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Importance of intralogistics solutions in a manufacturing company - research results

Abstract

Research background and purpose: In the face of dynamic changes in the market and growing competition, manufacturing companies are faced with the need to continuously improve their internal processes using intralogistics. There is a need to explore how intralogistics solutions can become a key factor in the development of manufacturing companies. In this context, the aim is to examine what manufacturing companies are guided by when making decisions to invest in selected intralogistics solutions – logistic train and/or automated guided vehicles (AGVs).
Design/methodology/approach: The study used a literature review and a quantitative research method. It was conducted by means of a survey addressed to the management of 31 manufacturing companies located in Poland, which use intralogistics solutions in the form of a logistics train and/or automated guided vehicles (AGVs) in their operations (targeted selection).
Findings: The study found that the use of intralogistics systems in the area of transport is associated with the introduction of many changes, contributing to the improvement of logistics processes, increasing the flexibility and efficiency of the resources used. The actions taken in this area affect the overall improvement of the functioning of the organization, enabling the achievement of strategic and operational effects. Enterprises become more competitive through the use of these solutions. Companies that invest in intralogistics optimization gain a competitive advantage by reducing costs, shortening lead times and increasing production flexibility.
Value added and limitations: The publication of research results is valuable material for future activities in the implementation of intralogistics solutions. Organizations face great opportunities, but at the same time challenges, related to the automation of internal processes and taking into account the requirements related to sustainable development. Moreover, we point out the need to conduct further research in this area, which may constitute valuable material for future decision-making processes.

Keywords: *intralogistics, AGV, logistic train, process automation, Logistics 4.0*

JEL Classification: O31, D2, L21

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1. Introduction

Global competition and the increase in the requirements of end users force manufacturing companies to make optimal use of their resources while maintaining the high quality of the products offered. Companies, as far as available knowledge and financial capabilities allow, try to implement devices and technologies available on the market to reduce production costs and avoid errors. Organizations face the challenge of personalizing products and responding faster to customer needs (Fernandes, et. al., 2019; Malagón-Suárez & Orjuela-Castro, 2023). Also taking into account the internal goals of manufacturing companies to effectively and efficiently use production and logistics resources, reduce inventories, optimize goods and information flows, increase process flexibility and maintain transparency (Winkler & Zinsmeister, 2019; Celliscan, et. al., 2024), choosing specific solutions can be a difficult task. A key element in the transformation of traditional business models of manufacturing companies are innovative solutions that are based on the use of value-adding technologies. The integration of existing operational processes with modern technologies allows for the creation of innovative solutions that not only improve operations, but also increase the efficiency of resource use. It is now said that the future of businesses is based on the tools offered by the Fourth Industrial Revolution.

The new industrial revolution, the era of *Industrie 4.0* (Industry 4.0[1]), offers new opportunities for development in various economic sectors. It is related to the progressive automation and computerization of processes, influencing the development of logistics concepts. As part of the global supply chains being created, radical changes are taking place in logistics processes, including ordering processes, through product design in accordance with consumer expectations, transfer of production data to centralized production planning systems, to integrated customer service systems (Płaczek, 2018). Industry 4.0 is a concept of transformation of enterprises, related to the improvement of internal processes with the use of available technologies. Above all, it strives to digitize and automate processes and consequently make it easier to meet the growing expectations of the market (Günther & Hompel, 2010).

Logistics for the fourth industrial revolution (Logistics 4.0) focuses on how to use new technologies in a way that will increase the flexibility, efficiency and efficiency

1 Integration of human and machine work, automation and computerization of processes through the use of appropriate tools and technologies. These include: the Internet of Things (IoT), data analysis, cyber-physical systems, cybersecurity, artificial intelligence (AI), additive technology (3D printing), digital twin and digitization, cloud computing, Big Data, virtual and distributed reality, collaborative robots, mobile robots (AGV), RFID, Blockchain, and Geolocation.

of the company's operations. The current fourth stage of logistics development offers the opportunity to create new business models, leading to standardization, reducing the transport of materials and their storage, thus creating added value in the ongoing processes, also in the ecological aspect (Rohrhofer & Graf, 2018). Companies are looking for solutions to meet the current challenges in the form of individualization, while optimizing processes and production costs (Abele et al, 2015).

