

Indicators as an Instrument of Measurement in Management Accounting in Logistics Enterprises in Poland

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Abstract

Purpose: The purpose of this study was to present the extent to which indicators applied by logistics providers in Poland measure logistics-related processes and performance in the context of implementing the concept of management accounting in the enterprises that were researched.

Methodology: The research methods used by the authors included a literature review of mainly German and Polish publications and survey research conducted in 2011–2013 among logistics enterprises in Poland. This study served as the basis for verifying four hypotheses and formulating conclusions.

Findings: The main results of this study showed that management accounting systems are implemented in about half of then logistics providers in Poland covered by the survey. 75% of all enterprises conducted indicator analysis to evaluate logistics processes, costs and performance, and 90% of the indicators used by these enterprises were of a financial nature.

Research limitations: The main limitation of the research was associated with conducting the survey. The low return rate of completed questionnaires did not allow for a detailed analysis of the undertaken subject to be conducted. Moreover, the research results cannot be generalized to all logistics companies in Poland.

Originality: The study was the first review of the application of indicators in logistics companies in Poland in relation to the implementation of the management accounting concept. The study provides knowledge about how Polish logistics enterprises use indicators as an important management accounting instrument.

Keywords: indicators, logistics, logistics enterprises, controlling, management accounting, Poland, Germany

JEL: M41, M49

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Introduction

The logistics market is considered by many analysts as the “barometer of the economy” and very sensitive to market changes. This is due to the relationship between logistics, sales of products in the domestic market and international trade (Fechner and Szyszka, 2010, p. 19). This makes the logistics market a very important sector from the perspective of modern economies, including in Poland, since it precisely reflects economic trends.

Despite the important economic role of the transport, shipping and logistics (TSL) sector, the business conditions and environment in which TSL enterprises operate are demanding as they now have to compete to survive in the market. Therefore, enterprises wanting to retain their position as logistics market players have been forced to expand and diversify their offers and to regularly conduct profitability analyses of their services and assess their logistics operations. Any review and assessment of logistics processes should cover not only time, structure and other qualitative aspects (i.e., related to client satisfaction), but should also focus on economic elements. The latter come from the accounting system, or more precisely an entity’s system of management accounting, alternatively called in this study a controlling system. It is associated with the development of management accounting in Poland since the early 1990s as influenced by two approaches: management accounting in the Anglo-American manner, and controlling according to tradition in the German-speaking countries. The core issues of controlling in German-speaking countries “overlap widely with what is internationally considered management accounting and management control” (Schäffer and Binder, 2008, p. 35)³.

There are many different tools and methods used in management accounting/controlling to measure costs and performance. They include cost accounting systems, single indicators, indicator systems, variance analysis, etc. The authors acknowledged the role of indicators as they are simple tools commonly used in business to measure and assess different aspects of logistics activities. The indicators may be applied by entities to the logistics system and its subsystems if there is no management accounting/controlling system within their organisational structure, as well as to the entire management

³ The authors use in this study mainly the label “controlling” for the issue under discussion, although in the international scope the term “management accounting” is used. This is due to a review in a wider range of German literature on the concept of logistics controlling. In addition, German companies have in their organisational structures controlling departments, not management accounting departments. As regards the organization of management accounting tasks in enterprises in Poland, the findings of other surveys show that the influence of the German tradition is stronger than the Anglo-American tradition, which is influenced by a greater number of controlling departments than management accountings departments in the surveyed firms (see Szychta, 2009, p. 82).

accounting/controlling system. It should be noted that the literature, particularly the German literature, focuses on the nature and role of so-called logistics controlling that reflects the use of selected instruments in logistics. The concept is often presented with reference to logistics enterprises (e.g., Gleich et al., 2014; Weber, 2010; Thomsen, 2008; Czenskowsky et al., 2007; Blum, 2006; Kaminski, 2002; Männel, 1993 and Reichmann, 1993).

The statement about the importance of indicators analysis to both logistics and controlling was corroborated by the results of empirical research presented in the German literature (e.g., Göpfert, 2013; Gaismayer, 2012; Jorasz, 2013; Weber et al., 2010; Schulte, 2005). The results showed that the most popular controlling activities that businesses undertake include the development and improvement of logistics indicators, as well as logistics cost planning and control (Göpfer, 2007; Weber, Blum, 2001; Karmańska, 2009; Dobroszek, 2014).

In Poland, the concept of management accounting/controlling started to develop only in the 1990s and gained its greatest popularity in the 2000s. The origins of logistics, and with it the TSL sector, date back to the 1980s and the majority of logistics enterprises were established between the late 1980s and early 1990s. While management accounting/controlling and its selected aspects in Polish businesses were studied to some extent by such researchers as Jarugowa and Skowroński (1994), Sobańska and Szychta (1995; 1996), Sobańska and Wnuk (1999; 2000), Radke and Schwarz (2000), Sobańska (2002; 2005) and Szychta (2002; 2007; 2009), the problem has not been investigated with an exclusive focus on logistics activities and entities. Thus, there was a research gap that, to some extent, this study fulfilled.

This study presented the extent to which indicators are applied by logistics providers in Poland to measure logistics-related processes and performance in the context of implementing the concept of management accounting/controlling by the enterprises that were being researched. The research methods used by the authors included a literature review covering mainly works by German and Polish researchers and survey research conducted in 2011–2013 among logistics enterprises in Poland.

The remaining part of this article is divided into four sections. Based on the literature review, the next section presents the concepts and practice of using indicators to measure the processes and performance of logistics enterprises. The next section describes the empirical research methodology adopted by the authors, and the following section includes a presentation of the research results and a verification of the hypotheses. The last section features final conclusions from the research.

Literature review

The term “performance measurement” first appeared in the literature in the 1980s and it relates mainly to the concept of management accounting. The measurement is carried out using different indicators or indicator systems, i.e., financial indicators were applied initially, to be complemented by non-monetary ones as businesses grew stronger around the world (Gleich, 2001, p. 7).

