SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2025
ORGANIZATION AND MANAGEMENT SERIES NO. 237

INDICATIVE ASSESSMENT OF THE FUNCTIONING OF SUPPLY LOGISTICS IN A SELECTED DISTRIBUTION CENTRE

Agnieszka GASCHI-UCIECHA

Silesian University of Technology, Faculty of Organization and Management; Institute of Logistic;
agnieszka.gaschi-uciecha@polsl.pl, ORCID: 0000-0003-2908-3842

Purpose: The main objective of the article is to analyse and evaluate the effectiveness of the procurement process using the index method, with particular emphasis on the possibility of improving the fluidity and quality of this process.
Design/methodology/approach: The study used qualitative research methods such as participant observation and interviews, as well as indicator analysis.
Findings: Empirical studies indicate that the problems occurring in a distribution centre in the procurement process are mainly caused by the use of two non-integrated WMS (Warehouse Management System) systems.
Originality/value: The results of the study may be useful for improving the procurement process in the entity under study.
Keywords: metrics and indicators, procurement logistics, logistics processes.
Category of the paper: research paper.

1. Introduction

Contemporary market developments create vast opportunities for businesses and distribution centres alike, encouraging creativity and the implementation of innovative solutions. These changes affect many areas directly or indirectly related to logistics, including supply logistics, warehousing, inventory management, and customer distribution (Dyczkowska, 2013).

As a key element of any company's operations, supply logistics is an integral part of the supply chain. It encompasses the processes of planning, organising, and executing the delivery of the raw materials, components, and other goods necessary for production or service provision. It plays an equally important role in distribution centres, directly affecting their profitability and competitiveness. This is particularly important in food distribution, where

market dynamics, specific quality requirements and the need to maintain the cold chain present additional challenges.

For this reason, procurement processes must be continuously improved and integrated with other business activities, as they form the foundation of operations and future development.

Additionally, effective control of procurement processes is becoming increasingly important in logistics. To this end, various metrics and indicators have been developed to monitor procurement activities. Analysing the results provides a comprehensive overview of the state of procurement processes and enables the implementation of changes aimed at enhancing the efficiency and effectiveness of the entire supply chain.

The main objective of this article is therefore to evaluate the functioning of supply logistics in a selected distribution centre using the following measures and indicators: the share of defective deliveries, the inventory level indicator and the receiving efficiency indicator.

2. The procurement process in the literature – selected issues

The tasks carried out as part of supply logistics focus primarily on the delivery of the necessary raw materials, materials, semi-finished products, spare parts and finished products, as well as other elements enabling the effective use of material and human resources. Deliveries are accompanied by the flow of relevant information supporting the entire process. Goods are delivered both to the recipient's supply warehouses and directly to their places of use. Close cooperation with all departments of the company is of key importance here, as it allows for a better understanding and planning of material needs, and thus maintains the expected quality of products and services (Jurczak, Konecka et al., 2024).

The main task of supply logistics is to ensure that the materials necessary for operations are delivered exactly when they are needed. The following tasks are performed as part of this function (Sharma, 2023; Szczepanik, Sobala, 2021):

- purchasing materials necessary for production,
- quality control of delivered raw materials and components,
- searching for new suppliers and developing lasting relationships with them,
- negotiating favourable pricing and contractual terms,
- maintaining stocks at an optimal, sufficient and safe level,
- deliveries tailored to current needs,
- close cooperation with departments using supplies in order to identify and understanding their needs,
- ensuring timely procurement of materials.

In supply logistics, four basic criteria for assessing the effectiveness of activities are of key importance (Wojtynek, 2020):

- Delivery time - refers to the period between the moment the order is placed and the actual receipt of the goods by the recipient.
- Quality - means the compliance of the delivered materials or products with the requirements and expectations of the purchaser.
- Reliability - the supplier's ability to deliver on time according to a pre-agreed schedule.
- Flexibility - includes the supplier's ability to respond to changing customer needs, including the ability to modify orders and adapt to unusual or individual requirements.