Key technologies include intralogistics within an organization – called intralogistics (Li & Huang, 2021; Peukert et al., 2020; Anderl et al., 2015; Kurschl et al., 2021; Karting et al., 2012; Schadler et al., 2019). Intralogistics is generally identified with Industry 4.0 and robotization and process automation (Wang et al., 2016). Intralogistics can be described as a process aimed at designing appropriate technological solutions for the integration and management of the flow of information and goods The key areas of intralogistics are the use of appropriate infrastructure and storage systems for the implementation of internal logistics processes, management and the use of information technologies. Appropriate combination and matching of solutions helps to maintain the transparency of processes, exchange of information and efficient implementation of the intended tasks. The area of intralogistics includes the flow of goods and information not only of manufacturing companies, but also distribution centers, railway terminals, airports, ports, supermarkets, hospitals and similar institutions. Due to the specific nature of the business in the area of production logistics, manufacturing companies are the fastest to implement intralogistics solutions (Schadler et al., 2019; Płaczek & Osieczko-Potoczna, 2024;). Intralogistics is defined as a future-oriented industry that represents all suppliers of conveyor technology, warehouses, systems, services and logistics software that enable the organization, optimization and control of material and information flows in industry, trade and public institutions (Günther et al., 2006).

In the era of Industry 4.0 logistics, it is worth analyzing the available intralogistics solutions in the field of transport, which can contribute to the optimal use of equipment and improve the flow of goods and information within the organization. The use of intralogistics solutions (logistic train and/or automated guided vehicles) allows for the automation of the internal transport process and the involvement of fewer people in its implementation (Płaczek & Osieczko, 2020). When selecting the right vehicle, special attention is paid to the cost and time aspects related to minimizing logistics costs, supplying materials to ensure continuity of production while effectively using the means of transport in accordance with the just-in-time concept, ensuring flexibility, reliability and quality of the activities performed (Reis et al., 2016). The implementation of such solutions is associated with large financial outlays, so each company analyzes the profitability of the investment and the payback period.

Tugger trains enable efficient and energy-efficient material deliveries in a single transport. An appropriate number of trailers can be attached to the tractor, which will

allow the necessary materials to be delivered according to demand in the right quantity. Depending on the capabilities and specifics of a given company, technical requirements are analyzed, the type and number of trolleys are selected, their size is selected according to the containers or objects to be transported.

Along with the development of available technologies, work is undertaken to improve control capabilities, reduce size, use other types of navigation and available types of sensors used. Undoubtedly, intralogistics solutions in the form of a logistics train and AGVs are examples showing the possibility of using Logistics 4.0/Industry 4.0 tools in the current operations of enterprises, influencing the automation of logistics processes.

Logistics 4.0 uses available technologies to detect inefficiencies, optimize them, streamline and automate processes (Bielecki, 2023). It includes the use of smart technologies in material handling, warehouse operations, inventory management and transport systems. The use of available technologies is aimed at maintaining the transparency of processes, in order to make the best use of available resources, it means using the right tools, equipment and technologies to increase predictability, reliability, and thus minimize risks, reduce transport costs and increase the flexibility and agility of the processes carried out. On the other hand, in the process aspect, it is strictly dependent on the type and functionality of the technologies used, which very often force a change in processes (Baretto et al., 2017).

Logistics in line with the Industry 4.0 era is about the use of intelligent tools and technologies to increase efficiency in management, the possibility of optimizing logistics costs and increasing the flexibility of response to reported demand. Direct exchange of information between all participants of supply chains allows for modern communication and digitization, allowing to ensure optimal conditions for the functioning of the company by obtaining large amounts of data on logistics processes and their processing. Key technologies also include issues related to cybersecurity and the possibility of using augmented reality solutions in the form of mobile interfaces, as well as the use of mobile robots (AGVs) (Ullrich, 2015). It is important to note that the logistics processes carried out in manufacturing companies can be improved by using solutions available on the market to allow the organization to reduce operating costs while maintaining high quality.

Organizations face great opportunities, but at the same time challenges, related to the automation of internal processes and taking into account the requirements related to sustainable development. The use of available technologies and equipment in manufacturing companies is conditioned by the search for opportunities to improve internal processes. Focusing on two types of vehicles: logistic train and AGVs, there is a need to conduct empirical research in order to determine: what companies are guided by when choosing them and what changes after their use are noticed by enterprises. The available literature does not identify elements influencing

the choice of intralogistics solutions. Indicating the reasons for the choice and the impact of their use can be a significant information for the small and medium-sized enterprise sector. Gathering the experience of other companies can be valuable information for other organizations, enabling the optimization and automation of internal processes.

2. Methods

The subject of the study were manufacturing companies located in Poland, which use intralogistics solutions in the form of a logistic train and/or automated guided vehicles (AGVs) in their activities. A deliberate selection of the research sample was made. It consisted in selecting manufacturing companies that have already implemented such intralogistics solutions and agreed to share their experiences by participating in the survey. Due to the lack of available data on the number of companies that use the above-mentioned types of internal transport, it was possible to reach these entities through suppliers offering such solutions on the Polish market. Thanks to their favor, it was possible to obtain direct contact with these companies, which is why the research sample is purposeful. Due to the above-mentioned limitations, the conducted research can be treated as a pilot study, being an introduction to further work in the long term.