According to Horváth (2008, p. 663), as an instrument supporting the management of an enterprise, performance measurement should deliver information necessary for both operational and strategic management. Brunner (1999, p. 11) stated that performance measurement is “a company-wide management system which transforms the process of the operationalization of company strategies and objectives into a permanent management system. The achievement of objectives is supported by a combination of strategies, strategic initiatives and the planning, controlling and monitoring of the relevant management quantities.”

Given the complexity of the performance measurement process, Gleich (2011, pp. 258–259) presented a framework for a performance measurement system, describing its key elements such as strategic and operational planning and management, drivers, measurement determinants, indicator development and improvement. The indicators themselves should serve certain purposes such as optimisation, control, provision of information, coordination and regulation (Piontek, 2005, p. 273). At the same time, the author noted that the applied indicators will fulfil their intended role in logistics management only if they are integrated within a specific system since using single indicators will usually lead to an incorrect interpretation. Göpfert (2013) shared this opinion, stating that a well-structured indicator system implemented in accordance with the nature of a business activity provides both a broad and the best view. A logistics indicator system is understood as “a uniform set of single indicators substantively correlated with each other, mutually complementary or explanatory, serving the achievement of the same primary objective” (Göpfert, 2013, p. 380).

From the provider’s point of view, it is important to note that different approaches applied to performance measurement should not focus exclusively on the transparency of costs and results, but they should cover the entire system, i.e., its “soft” aspects and measurement based on both financial and non-financial indicators.

The performance measurement system should ensure that an enterprise maintains the appropriate level of effectiveness and efficiency. While effectiveness affects the

fulfilment of objectives and strategies, efficiency has an effect on operational processes and activities in terms of time, costs and quality (Roberts et al., 2013, p. 217). Appropriately selected indicators covering these aspects and integrated into a properly structured indicator system will ensure quality information supporting the management of an entity.

Performance measurement in logistics includes mainly aspects of individual measures rather than systems of measures. This confirms the overview of the logistics literature. For example, A.T. Kearney (1991) doesn't present a proper system of measures for logistics but only characterizes individual performance measures. The author highlighted that logistics management and measurement should focus on logistics service quality, have a process perspective and emphasize the importance of the customer. In turn, Anderson et al. (1989, p. 253–262) wrote that logistics performance measurement systems are a split between measuring either internal or external effectiveness. The authors considered that in this area of performance measurement for logistics, there is a gap because where financial ratios are only addressed to the management level, operating measures are used to communicate what is going on at the organisation's lower levels. Compared to this theory, the practice is far from ideal. According to Gomez et al. (2000, p. 426), on a strategic level, financial temporary indicators prevail in business, while the operational level uses mainly single indicators, not connected with the strategy of an enterprise. This reflects a lack of integration between the operational and strategic levels, which consequently reduces the effectiveness of the indicator-based performance measurement system.

A wide selection of logistics indicators has led to the development of different indicator systems or sets of measures, structured according to specific criteria within the logistics controlling system and available for logistics enterprises to use in their business practices.

The balanced scorecard (BSC) is a basic and strategic instrument of controlling, based on indicators and designed to measure and evaluate logistics activity. The BSC is also most commonly referred to in the literature on logistics controlling (e.g., Czenskowsky et al., 2007; Weber et al., 2010; Schneider, 2013). Czenskowsky et al. (2007) noted that logistics providers also use DuPont (ROI) indicators. The findings presented by these authors showed that most of the 18 logistics companies studied use the DuPont system, i.e., 100% of large entities and 38% of medium entities. However, although promoted in the German literature on logistics controlling, BSC is less common in business practice, with only 23% of large logistics companies using the instrument, compared to 50% of medium-sized entities (Czenskowsky et al., 2007, p. 256).

Another example of a model designed to be used in logistics is an indicator system based on the supply-chain operations reference (SCOR) model, where the attributes of logistics process measurement were divided into two perspectives: client-related (external perspective) and enterprise-related (internal perspective). The first attribute refers to delivery reliability and the ability to ensure the timely delivery of the right product to its destination in an appropriate condition and amount. Another attribute, responsiveness, refers to the time needed to deliver products to a client. Flexibility, in turn, relates to the ability to respond to market changes and competitor activity. Another attribute, supply chain costs, serves in measuring all costs related to the supply chain. The equity employed attribute reflects effective management of fixed assets and current assets to meet the demand and satisfy customer expectations (Weber et al., 2010, p. 167). These attributes refer to the three levels of the SCOR model: the first main level covering basic management processes; the second, the “configuration” level, determining process categories (31 measures); and the third, the development level, describing the elements of the processes (524 measures).

In addition, German researchers such as Reichmann (2001) and Schulte (1999) designed indicator systems for logistics and logistics companies. For example, the first author put an emphasis on indicators such as handling capacity, logistics costs/sales volume and ability to carry out deliveries. These measures are found in all areas of logistics, i.e., materials management, production logistics and sales logistics. Every area is divided into smaller sub-areas, also subject to ratio analysis (Reichmann, 2001, p. 227). Reichmann’s indicator system may be an element of planning in key logistics areas and sub-areas, their monitoring and assessment. The indicator system by Schulte (1999, p. 64) takes the form of a matrix covering a wide selection of different measures, as it reflects the classification of indicators according to their structure, productivity, economic efficiency and quality on the one hand, and logistics areas such as supply, flow of materials, transport, warehousing, commissioning, planning, production management and distribution on the other. However, Göpfert (2013, p. 383–384) classified indicators according to such criteria as logistics areas, transfer functions, scope, statistical structure, time frame, objective and the method of their development.