Supply logistics, as a key element of the supply chain, requires proper inventory management and close cooperation with suppliers. The integration of activities in this area allows for cost optimisation, increased efficiency and the building of competitive advantage (Bedey, Eklund et al., 2008).

Nowadays, procurement no longer focuses on the products themselves, but on the capabilities of suppliers. It takes on a proactive character, building and managing networks of connections and the processes that occur within them. This stems from the concept of supply chain management, which applies to all areas of a company. This translates into the essence of modern management, i.e. supply chain integration (Nogalski, Niewiadomski, 2013).

3. Metodology

A wide range of logistics indicators is used to measure and evaluate a company's performance.

Indicator analysis is a relatively simple method of examining the processes carried out in a company. It is based on constructing and evaluating relationships between different variables. It is very important to select and estimate the values of the parameters under study appropriately and to interpret the results correctly, which is done on the basis of a comparison with accepted reference bases (Dmuchowski, 2019).

The concepts of a measure and an indicator are related to index analysis. A measure is a number characterising a certain phenomenon, expressed in an appropriate unit of measurement allowing it to be compared with other phenomena (Twaróg, 2003). Measures in logistics serve an informational function and do not have evaluative properties in themselves. Expressed in absolute units, the values of measures determined on the basis of research allow the actual state to be quantified. Measures can also be used to create indicators. Logistics indicators are used to measure the effectiveness of logistics systems, define quantitative objectives, check the level of achievement of the company's objectives and the degree to which customer needs are met. Properly formulated logistics indicators enable early recognition of

negative and positive trends in the process (early recognition function) and contribute to the proper control of logistics processes (control function) (Twaróg, 2003).

Indicator analysis enables the acquisition of relevant information about the logistics processes being implemented, as well as the identification of deviations from the adopted planning assumptions. Thus, it indicates the need to introduce appropriate improvements. Indicators serve as a tool for evaluating previously made decisions and, at the same time, provide a basis for formulating directions for further action (Gaschi-Uciecha, 2018).

The following indicators were used in the analysis:

- share of defective deliveries,
- warehouse stock level indicator,
- receiving efficiency ratio.

The indicator analysis made it possible to assess the efficiency of the procurement process in the company under study, which helped identify areas for improvement.

4. Results

Based on data received from the research entity, an indicator analysis was conducted for the priority disruption, i.e. discrepancies in inventory levels, which were identified using the FMEA method (Gaschi-Uciecha, Osińska, 2024). This analysis provided a better understanding of the scale and impact of the problem on the organisation's operations in individual months from December 2023 to May 2024.

The measures and quantitative indicators selected for the analysis of the research subject are presented in Table 1.

Table 1.
Selected quantitative indicators

Name	Method of calculation	Description
Percentage of defective deliveries	$LWD = \frac{Liczba\ wadliwych\ dostaw\ w\ badanym\ okresie}{Łączna\ liczba\ dostaw\ w\ badanym\ okresie} * 100\%$	This indicator expresses the ratio of defective deliveries to the total number of deliveries. Defective deliveries include products that do not meet the parameters specified by the recipient, were damaged during transport, or do not comply with the customer's order.

Cont. table 1.

Inventory level indicator	$Mzp=Zi+(Omp-Omr)$ Zi – inventory volume at the beginning of the period under review [thousands of items] Omp – warehouse turnover by revenue in the period under review [thousand units] Omr – volume of warehouse turnover by expenditure in the period under review [thousands of items]	The indicator provides information on how much stock is in the warehouse at a given moment.
Receiving efficiency indicator	$WP = \frac{Ilość\ linii\ przyjętych\ towarów\ w\ badanym\ okresie}{nakłady\ czasu\ pracy\ [rbh]\ w\ badanym\ okresie} * 100\%$	This indicator reflects the effectiveness of the goods receipt process. It is calculated for the lines of goods received and allows the warehouse efficiency to be determined.