In order to conduct the basic study, a research tool in the form of a questionnaire was prepared. The prepared questionnaire was evaluated in a pilot study by the managerial staff of three companies from the point of view of their accessibility and ease of interpretation. The final questionnaire of the survey was made available in print, during direct contact with companies (respondents) and in electronic form, as Google Form. The questionnaire consisted of 27 closed and semi-open questions and a metric. 31 completed questionnaires were obtained, which were subjected to further statistical analysis. The research was conducted from May 2020 to January 2021.

There were also factors limiting the conduct of the research, related to the fear of manufacturing companies sharing too detailed data, despite the anonymity. The subject matter is one of the elements of the competitiveness of enterprises, therefore few organizations agreed to answer the research. In order to encourage the company to participate in the study, issues related to cost outlays and financial results were omitted. Completing the surveys was voluntary and the data was anonymized, which ensured the confidentiality of respondents' answers. Ensuring the confidentiality and anonymity of data was intended to increase the credibility and comfort of respondents, which could translate into greater openness in providing answers.

The article uses literature analysis and quantitative methods. The collected data were subjected to quantitative and qualitative analysis. The obtained data were presented in

the form of tables and charts. The collected data were subjected to statistical analysis. Pearson's Chi Square test of independence and correlation analysis were performed. The data obtained as a result of the research procedure were subjected to statistical analysis based on the STATISTICA version 13.0 program. A Likert scale was used to assess the impact of using the tested intralogistics solutions.

The quantitative research involved 31 manufacturing companies operating in 10 Polish voivodships and representing various sectors of activity (Figure 1). The largest number of companies came from the Podkarpackie (23%), Małopolskie and Dolnośląskie (19% each) and Świętokrzyskie (9%) voivodeships. Most of them (32%) declared belonging to the automotive industry, followed by the construction and chemical industry (13%) and the production of household appliances and plastics processing (10%). The remaining companies represented the food, bicycle and furniture industries. The resulting industry structure results mainly from the processes carried out and the desire to automate them through the use of the above-mentioned intralogistics solutions.

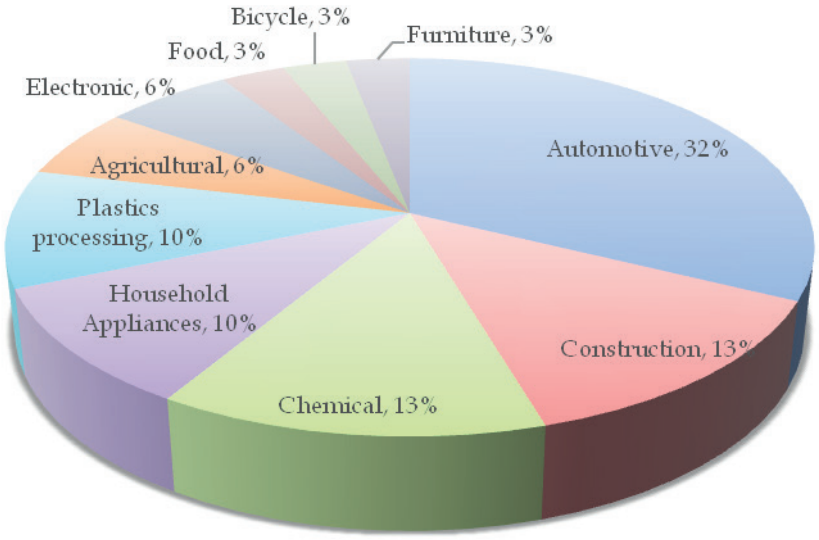

Figure 1. **Structure of entities in the survey by industry**

Source: own study

On the basis of the distribution of industry affiliation, it can be assumed that the automotive industry (32% of entities) is represented by large enterprises, i.e. employing more than 250 people. The sector of small and medium-sized enterprises are representatives of the food, bicycle and furniture industries. This assumption was not confirmed, because 90% of the research sample are large enterprises employing more than 250 people. The remaining 10% of the surveyed entities are small and medium-sized enterprises, among which 7% are medium-sized enterprises and only 3% are small enterprises.

The characteristics of the research sample in terms of these two features (industry affiliation and size of employment) indicate that there is no dependence limiting the use of intralogistics solutions. Intralogistics solutions are used by both large and small companies belonging to various industries.

3. Results and discussion

3.1. Characteristics of intralogistics solutions used in the surveyed companies

Among the intralogistics solutions used, companies use logistic trains (*Tugger/Mizusumashi*), AGVs or both intralogistics solutions at the same time. The results are presented in Table 1.