Regarding Polish authors, it is worth mentioning the approach presented by Kowalska (1998, p. 57), who developed a classification of measures used to evaluate logistics processes. The first aspect of this classification refers to measures applied to logistics processes in supply chains, while the other one has to do with logistics costs. Each of these groups could be further divided into smaller sub-groups.

Another example of an indicator system applicable to a logistics activity is the model designed by Krauth and Moonen et al. (2005, p. 244) who analysed indicators from two perspectives. The internal perspective embraces the management-related aspect, covering for example effectiveness, efficiency, satisfaction, IT and innovation and the employee-related aspect. The external perspective, on the other hand, refers to clients, social responsibility and the external environment of a company. This model does not show how the indicators are connected with each other but rather classifies them according to specific criteria.

Mentzer and Konrad (1991) also presented a wide selection of indicators referring to areas such as transport, warehousing, inventory monitoring and other processes. Within these categories, the areas of measurement were further divided, taking into account time, costs and resources. The authors said that these indicators may be used by enterprises in business practice, noting that they should be adapted to the individual needs and character of an entity.

Although other indicator models available in the literature apply to supply chain management, they are based on measures that could be used by logistics enterprises and logistics in general. Some proposals were presented by Hieber (2002) and Karrer (2005).

Described in numerous research papers, logistics indicator models, together with specific classification of indicators, are not necessarily applied in business practice. Empirical research presented by Czernikowski et al. (2007, p. 259) indicated that most logistics enterprises in Germany use single indicators rather than entire indicator systems. This means that implementing ready-to-use indicator systems or integrating them into an existing system is time consuming and costly, although researchers clearly point to the benefits of such a decision.

Keebler (2000), on the other hand, investigated the use of logistics indicators by U.S. enterprises, also by reference to the supply chain. The research results showed that only half of the companies studied acknowledge the usefulness of the proposed and applied indicators, while a third of them say the indicators actually support supply chain coordination. According to Keebler's performance measurement in logistics, 60% of the companies use effectiveness and efficiency indicators. Within this second area, however, the use of indicators applicable to recycling, for example, is slightly less common (Weber et al., 2010, p. 41).

Empirical research was conducted in 1991 in Germany, where companies could choose from 80 operational and strategic indicators classified into such categories as global logistics management, experience transformation, as well as administrative and dispatch functions (Göpfert, 2013, p. 383–384). The results showed that more than 80% of enterprises highlighted the significance of the global logistics indicators aimed at controlling the entire logistics system. They included, among others, average stock, average completion time, scope of services and share of logistics costs in total costs. Equally important were indicators belonging to the other two categories. As a result, about 40 indicators important for strategic and operational management of logistics activity were identified; however in business, the most popular were indicators supporting the operational aspects of logistics management (Göpfert, 2013, p. 385). In addition, this empirical study revealed an important practical role of indicators affecting the measurement of logistics services, and therefore their results (e.g., average time variation, scope of inventory). These were followed by process-related indicators (e.g. average use of warehouse capacity) and finally, measures applicable to specific aspects (e.g. number of computer workstations per employee). Given the division into quantitative and qualitative indicators, Göpfert (2013, p. 388–390) underlined that the latter prevail over the former.

To complement the review of the literature and empirical studies on the research area, it is vital to mention empirical research by Weber et al. (2012), presenting a broad analysis of an indicator system used in logistics controlling. The authors cited only the most important findings applicable to logistics enterprises. As for indicators relating to finance, processes, clients, innovation and risk, they found that logistics providers use mainly financial indicators (46%), followed by process-related ones (24%). The former include, in particular, the costs of freight and logistics management/administration, while the latter cover timely delivery and the use of human resources or space. Despite the need for improvement in many areas, the study authors pointed to numerous positive signs, e.g., focus on selected yet important indicators, the integration of strategic and operational aspects within ratio analysis and integration in performance measurement among companies operating in supply chains (Weber et al., 2012, p. 1–46).

To sum up the discussion on the use of indicators and indicator systems, they constitute significant instruments commonly applied in logistics management and logistics enterprise management. Given the wide selection of measures used to analyse and measure logistics activity, it became necessary to arrange them, which is why researchers present different models or systems to support businesses and their management processes. It is not important to have a lot of measures, but to make sure they are adequate and provide quality information. Such an approach will facilitate making decisions which are right and effective.

However, many models presented in the literature are not fully applicable to business practice. The «chaos» that is often encountered with relation to logistics measures in logistics enterprises may be due to the lack of time to arrange them, the lack of proper IT systems and the resulting high implementation costs or resistance to change among employees. An important role may be therefore attributed to the concept of logistics controlling, which assumes that a controlling department employee, specialising in controlling and logistics, should perform analysis based on indicators, and develop and implement effective indicator systems to be used in logistics management, logistics enterprise management and supply chain management.

Having acknowledged the role of performance measurement in logistics activity and the continuous integration of logistics indicators with the concept of controlling (mainly in Germany), this study then focused on selected results obtained from a study on the implementation of management accounting and its instruments, including performance measurement in logistics enterprises in Poland.

Methodology of empirical research

In 2011 to 2013, the first co-author of this study carried out survey research among a group of logistics enterprises operating in Poland. The empirical research was based on a questionnaire consisting of two parts. The first part referred to the implementation of controlling systems by logistics enterprises in Poland, while the other part investigated the types of instruments used to measure costs and the results of logistics activity. This study presents the results obtained from the first part of the survey research, serving as a basis for verifying the following research hypotheses:

H1. Analysis of logistics processes, costs and performance based on indicators is carried out mainly by the logistics department or by functions/departments/units other than the controlling/management accounting departments.

H2. To measure their logistics activity, logistics enterprises in Poland tend to use single indicators rather than indicator systems.

H3. The indicators analysis of logistics enterprises is based mainly on financial parameters.

H4. When monitoring logistics costs, businesses measure them mainly against their sales revenues.

These four hypotheses have been formulated based on the existing empirical research on performance measurement in logistics conducted by other authors.