Source: Own study based on literature (Miłaszewicz, Wengel, 2015; Twaróg, 2003).

The indicators and metrics presented above were calculated taking into account the division into two WMS systems – WAPRO MAG and QGUAR – presenting the results for individual months of the analysed period (December 2023 – May 2024).

A summary of data on the number of deliveries and the number of defective deliveries from both WMS systems is presented in Table 2.

Table 2.
Summary of the number of deliveries and defective deliveries from both WMS systems

		December	January	February	March	April	May
Number of deliveries		46	39	35	40	43	40
Number of defective deliveries	WAPRO Mag	40	28	27	30	33	28
	QGUAR	37	29	27	28	30	29

Source: Engineering work materials: Osińska (2024), promoter A. Gaschi-Uciecha.

The summary of the results of the number of defective deliveries indicator is presented in Table 3 and Figure 1.

Table 3.
Summary of results for the indicator – number of defective deliveries

	December	January	February	March	April	May
WAPRO Mag	86.96	71.79	77.14	75.00	76.74	70.00%
QGUAR	80.24%	74.36%	77.14	70.00%	69.77%	72.50%

Source: Engineering work materials: Osińska (2024), promoter A. Gaschi-Uciecha.

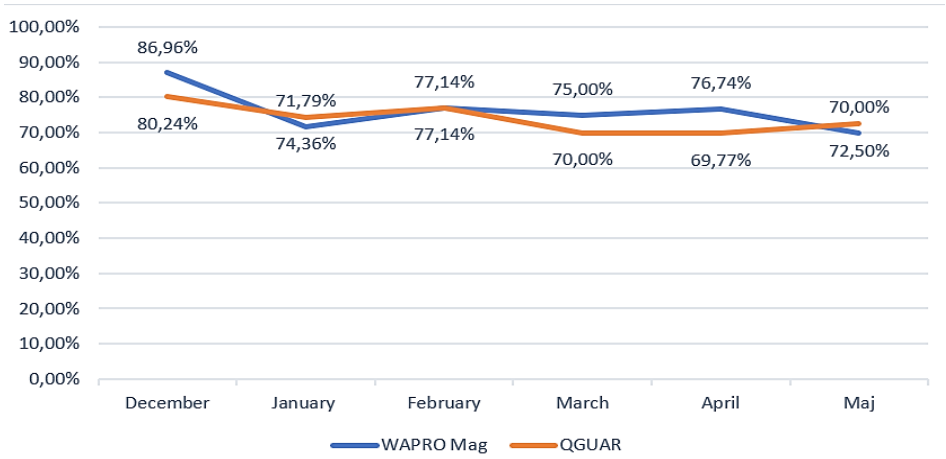

Figure 1. Chart for the defective delivery rate.

Source: Engineering work materials: Osińska (2024), promoter A. Gaschi-Uciecha.

The summary of the results for the warehouse stock index is presented in Table 4 and Figure 2.

Table 4.
Summary of results for the indicator - warehouse stock levels

	December	January	February	March	April	May
Actual quantity	4,364	4,453	4418	4472	4413	4455
WAPRO Mag	4390	4475	4465	4495	4450	4480
QGUAR	4353	4449	4431	4458	4408	4437

Source: Engineering work materials: Osińska (2024), promoter A. Gaschi-Uciecha.