Table 1. **Division of entities by type of solution used**

Type of solution used	Number of entities	% of enterprises
Logistic train (*Tugger/Mizusumashi*)	17	55
AGVs	10	32
Use of both of the above solutions at the same time	4	13

Source: own study

The number of solutions used in enterprises varies. Each company implements an appropriate number of vehicles to carry out internal transport between the raw material warehouse, the production hall and the finished goods warehouse. Based on the information received during research carried out in enterprises, intralogistics solutions were often implemented as a pilot on selected production lines, and then transferred to other areas of the company.

From the developed box plot, information was obtained that the typical range of variability is from 1 to 24 pieces of the tested intralogistics solutions. The average value

is 5 pieces, while the middle value is 4. In the surveyed enterprises (top quartile), 75% of the number using the above-mentioned intralogistics solutions have 6 or more such vehicles, while (bottom quartile) only 25% of the data obtained comes from organizations using one or two such devices. In order to verify the relationship between the number of employees in the surveyed enterprises and the number of intralogistics solutions used, a correlation coefficient significance test was performed. Analyzing the number of solutions used, it was found that there is a moderate relationship (correlation result r=0.612) between the number of employees and the total number of surveyed means of transport.

Taking into account the industry and the size of employment, as well as the solutions used and their quantity, it was noted that the choice and number of vehicles do not necessarily depend on the size of the people employed and the specifics of the products produced. Single vehicles are used in both medium-sized and large enterprises, as well as in the case of larger quantities of intralogistics solutions. On the basis of the data collected, it is not possible to draw conclusions about the amount of internal transport needed depending on the size of the company and/or the industry in question.

Taking into account the time since manufacturing companies have been using the tested intralogistics solutions, it was found that the experience of entities in the application/use of AGVs and logistics trains is diverse. It ranges from one to 20 years. For the sample studied, the average time from the implementation of the first intralogistics solution is over 6 years. This is justified because the process of implementing innovative solutions is long-term and requires significant expenditures. The largest group of respondents (39%) are entities that have been using vehicles for five years, and 35% of companies declared that they have been using intralogistics solutions for two years. Other entities declared that they had been using the surveyed intralogistics solutions for a decade and up to 12 months.

3.2. The impact of the applied solutions on the company

When making the decision to choose and purchase a logistic train and/or AGV (Figure 2), companies, regardless of the industry they represent, were guided by the desire to optimize transport (97% of the responses). Subsequently, the improvement of workplace organization (84% of ticks) and the improvement of work safety (77% of ticks) were indicated. The need to look for cost savings was indicated by only 39% of respondents. The results obtained are quite surprising because, despite the generally observed pressure to minimize costs (Wahdah, et. al., 2024), they are not the most important factor influencing the acquisition of the indicated intralogistics solutions. For the respondents, the argument about the need to modernize the means of internal transport, which were often depreciated and exploited, was also less important.

Figure 2. **Reasons for choosing intralogistics solutions in manufacturing companies (number of indications)**

Source: own study

In the opinion of all respondents, the decision to implement intralogistics solutions in the area of internal transport was the right one, as it improved the functioning of the organization, including internal logistics (Figure 3). Respondents also indicated an improvement in ensuring continuity of flow (90%) and efficiency of internal transport (87%). Over 70% of respondents see the positive impact of intralogistics solutions on the reduction of excess inventory on the production floor, no downtime of production lines (which are related to the efficient functioning of internal logistics, no delays) and a reduction in the number of people involved in the internal transport process.

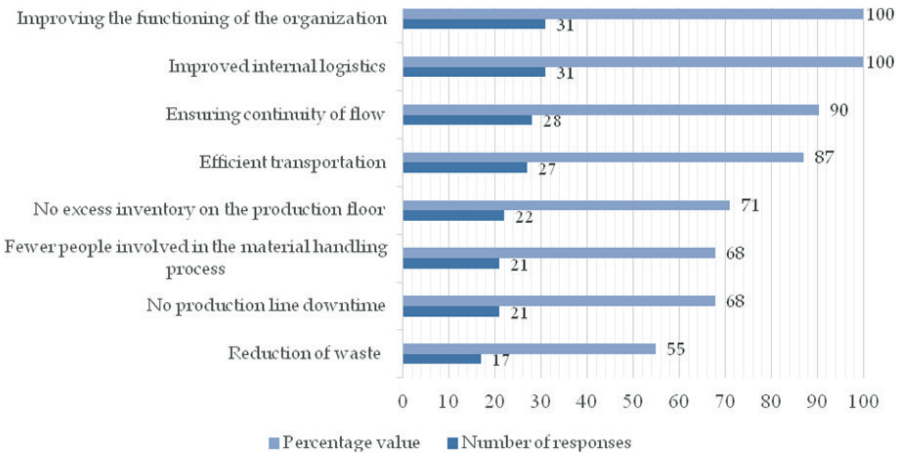

Figure 3. **Impact of the use of intralogistics solutions in a manufacturing company**

Source: own study

Due to the delivery of goods in accordance with demand, maintaining the continuity of flow, effective use of the means of transport, there is no need to store larger batches of materials in the production hall, thus maintaining transparency, order and minimizing the possibility of mistakes. Every second respondent declared that the implemented intralogistics solutions influenced pro-ecological activities related to waste reduction (due to the use of solid packaging).