To select enterprises to be included in the research sample, the authors used the Polish Classification of Activity (Regulation of the Council of Ministers of 24.12.2007). The entities were selected from section H (transport and warehousing), in particular divisions: 49 (overland transport and pipeline transport), 50 (water transport), 51 (air transport), and 52 (warehousing and transport supporting services). The selection of the research sample was targeted and thus was not representative.

Initially, the authors planned to investigate medium and large logistics enterprises operating in Poland, taking into account the number of employees⁴. This was based on the assumption that, given their financial capabilities and information needs of their boards, the systems of management accounting would be most common in medium and large companies. What is more, the results of previous research on management accounting and instruments of controlling applied by Polish enterprises (see Szycha, 2007, p. 222–235) corroborate this view. However, bearing in mind numerous problems encountered when creating databases on the studied entities, the authors decided to also include small logistics enterprises.

Thus, the studied population covers small, medium and large logistics enterprises operating in Poland, with domestic, foreign or mixed capital. The selection of statistical units to be subject to empirical research was a directed process, partially based on snowball sampling procedures.

The basic tools used to gather information included a standardised questionnaire sent to the respondents by mail, phone interviews using standardised questionnaires (CATI technique), and interviews conducted in logistics companies using standardised questionnaires (two sessions).

The empirical research covered several stages: a pilot study and the main study divided into four sub-stages. Out of 1,500 questionnaires sent by mail and filled in during telephone interviews, the authors received 69 properly completed forms. In total, the questionnaires completed by the respondents (actual return rate) and effective telephone interviews accounted for 3.8% of the overall number. The return rate may be considered relatively satisfactory, especially given the limited possibilities of conduct-

⁴ Enterprises were classified into small, medium and large entities according to the Act of 2nd July 2004 on Freedom of Economic Activity (Journal of Laws No 173, item 1807 with further amendments).

ing empirical research as most data on management accounting is confidential and companies are often reluctant to participate in empirical research.

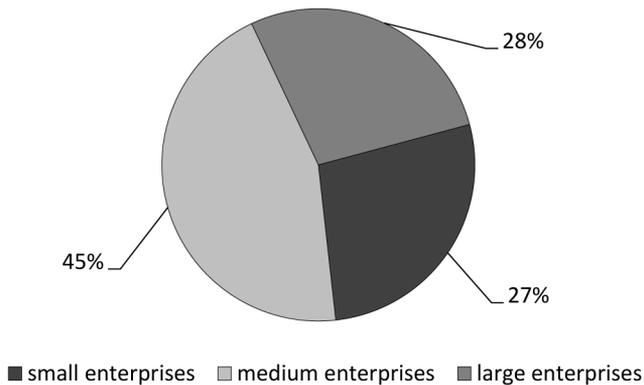
Presentation of results and verification of hypotheses

Description of logistics enterprises subject to the research

The logistics enterprises under research were categorised according to the following criteria: employment, sales revenue in millions of euros a year, source of capital, date of foundation and scope of logistics services provided, with employment being the key criterion taken into account when dividing enterprises into small, medium and large entities.

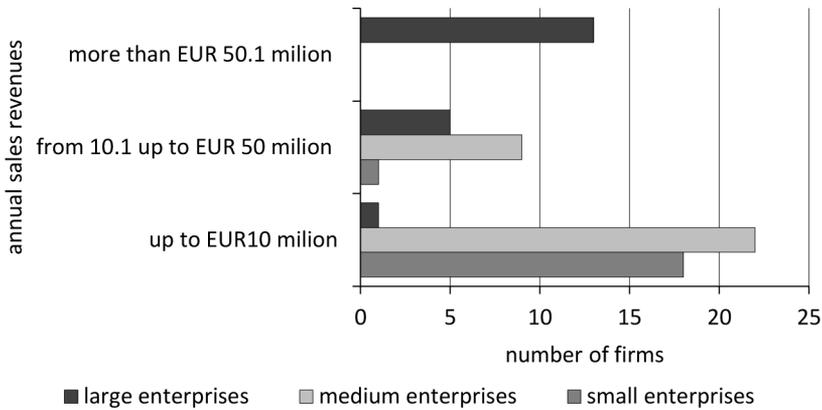
Most logistics enterprises subject to the statistical analysis were medium companies (31), accounting for 45% of the total research sample. As for logistics providers employing 50 persons or more than 250 persons, there were 19 entities in each category (Figure 1).

Figure 1. Structure of logistics enterprises researched by number of employees



Source: compiled by the authors.

Analysis of sales revenues (in millions of euros a year) shows that 59% of the respondents usually generate EUR 10 million a year. Most enterprises in this group are those employing 51–250 people (54%), 10 percentage points more than those with up to 50 employees. Another group includes entities that generate EUR 10.1–50 million in sales revenues a year (22%), and is generally made of medium and large enterprises (60% and 33% respectively). The last group covers logistics providers with sales revenues exceeding EUR 50 million a year (19%) and more than 250 employees. The relationship between employment and sales revenues is shown in Figure 2.

Figure 2. Relationship between employment and annual sales revenue (millions of euros)

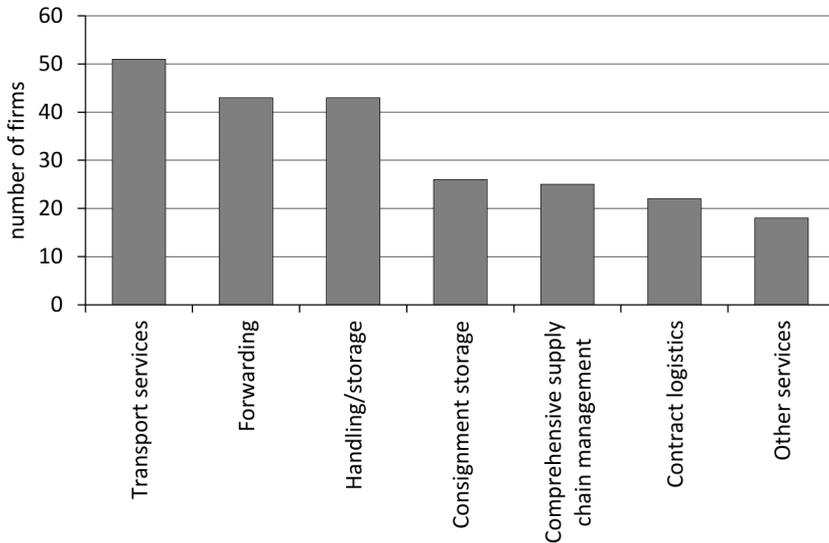
Source: compiled by the authors.

