** W ramach zintegrowanego przepływu ładunków w przedsiębiorstwie produkcyjnym transport ma istotne znaczenie. Wśród takich funkcji jak planowanie, gromadzenie zapasów i gospodarka magazynowa oraz ekspedycja, transport pozostaje funkcją, która decyduje o fizycznym przepływie ładunków. Celem artykułu jest określenie działań podejmowanych przez przedsiębiorstwa produkcyjne w odniesieniu do zarządzania procesowego. Analiza pokazała jakie procesy i działania podejmowane są w przedsiębiorstwach w ramach zarządzania procesowego, jakie metody zostały wykorzystane przy identyfikacji procesów, na jakie problemy napotykają przedsiębiorstwa

podczas jego wdrażania. Na podstawie badania zidentyfikowano również metody i narzędzia pozwalające na zwiększenie efektywności procesu transportowego. Badanie pozwoliło również określić, jakie problemy najczęściej występują w przedsiębiorstwach produkcyjnych podczas realizacji procesu transportowego i tym samym znaleźć rozwiązanie, które wpłynie na jego usprawnienie. Ze względu na specyfikę analizowanego problemu, realizacja postawionych celów empirycznych opierała się na wykorzystaniu metod badawczych: ankiety i badania eksperckiego. Badania empiryczne przeprowadzono na 15 przedsiębiorstwach funkcjonujących na terenie województwa śląskiego w czwartym kwartale 2021 roku i pierwszym kwartale 2022 roku.

**Słowa kluczowe:** zarządzanie transportem, zarządzanie procesowe, procesy transportowe

### 制造企业运输管理过程方法

**摘要运:** 运输作为制造企业货物综合流动的一部分, 具有十分重要的意义。在计划、储存以及库存管理和催交等功能中, 运输仍然是**决定**货物实际流动的功能。本文的目的是**确定**制造企业在过程管理方面采取的行动。分析表明企业在流程管理中采取了哪些流程和行动, 使用了哪些方法来识别流程, 以及企业在实施过程中遇到了哪些问题。根据这项研究, 还确定了可以提高运输过程效率的方法和工具。该调查还可以确定制造企业在实施运输流程时最常遇到的问题, 从而找到改进的解决方案。由于所分析问题的特殊性, 实施提出的实证目标是基于使用以下研究方法: 问卷调查和专家调查。对 2021 年第四季度和 2022 年第一季度在西里西亚省运营的 15 家企业进行了实证研究。

**关键词:** 运输管理, 过程管理, 运输过程。