The respondents also saw other, additional benefits of the implemented intralogistics solutions in the form of a logistics train and an automated guided vehicle (Figure 4).

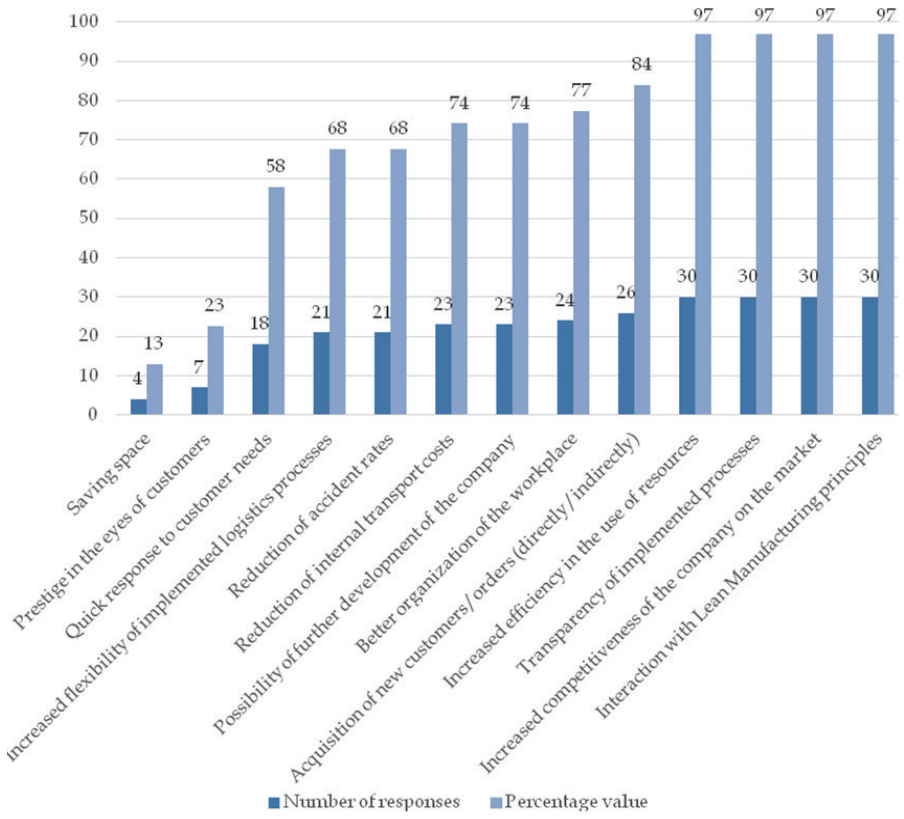

Figure 4. **Benefits of using the tested intralogistics solutions**

Source: own study

In addition to the general improvement in the implementation of logistics processes, in the opinion of the respondents, there are also noticeable benefits related to:

1. with an increase in the competitiveness of the company on the market (97%),
2. transparency of processes (97%),
3. with an increase in the efficiency of the resources used (97%),
4. with the interaction of intralogistics solutions with the principles of *Lean Manufacturing* (97%),
5. with the acquisition of new customers or orders directly or indirectly (84%),
6. with the possibility of further development of the company (74%),
7. with better organisation of the workplace (77%),
8. with a reduction in internal transport costs (74%),
9. with a reduction in the accident rate (68%),
10. with increased flexibility of logistics processes (68%).

Before making a decision to use specific intralogistics solutions, it was necessary for manufacturing companies to verify the organization's readiness to change or implement the means of internal transport available on the market. When examining their capabilities, organizations had to assess what type of means of transport would work in their business and what amount would be optimal for them. Depending on their knowledge of the transport systems offered and the experience of their staff, more than half of the companies (58%) were able to assess the current situation on their own and verify whether this solution would also work for them based on benchmarking and comparisons. The remaining 42% of companies needed support and assurance from companies offering such solutions on the market, or companies involved in the optimization of internal flows, whether their processes were organized enough to plan the delivery of goods in specific loops, or whether their internal system would allow for efficient information flow and the use of AGVs.