Most of the logistics enterprises in Poland (68%) researched use domestic capital, compared to 32% using foreign or mixed capital. More than a half of the logistics enterprises (60%) have operated for more than 15 years, i.e. they were founded after 1990, following the introduction of the free market economy in Poland. In 1991 to 1996, establishing logistics companies in Poland was particularly popular, especially since 1993, when logistics started to grow dynamically in Poland and with it the TSL sector. There is a big group of entities operating in the Polish market for 8 to 15 years (24%) and for 2 to 8 years (12%). For both groups, the rate of new company creations was moderate, i.e. about 3 companies a year. Based on the employment criterion, in the population of logistics enterprises operating in the Polish TSL sector for more than 15 years, which could potentially have a system of controlling, most companies are medium (40%) and large (38%). As regards their sales revenue, 48% of entities generate up to EUR 10 million a year, 25% generate EUR 10.1–50 million, and 28% up to EUR 50.1 million.

Analysis of the scope of logistics services shows that the respondents focus mainly on transport and shipment, and less on warehousing and handling. About a third of enterprises operate in contract logistics (see Figure 3).

As for the scope of transport services, the majority of logistics enterprises provide their services across Poland and in Europe (outside of Poland), and about one third serve their clients worldwide (outside of Europe). When it comes to the type of transport services, logistics enterprises focus mainly on overland transport (about 60% of companies), and less often on water and sea transport.

Figure 3. Scope of services provided by logistics enterprises being researched (aggregate answers expressed in numbers)



Source: compiled by the authors.

The types and distribution of services can be supported by the results of a study on logistics outsourcing, which indicated that logistics processes transferred by enterprises to external providers include external transport (including courier and express services), shipment (including insurance of logistics services, customs services, parcel tracking, shipment arrangements) and, to a lesser extent, warehousing services (Klimczak and Sekieta, 2012, p. 21).

Results of indicators analysis for management accounting

Among the logistics enterprises researched, 49% (34 entities) said they had a system of management accounting/controlling introduced, compared to 51% (35 entities) that did not have a system. The implementation of the system in those entities was directly proportional to employment and sales revenue but there was no significant statistical relationship regarding the source of capital, time of operation in the TSL sector or the scope of services provided. This relationship was reflected by the adopted statistics, i.e. Chi-square test of independence and Spearman's correlation (rank) coefficient (p -value < 0.05).

As for the types of management accounting/controlling instruments, the logistics enterprises researched used mainly operational and selected strategic methods of

controlling (46%), followed by ad hoc single instruments (26%) and operational instruments alone (17%). Implementing ad hoc single instruments suggested that the entities under study did not have fully developed and structured systems of controlling, and controlling activities were performed only occasionally by other departments. Further analysis of the results indicates that ad hoc methods and instruments of controlling were implemented primarily by small enterprises.

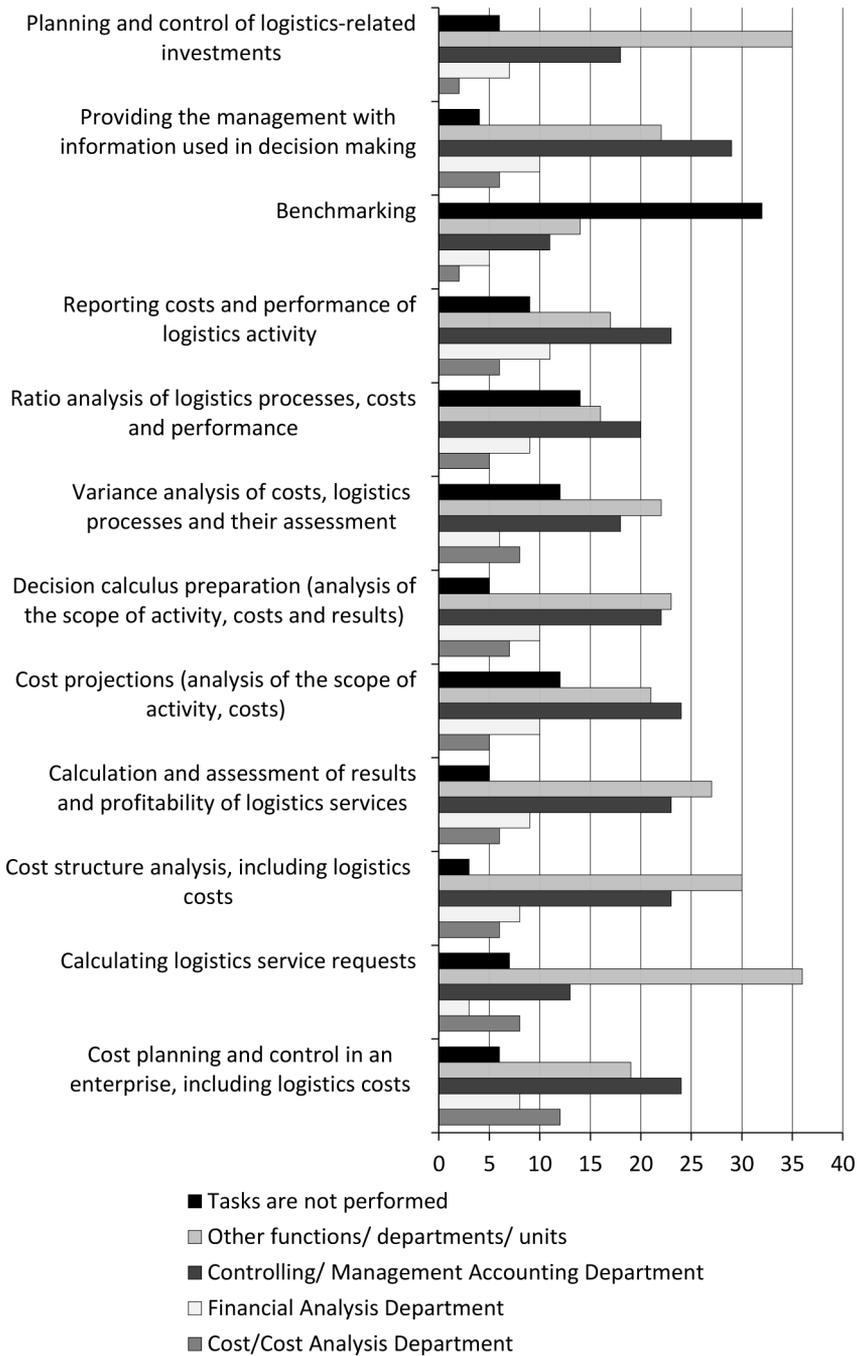
Implementation of the system of controlling, or the lack of one, was subject to analysis covering activities and instruments used in performance management including relevant indicators. Out of 67 enterprises that responded to the question on the types of controlling activities and their respective departments (including the entities that declared they did not have a system of controlling introduced), 75% said they had conducted indicator analysis to evaluate logistics processes, costs and performance, while 81% admitted having carried out variance analysis and evaluation of logistics processes. Although the figures do not indicate that indicator analysis is the key action undertaken by the studied enterprises, it was nevertheless very popular among those entities.