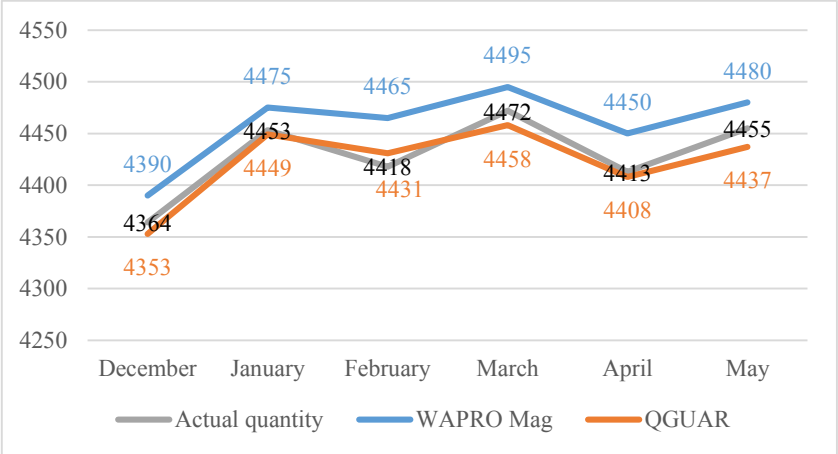

Figure 2. Chart for the warehouse stock level indicator.

Source: Engineering work materials: Osińska (2024), promoter A. Gaschi-Uciecha.

The results of the acceptance efficiency indicator are presented in Table 5 and Figure 3.

Table 5.
Summary of results for the acceptance efficiency indicator

	December	January	February	March	April	May
WAPRO Mag	0.1139	0.1899	0.1805	0.2041	0.1848	0.1613
QGUAR	0.1236	0.2011	0.1874	0.2174	0.1965	0.1676

Source: Engineering work materials: Osińska (2023), promoter A. Gaschi-Uciecha.

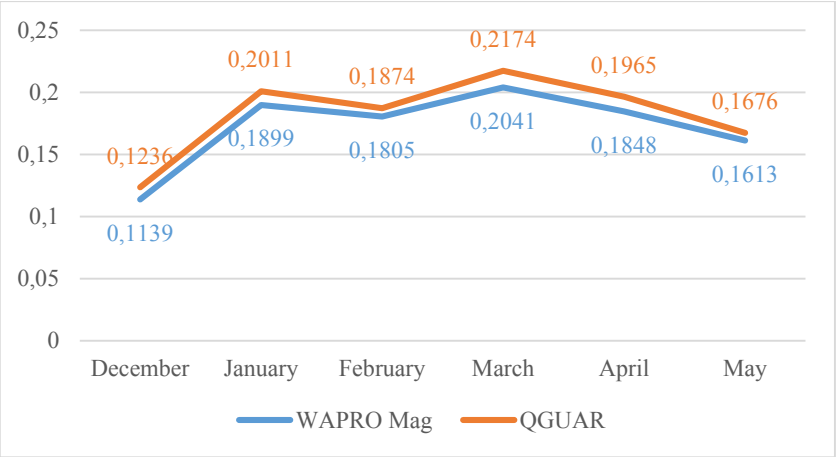

Figure 3. Graph for the admission efficiency indicator.

Source: Engineering work materials: Osińska (2024), promoter A. Gaschi-Uciecha.

The analysis revealed significant differences between the two WMS systems. Although they handle the same deliveries, the results in each programme differ, mainly due to human error and manual acceptance procedures.

The defective delivery rate indicator primarily points to a high percentage of deliveries with irregularities. The most common problem is that the products' expiry date is too short. Fresh food products usually have a shelf life of several days, while the minimum period required by the customer is usually 5 days. In practice, however, this requirement is often not met. In addition, the indicator reveals slight differences between the systems, suggesting errors resulting from manual data entry. The solution to this problem is process automation.

The warehouse stock indicator also revealed differences between WMS systems. There is a clear trend towards lower stock levels in the QGUAR system. This is due to its simpler operation – compared to WAPRO Mag – which translates into fewer errors made by employees. As a result, the data in QGUAR more often reflects the actual situation. Nevertheless, discrepancies with reality are still observed, which is why it is recommended to implement a single, integrated WMS system with an automatic data entry function, which will reduce human error and minimise differences in reported stock levels.