Based on the results obtained, it was decided to check whether the method of verifying the company's readiness for the implementation of a logistics train and/or AGVs depends on the industry. The null hypothesis H0 was adopted: there is no relationship between the organization's industry and the method of verifying readiness for the use of intralogistics solutions, and the alternative hypothesis H1, assuming that such a relationship exists. Assuming a significance level of $\alpha=0.05$, the Pearson Chi Square test of independence was performed. The result obtained $p=0.52$ does not give grounds for rejecting the null hypothesis. It follows that the industry has no influence on the method of assessing and confirming whether the organization can use the above-mentioned intralogistics solutions.

It seems certain to say that the use of intralogistics solutions results in the introduction of certain changes in the organization. This was confirmed by the results obtained, as over 96% of companies believe that their implementation forced the adaptation of the

already existing production environment to new organizational and technical solutions (Figure 5).

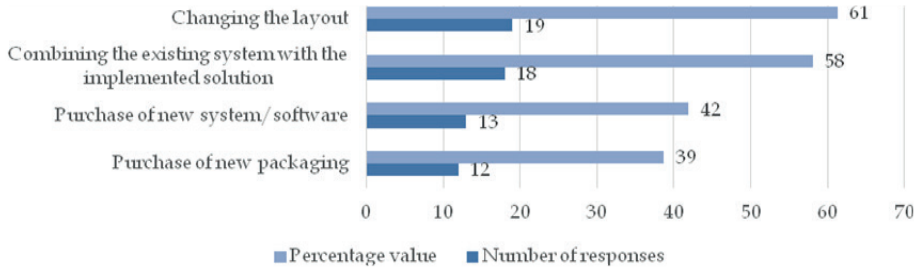

Figure 5. **The scope of changes in enterprises during the implementation of the surveyed intralogistics solutions**

Source: own study

The respondents most often indicated a change in the layout (61%). Other changes concerned the combination of the software/system with the transport solution (58%) and its purchase (42%). Some companies (39%) have invested in the purchase of fixed packaging for the storage and transport of materials and products when changing the means of internal transport. The change in the design of the hall was related to the design of the route of the logistics train, striving to optimize the route, reaching individual production stations or warehouses between stations, to which products had to be delivered or collected. In the case of the implementation of automated guided vehicles, the main reason for the reorganization of the layout was the issue of adjusting the navigation of the equipment or changes regarding the alignment of the floor, the removal of thresholds and ensuring access to individual points in the company. The respondents also indicated a change related to the connection of the existing system with the implemented solution. This was due to the desire to automatically download data on the current demand at workstations by transport vehicles.

Companies making decisions to implement intralogistics solutions are forced to incur certain financial outlays for this purpose. In the examined sample, the pool of funds for this purpose came from the organization's own resources. Companies from their own financial sources (own cash, allocation of part of the profit) decided to purchase a logistic train and/or AGVs. Various other forms of financial support, e.g. grants, EU/state or municipal projects, were not used because the enterprises declared that in the audited period they did not have knowledge about the possibilities of applying for support in this area.

Despite the investment risk taken, the respondents saw the possibility of recovering the costs incurred. More than a quarter of companies indicated that the impact on financial issues was noticeable up to 6 months, 23% that up to a year, while over 50% believed that the benefits were visible after 1 year from the application of the chosen solution

Modern companies attach great importance to their human resources. The success of the company depends on their skills and competences, especially in the era of progressive digitization and process automation. In practice, however, employees are afraid of changes involving the introduction of new solutions, especially technological solutions. They are afraid that the new solutions will contribute to reducing employment and thus losing their jobs. The attitude of employees to the introduced changes depends on the managerial staff, whose task is to provide basic information on the proposed improvement solutions. In the group of surveyed companies - in the majority of the respondents (27 companies), employees positively perceived the introduced changes (after some time they got used to the implemented transport systems). In organizations where accidents on production halls involving forklifts occurred, there were also opinions on improving work safety. Only in four companies (large entities from various industries that have been using selected intralogistics solutions for a long time (6-10 years) the reception of the solutions used by employees was negatively assessed and was related to people's resistance and reluctance to introduce changes in the organization.

Respondents were asked to rate the impact of intralogistics solutions in relation to:

- improve occupational safety,
- increase in flexibility and speed of response to customer needs,
- improving the quality of logistics services,
- reduce energy costs,
- reduce the burden on the environment,
- reduce the unit costs of manufactured products.

The assessment uses a 5-point Likert scale, where 1 means definitely not, 2 – rather not, 3 – hard to say (neither yes nor no), 4 – rather yes, 5 – definitely yes. The percentage share of individual indications in the assessment of the above components is presented in Figure 6.

Taking into account the marked answers "rather yes" and "definitely yes", the importance of the logistics train and/or AGVs for the improvement of the evaluated elements is of great importance. The percentage is particularly high in the case of the impact on work safety – 100%, increase in flexibility and speed of response to customer needs – 97% and improvement in the quality of logistics services – 94%. According to half of the respondents (58%), intralogistics solutions have an impact on reducing energy costs. Only 13 respondents (42%) believe that these solutions contribute to reducing the burden on the environment.