Moreover, the research showed that in 20 companies, ratio analysis is conducted by their controlling departments, whereas in 16 entities other functions/units are responsible, such as a cost analysis department (5 companies) or a financial analysis department (9 companies). It was found that 14 entities do not carry out indicator analysis. Regarding variation analysis of logistics costs and processes, 22 entities said it was assigned to other functions/units; in 18 companies it was the responsibility of the controlling department; in 14 companies the task was not performed, while in the remaining entities it was carried out by the cost analysis department or financial analysis department. By "other departments," the respondents usually meant logistics, transport and finance departments. Management accounting/controlling activities and their respective departments are presented in Figure 4.

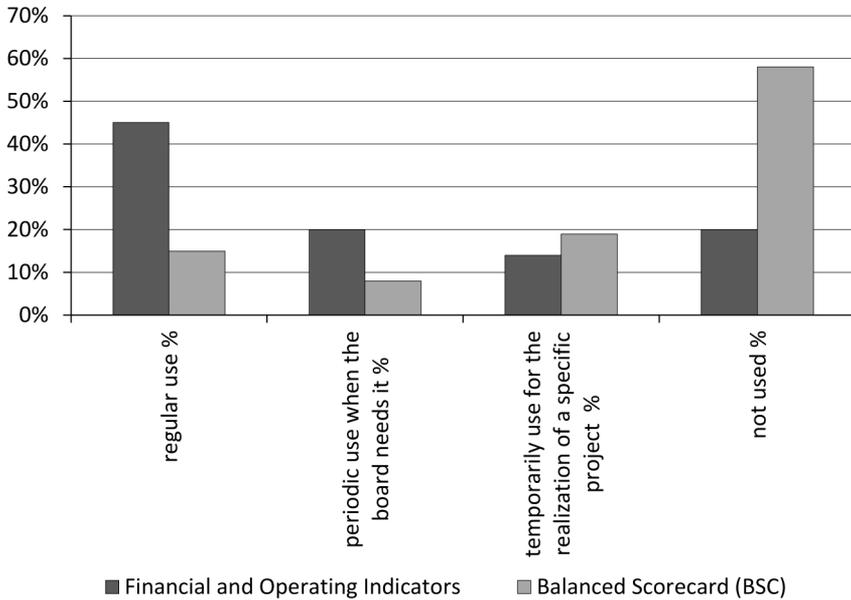
Based on the results and their analysis using descriptive statistics, it was possible to verify the first hypothesis (H1). The hypothesis should be denied, as in the studied enterprises, indicator analysis of logistics process, costs and performance was not usually performed by logistics departments or other functions/departments/units, but was largely integrated in the system of controlling/management accounting.

To verify the second hypothesis (H2), the authors compared two operational instruments of controlling/management accounting, i.e. financial and operational indicators, with the balanced scorecard (BSC) as a strategic instrument of controlling/management accounting, and took into account the frequency of their application (see Figure 5).

Figure 4. Management accounting/controlling activities in logistics enterprises researched



Source: compiled by the authors.

Figure 5. Application of single indicators and the balanced scorecard

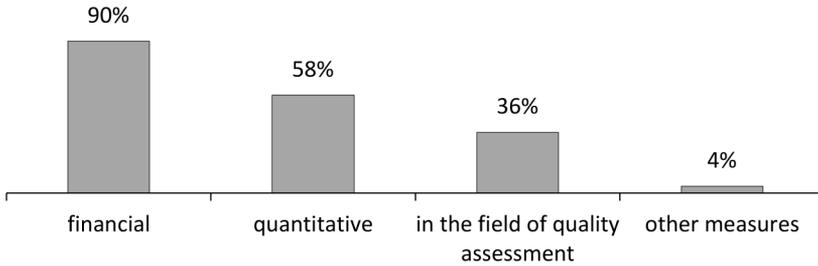
Source: compiled by the authors.

