4. CONTROLLING IN SUPPLY CHAIN MANAGEMENT

In this chapter, key issues related to controlling in supply chain management are presented. Particular emphasis is placed on the analysis of logistic data, which can be conducted using a spreadsheet. Here, you will find:

- concept of controlling,
- objectives and scope of controlling in the supply chain,
- basic Key Performance Indicators (KPIs) in the supply chain.

4.1. Introduction

Controlling can be defined by identifying its main task, which is to ensure result-oriented planning, control, and monitoring of a company's activities based on accounting and financial data (Hahn, 1987). Controlling can be described as "a system of mutually agreed measures, principles, goals, methods, and techniques that serves the internal control and management of outcome-related objectives" (Nowak, 2015). **Controlling in the supply chain** is the process of managing and optimizing financial, material, and informational flows throughout the supply chain (Chopra & Meindl, 2007). Supply chain controlling **includes** data analysis, forecasting, performance monitoring, and corrective interventions, which allows for continuous adjustment of activities to changing market and operational conditions (Cigolini et al., 2004). Differences exist between supply chain controlling and enterprise controlling, as presented in Table 4.1.

Table 4.1. Differences between controlling in the supply chain and in the enterprise

Differentiating criterion	Controlling in supply chain	Controlling in enterprise
Range of activity	includes the management and coordination of activities in many independent organizations that cooperate to produce and deliver products to the final recipient	focuses on the internal processes of one organization, focusing on optimisation and operational efficiency within the enterprise itself
Strategic goal	strives to optimize the entire process from suppliers to customers, focusing on the integration and synchronization of activities between various entities	focuses on achieving the financial and operational goals of the enterprise itself, such as profitability, operational efficiency and compliance with the budget
Areas of intervention	deals with aspects such as order fulfilment time, logistics costs, quality of cooperation between partners and inventory management at the level of the entire chain	may focus on controlling internal costs, analysing the profitability of products or departments, and optimizing business processes within the company
Tools and methodologies used	often uses advanced IT systems that integrate data from various enterprises, such as ERP or SCM systems	may use more company-centric tools and systems that may not necessarily be integrated with external business partners

Source: (Mazur et al., 2021; Nesterak et al., 2020; Vollmuth, 2000)

In summary, controlling in the supply chain requires a more holistic approach to management and coordination of activities than controlling focused on a single enterprise, where the priority is the optimisation of internal business processes.

In controlling, detailed information about the past is not sufficient; it is also essential to develop and implement new concepts, instruments, and tools that provide precise information about the future development of the enterprise in the supply chain. Therefore, one of the characteristics of a controlling system is the presence of two types of feedback (Nesterak, 2002):

- feedback (feed-back) – regulation that allows for identifying deviations in the plan-execution system and for taking appropriate corrective and preventive actions to avoid deviation from the set goal,
- feed-forward – understood as control related to the use of forecasted quantities and information about past actions to determine what kind of actions should be taken in the future.

In this perspective, controlling directs the future activities of enterprises by creating an "early warning" system. This system identifies signals that can significantly affect the future of the company and the entire supply chain, which in turn influences the achievement of set goals.

Supply chain controlling aims to achieve objectives through integrated analytical, strategic, and operational activities that encompass both internal functions of the enterprise and its interactions with external partners in the supply chain. **Key objectives of supply chain controlling** include (Chopra & Meindl, 2007):

- increasing operational efficiency through process analysis, workflow optimisation , and waste minimization, which improves the overall performance of the supply chain,
- cost reduction, as controlling and continuous monitoring of costs within the supply chain help identify areas where savings can be achieved without compromising quality,
- ensuring compliance and quality by monitoring and ensuring adherence to regulations and quality standards throughout the supply chain,
- improving collaboration between partners through better planning, communication, and coordination of activities,
- increasing the flexibility and resilience of the supply chain by developing the ability to quickly adapt to market changes or operational environments and minimizing the risk of downtime or disruptions,
- optimizing inventory management, which balances the needs for cost reduction with requirements for product availability,

- improving the decision-making process by providing key data and analyses that support strategic and tactical management decisions,
- ensuring continuous improvement by promoting a culture of continuous improvement within the supply chain through regular reviews, assessments, and process updates.

In summary, controlling supports the implementation of supply chain strategies by providing precise data and analyses that assist in strategic planning and process optimisation . Through real-time monitoring of indicators, it enables quick responses to changing market conditions and customer needs. Additionally, controlling supports risk management in the supply chain by identifying potential threats and proposing solutions that minimize their impact on achieving set goals.

4.2. Key performance indicators in the supply chain

In the literature, the issue of supply chain controlling is most often analysed from the perspective of the tools used. Bibliographic sources indicate that the most effective controlling tools include activity-based costing, target costing, indicator systems, balanced scorecards, and benchmarking (Dobroszek, 2011; Guersola et al., 2018). This study, which focuses on the use of spreadsheets in the analysis of logistic data, emphasizes indicator analysis due to its applicability in this particular tool.