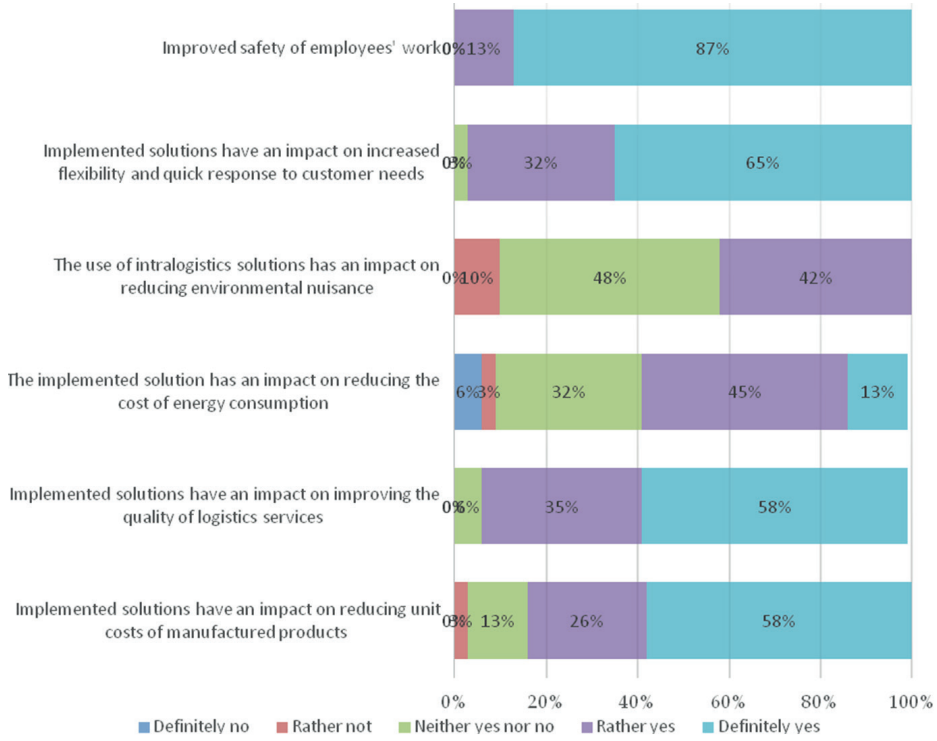

Figure 6. **Share of individual respondents' responses in the assessment of the impact of intralogistics solutions used (in %)**

Source: own study

For the obtained assessments of the impact of intralogistics solutions on the tested elements (Figure 6), average values were calculated, which are presented in Table 2.

Table 2. **Average value of the obtained assessments of the impact of intralogistics solutions on selected elements**

Evaluation element	Average value of the obtained grades
Improving employee safety	4.87
Improve flexibility and responsiveness to customer needs	4.61

Improving the quality of logistics services	4.52
Reduction of unit costs of products	4.39
Reduce energy costs	3.54
Reducing environmental impact	3.32
The degree of novelty of the intralogistics solutions used on the scale of a given company	4.55
Degree of novelty of the intralogistics solutions used on a market scale	3.32

Source: own study

The average value of the received grades for selected elements is in the range of 3.32-4.87. The respondents confirmed the positive impact of the use of intralogistics solutions on the evaluated elements. For manufacturing companies, logistics trains and/or AGVs are a novelty (innovation/investment), improve work safety, improve the quality of logistics services within the company, increase flexibility and responsiveness, and additional benefits – reduce unit costs of products. This enables further improvement of the organization, implementation and implementation of other available solutions allowing for automation and computerization of internal processes, thus increasing the competitiveness of the company. Their use affects the innovativeness of manufacturing companies.

It was decided to check whether the involvement of a given company on the foreign market has an impact on the implementation of the tested intralogistics solutions in the area of internal transport.

Over 80% of companies confirm that their involvement in foreign markets (cooperation, cooperation) has had an impact on the use of selected intralogistics solutions. This is related to the exchange of experience, modeling on other organizations and adopting proven good practices from cooperating companies or the customers themselves. Among the responses, there were three negative (10%) and two from organizations operating only within the country, not cooperating with other entities outside the country. Based on the interviews, the inspiration for the use of selected intralogistics vehicles came from Western European countries.

4. Conclusions

Modern technologies of Industry 4.0 are most often implemented in the most economically developed countries. Companies in Poland mostly deal with the automation of individual

machines and processes. They face the challenge of preparing for the implementation of Industry 4.0 solutions.