The diagram shows that single financial and operational indicators were used regularly. They were also applied to support periodical assessment. Popular in controlling and logistics controlling literature, the BSC-based indicator system was not used in business practice by most of the Polish enterprises researched. Therefore, based on the results, the second research hypothesis (H2) is affirmed.

Another aspect refers to the type of parameters taken into account during indicator analysis. The collected data showed that financial indicators were measured by 90% of the logistics enterprises researched (62 companies), followed by quantitative indicators (58%) and quality assessment measures (36%). As regards financial indicators, the respondents underlined the importance of profitability (50 companies), liquidity (43 companies) and rotation (23 companies). Other indicators referred to (4%) included client productivity, capacity, coefficient of fleet utilisation, and time-related indicators (see Figure 6).

Based on this analysis, it was concluded that most logistics enterprises mainly used financial indicators, but more than half of them also calculated quantitative indicators, and a third used quality assessment measures. Taking this data into account, the third hypothesis is affirmed.

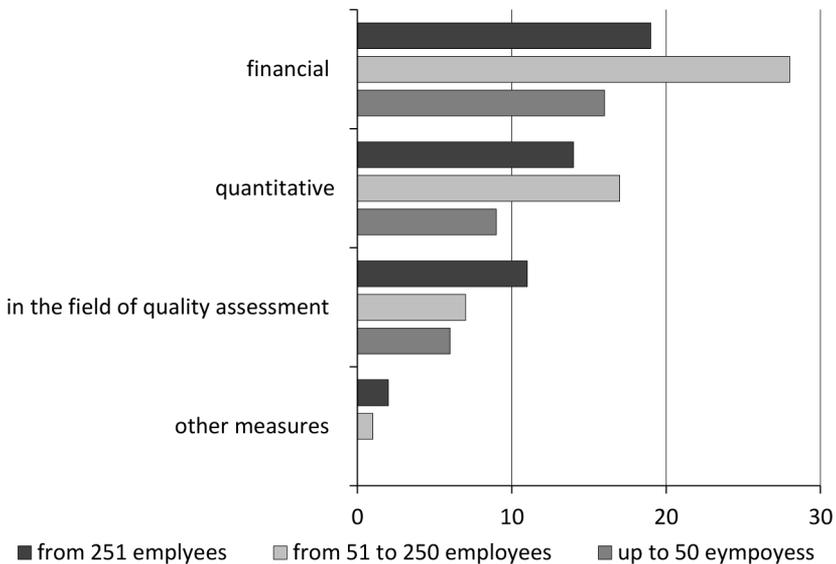
Figure 6. Parameters used in indicator analysis



Source: compiled by the authors.

To complement the research, the authors conducted a more detailed analysis of the indicators. Having compared the parameters used in indicator analysis by small, medium and large companies, the authors noticed that, irrespective of their size (defined based on number of employees), the logistics enterprises subject to research measure indicators representing all groups considered. Notably, both financial and quantitative parameters prevailed in medium enterprises, quality assessment indicators were more popular in large entities, while small logistics providers quite often used financial indicators only (see Figure 7).

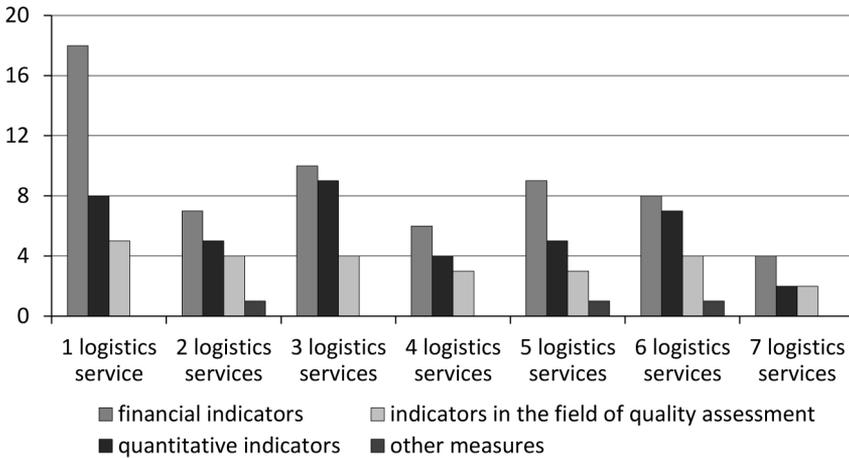
Figure 7. Indicators used to measure logistics activity vs. employment in the enterprises researched



Source: compiled by the authors.

The authors also analysed the relationship between the number (scope) of logistics services provided by the enterprises and the types of indicators they used. The use of indicators representing individual indicator groups was most proportional in enterprises providing two or four logistics services. Furthermore, the analysis showed that smaller entities (usually offering one logistics service) most often used financial indicators (see Figure 8).

Figure 8. Indicator parameters vs. the scope of logistics services in enterprises



Source: compiled by the authors.

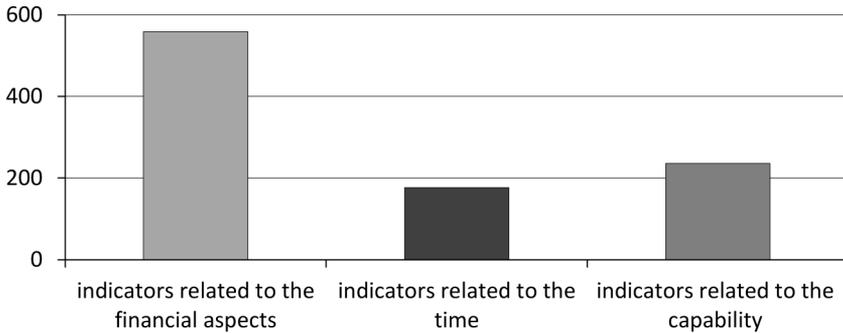
Based on the results of the empirical research, accepting the H2 hypothesis that logistics providers researched tended to use selected financial and operational indicators rather than indicator systems was justified.