Key Performance Indicators (KPIs) used in supply chains are an essential tool for measuring and monitoring the efficiency and effectiveness of activities within the supply chain. KPIs can be categorized based on the pillar they cover (Dobroszek, 2011):

- supply chain pillar – at this level, indicators are used that apply to the entire supply chain, such as total order fulfilment time across the supply chain, total supply chain costs, and the cash-to-cash cycle,
- partner relationship pillar – on this level, indicators are calculated that reflect the cooperation between business partners and the resulting effects, such as the relationship between the supplier and the retailer; characteristic indicators

in this area include the ability to fulfil deliveries and the payment reliability of merchants,

- individual economic entity in the supply chain pillar – although entities in the supply chain function in connection with each other and pursue a common goal, each should assess its economic activity separately.

The most commonly used key performance indicators in supply chains include (Dias & Silva 2021; Lehyani eta la., 2018; Rasool et al., 2023; Yurtay et al., 2023): OTIF (On-Time In-Full) – measures the percentage of orders delivered to the customer on time and in full, according to their specifications.

Formula:

$$OTIF = \left(\frac{number\ of\ orders\ delivered\ on\ time\ and\ in\ full\ quantity}{total\ number\ of\ orders}\right) \times 100\%$$

The high level of OTIF implementation indicates the effectiveness of inventory management, production planning, transportation time management and accuracy in the order acceptance process.

Formula in Excel:

OTIF = ([number of orders delivered on time and in full quantity] / [total number of orders]) * 100%

- order processing time LT (Lead Time, Order Fulfilment Time) – measures the time from accepting an order to its delivery to the customer.

Formula:

$$LT = delivery\ date - date\ of\ acceptance\ of\ the\ order$$

Lead time includes:

- order preparation time – the time needed to process the order in the system,
- production time – the time required to manufacture or prepare the ordered products,
- delivery time – the time that elapses from the moment the product is sent to the customer until it is received.

Formula in Excelu:

LT = [delivery date] – [date of acceptance of the order]

- customer service level – measures an organization's ability to meet customer requirements, often defined as the percentage of orders fulfilled without errors (see the chapter on Inventory Management),
- inventory availability rate (IA) – percentage of time that inventory is available to customers without delays.

Formula:

$$IA = \left(\frac{the\ number\ of\ days\ that\ inventory\ was\ available}{total\ number\ of\ days\ in\ the\ period}\right) \times 100\%$$

or

$$IA = \left(\frac{available\ stock\ quantity}{desired\ inventory\ quantity}\right) \times 100\%$$

The indicator measures the percentage of days or instances in which inventory was available for immediate fulfilment relative to the overall demand or number of days in a specified period. This allows for an assessment of how effectively a company manages its inventory in the context of meeting customer expectations.

Formula in Excelu:

IA = ([the numer of days that inventory was available] / [total number of days in the period]) * 100%

or

([available stock quantity] / [desired inventory quantity]) * 100%

- inventory turnover ratio (IT) – measures how often the company uses and replaces inventory in a given period, shows how efficiently the organization manages its resources and responds to market demand.

Formula:

$$IT = \left(\frac{cost\ of\ goods\ sold}{average\ inventory\ level}\right) \times 100\%$$

A too high indicator may indicate a risk of inventory shortages. A too low indicator may signify excessive inventory or poor sales. The ideal level of the inventory turnover ratio depends on the industry and the specifics of the company, as well as its supply chain management strategy.

Formula in Excel:

IT = ([cost of goods sold] / [average inventory level]) * 100%

- Rate of Return (RoR) – percentage of products returned by customers in relation to the total number of products sold.

Formula:

$$RoR = \left(\frac{number\ of\ units\ returned}{total\ number\ of\ units\ sold}\right) \times 100\%$$

A high rate of returns may indicate problems with product quality, discrepancies in descriptions, or improper fulfilment of customer expectations, which negatively affects their satisfaction.

This indicator helps companies identify issues in products or processes that may need improvement. Analyzing the reasons for returns can lead to changes in production processes, enhanced quality of products or services, and better inventory management and forecasting.

Formula in Excel:

RoR = ([number of units returned] / [total number of units sold]) * 100%

- supplier performance index (SPI) – assessing and monitoring supplier performance within the supply chain; determine how well suppliers meet established criteria, such as the quality of delivered products, on-time delivery, or the ability to complete orders without errors (see the chapter on Analytics in the area of supply and purchasing). Formula:

$$SPI = \left(\frac{sum\ of\ points\ for\ all\ criteria}{maximum\ possible\ number\ of\ points}\right) \times 100\%$$

The SPI is usually calculated based on several individual performance indicators, such as delivery quality, timeliness, and flexibility. Points are awarded based on the fulfilment of specific criteria, and the maximum total points correspond to the supplier's ideal performance.

Formula in Excel:

SPI = ([sum of points for all criteria] / [maximum possible number of points]) * 100%

Chapter Questions

1. What are the key objectives of controlling in the supply chain?
2. What actions are taken within controlling to reduce costs in the supply chain?
3. How does controlling ensure compliance and quality in the supply chain?

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