The successful implementation of innovative intralogistics solutions in manufacturing companies requires not only financial resources, but also support in the field of change management, employee education and better project planning. The main concerns limiting the effective implementation of modern intralogistics solutions in manufacturing companies focus on issues related to safety, automation and adaptation to foreign trends. In addition, these concerns result from frequently occurring financial constraints, access to external sources of financing (SMEs) and human resources - resistance to change, employee turnover, generational change or aging societies.

According to the ASTOR Whitepaper report (2016), the delays are due to Polish's late opening to Western technologies, lack of access to adequate capital and lack of specialized engineering staff. The conducted research confirms that usually companies cooperating with foreign entities invest in the implementation of modern solutions available on the market.

Despite the barriers limiting the effective implementation of modern intralogistics solutions, it is crucial to take action to overcome them. The results of the research clearly indicate that the decisions made by manufacturing companies in the use of selected intralogistics solutions – a logistics train and/or AGVs, contributed to the achievement of benefits. This made it possible to distinguish two aspects: business and operational, and to assign the above-mentioned elements to them (Fig. 7). The benefits of transparent processes and increased efficiency of resources can be attributed to both aspects. Factors clearly assigned to business aspects were indicated by the respondents 104 times, while operational aspects were indicated 123 times. This indicates that the benefits in operational aspects are more often perceived by respondents, because many times counting on achieving them, manufacturing companies decide to use intralogistics solutions. Nevertheless, their implementation affects not only the implementation of individual activities, but also has a significant impact on the further development of the company, allowing for far-reaching changes.

Quantitative research shows that:

1. The main reason for the selection of the indicated solutions are operational aspects related to the optimization of internal transport, better organization of the workplace and improvement of safety,
2. The use of intralogistics solutions in the form of a logistics train and/or automatically operated AGVs affects the functioning of the organization, internal logistics, increasing its flexibility, ensuring flow continuity, and the efficiency of internal transport.
3. Intralogistics solutions have a positive impact on the reduction of excess inventory on the production floor, no downtime of production lines (which are related to the efficient functioning of internal logistics, no delays) and reduction of costs and the

number of people involved in the implementation of internal transport. In addition, they increase the efficiency of the resources used. In addition, the processes carried out are more transparent, the workplace is better organized. Employee safety is improved by reducing the accident rate.

4. The implementation of intralogistics solutions is related to the introduction of changes in the company, allowing for the efficient functioning of vehicles. The changes are related, m.in others, to the redesign of the production hall and the combination of the company's system and intralogistics solutions,
5. their use has a positive impact on operational and business aspects, with the former being much more often noticed by the surveyed companies,
6. It is important to skillfully combine resources, knowledge and technology.

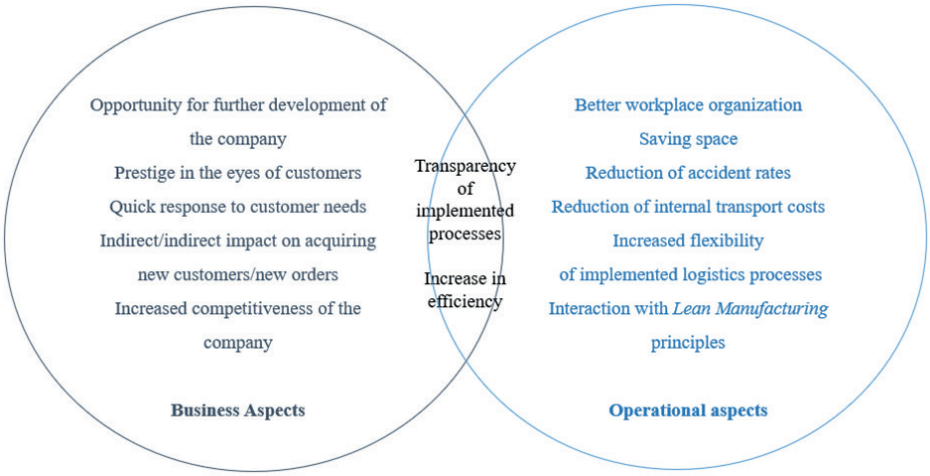

Figure 7. **Benefits after the use of the tested intralogistics solutions – business and operational aspects**

Source: own study

The use of intralogistics systems in the area of transport has a positive effect on the overall improvement of the functioning of the organization, improvement of logistics processes, increase in flexibility and efficiency of the resources used. The use of logistic trains and/or AGVs interacts with the principles of *Lean Manufacturing*. Through the use of these solutions, companies become more competitive and it also directly (indirectly) affects the acquisition of new orders/customers.

Authors' contribution

E.P: article conception, theoretical content of the article, analysis and interpretation of results, draft manuscript preparation; **K.O-P**: research methods applied, conducting the research, data collection, analysis and interpretation of results

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