Later during the analysis, the authors verified the application of 28 financial and operational indicators, mainly relating to transport and warehousing subsystems. The obtained data supported the H3 hypothesis that financial indicators prevailed over the operational ones (56% and 44% respectively) in the studied logistics enterprises. As for the scope of logistics services, more enterprises used indicators to evaluate their transport activities (53%) rather than warehousing-related ones (47%), which corroborates the statement that the TSL sector in Poland is focused more on transport and less on warehousing.

To complement their analysis, the authors investigated the enterprises taking into account the indicators relating to financial aspects (income, costs, liquidity), time and capability. Figure 9 shows that the largest number of indications on the calculation of individual ratios listed occurs for indicators relating to financial aspects (for 14 indi-

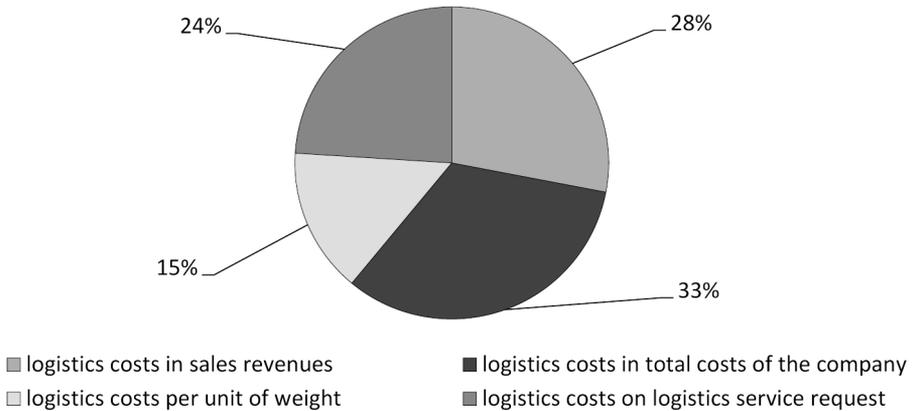
cators listed, the total number of indications is equal to 528). Next, the surveyed companies calculated indicators related to capability (for the 8 indicators listed, the total number of indications is equal to 270) and indicators related to the time (for 4 indicators listed, the total number of indications is equal to 177).

Figure 9. Indicators by their selected aspects



Source: compiled by the authors.

Figure 10. Methods of monitoring logistics costs in enterprises



Source: compiled by the authors.

The final stage of the analysis covered the verification of the H4 hypothesis that refers to monitoring logistics costs in a logistics enterprise. By its nature, a logistics activity consists in providing services by logistics enterprises. As logistics costs prevail over other costs, they need to be properly monitored and measured. The questionnaire survey results indicated that 78% of the respondents monitored their logistics costs,

compared to only 19% that did not. To verify the H4 hypothesis, the authors used descriptive statistics method. The results are presented in Figure 10.

As shown in the diagram, logistics enterprises in Poland usually analysed logistics costs against their total costs (33%), and less often against their sales revenues (28%). In Germany, however, this relationship was the inverse, i.e., monitoring logistics costs was focused primarily on sales revenues (Blum, 2006, p. 136).

Summary

Given the number of underlying aspects, analysis of indicators is a complex subject both from the scientific and practical perspectives. Its application in logistics activity and performance measurement of logistics enterprises is complicated because logistics itself covers many different processes, services, customer relationships, etc.

Indicators seem to be simple to implement, which is why they are used, for example, in logistics management, particularly given the wide selection of logistics indicators. On the other hand, it may be difficult to determine which indicators to use and how they should be arranged and related to each other to provide relevant information. Therefore, researchers dealing with performance measurement started to develop indicator systems and models, such as BSC, pointing out that they could enhance the performance of an enterprise more effectively than single indicators.

Performance measurement should constitute an integral part of an enterprise's management accounting/controlling system. As a result of combining controlling and logistics, logistics controlling has been developed, aimed at supporting logistics management and thus the way in which logistics enterprises operate. The concept of logistics controlling is particularly popular in German literature and often relates to logistics providers. Apart from cost accounting, its basic instruments include different indicators and their analysis.

The authors of this study investigated the indicators used by logistics enterprises important to the Polish economy. The results of the empirical research conducted by the authors and by German investigators showed that single indicators prevail over indicator systems (the BSC system in particular) in business practice. Although popular in theory, indicator systems are not easy to implement in logistics enterprises or are not familiar to practitioners. Such a tendency is more common among enterprises based in Poland than in Germany. Most single indicators relate to financial aspects.

This is confirmed by the results of empirical research carried out both in Poland and Germany.

Although operational indicators, i.e. process-related ones (including time and efficiency) are less popular in the system of controlling, they may be more often used by individual sub-systems, such as transport and warehousing. This statement is supported by the results of other research indicating that analysis based on indicators is carried out by logistics and financial analysis departments. Based on the research conducted by the authors, the assessment of this aspect is relatively positive, although it should be noted that the number of enterprises in the research sample was limited, and the selected departments did not significantly differ regarding their size.

To sum up, the presented empirical research did not fully cover the subject of indicators used by Polish logistics enterprises, as its focus was on investigating the implementation of management accounting/controlling and its instruments in general. Nevertheless, the research helped its authors evaluate the importance of analysis by indicators in the Polish logistics sector. The study results provide a basis for undertaking a more detailed analysis of measurement in logistics. Based on the results, it can be stated that enterprises should not only focus on financial indicators but also on those relating to investment and risk, and should include them in their reporting systems. At the same time, the indicators should be integrated into a coherent performance measurement system, providing managers with regular and relevant information supporting performance control and assessment, as well as strategic and operational decisions.

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