The warehouse goods receipt efficiency indicator showed that this process usually takes longer when entering data into the WAPRO Mag system than into the QGUAR programme. This is one of the reasons why the warehouse uses the latter system more often – QGUAR is more transparent and easier to use than WAPRO Mag. Regardless of the software used, however, the time taken to receive deliveries remains too long – in extreme cases, it is almost 4 hours. Therefore, it is recommended to implement a single, integrated WMS system with the ability to automatically enter data using RFID technology.

5. Conclusion

Discrepancies in stock levels are the most serious problem in the company, contributing both to slow processes and to growing employee frustration resulting from the need to repeatedly enter the same data manually and verify it at each stage of the procedure. The main cause of this phenomenon is the parallel use of two independent and non-integrated WMS systems, which additionally require manual data entry, significantly complicating operational processes.

The most effective improvement would be to standardise and integrate the systems by implementing a single WMS solution that would meet the needs of all departments and provide a comprehensive approach to warehouse processes. In addition, it is recommended to replace the equipment with newer models and update the software, which will eliminate technical errors and speed up operations. It is important to note that the research entity has already begun discussions on the implementation of a single, integrated WMS system equipped with RFID technology support.

Reference

1. Bedey, L., Eklund, S., Najafi, N., Wahrén, W., Westerlund, K. (2008). *Purchasing Management. Chalmers: Department of Technology Management and Economics.* Gothenburg, p. 11.
2. Dmuchowski, R. (2019). Sposoby oceny sprawności procesów logistycznych. *Kwartalnik Naukowy Uczelni Vistula, no. 4(62)*, p. 94.
3. Gaschi-Uciecha, A., Grabowska, J. (2024). Analiza i ocena przebiegu procesu zaopatrzenia dla wybranej kopalnii wega kamiennego. *Zyszty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie, z. 212.* Gliwice, pp. 129-141.
4. Gaschi-Uciecha, A., Osińska, A. (2024). Investigation of procurement process problems in a selected distribution centre. *Zyszty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie, z. 212.* Gliwice, pp. 129-141.
5. Gaschi-Uciecha, A. (2018). Analiza i ocena procesu transportowego w wybranym przedsiębiorstwie sektora TSL. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie, z. 121.* Gliwice, p. 114.
6. Jurczak, M., Konecka, S., Łupicka-Fietz, A., Pawlicka, K. (2024). *Podstawy logistyki.* Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
7. Miłaszewicz, B., Wengel, M. (2015). Wskaźnikowa ocena funkcjonowania logistyki dystrybucji. *Logistyka, no. 6*, p. 791.

8. Nogalski, B., Niewiadomski, P. (2013). Koncepcja oceny dostawcy w elastycznym zakładzie wytwórczym – strategiczna perspektywa sukcesu. *Zarządzanie i Finanse, vol. 11, no. 4, part 2.* Gdańsk: Uniwersytet Gdański, p. 292.
9. Osińska, A. (2009). *Organizacja procesów transportowych przez wybranego operatora logistycznego.* Materiały pracy inżynierskiej pod kierunkiem A. Gaschi-Uciecha. Zabrze.
10. Sharma, P. (2023). *The New Era Of Supply Chain Management And Procurement*.
11. Skuza, Z. (2019). Wybrane aspekty logistyki zaopatrzenia w badanym przedsiębiorstwie. *Gospodarka Materiałowa i Logistyka, no. 11*, pp. 2-6.
12. Szczepanik, T., Sobala, N. (2021). *Zarządzanie ryzykiem w systemach logistycznych*. Częstochowa: Wydawnictwo Politechniki Częstochowskiej.
13. Twaróg, J. (2003). *Mierniki i wskaźniki logistyczne.* Poznań: Biblioteka Logistyka, p. 23.
14. Wojtynek, L. (2020). Wskaźniki pomiaru i oceny podsystemów logistycznych. In: J. Rut (ed.), *Przegląd Nauk Stosowanych* (pp. 59-68). Opole: Oficyna Wydawnicza Politechniki Opolskiej.