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# Stock levels in relation to the competitiveness of the company

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**Abstract**

**Purpose** – The objective of this study is to explore the contribution of inventory management and levels in manufacturing and industrial companies to the competitiveness of the company in an uncertain macroeconomic environment, such as during times of crisis. The objective of the research is to ascertain the impact of consciously devised inventory strategies on cost efficiency, the amount of tied-up capital, customer service levels, and the impact on corporate performance.

**Design/methodology/approach** – The study's methodology is based on a combination of primary and secondary research methods. The present study focuses on a period of crisis, which is defined as 2020-2022. The present study draws on empirical data (i.e., inventory levels, turnover, orders, and average price) from a global market-leading manufacturing company in order to apply a range of inventory analysis techniques. Such techniques include ABC and XYZ analysis, as well as inventory turnover rate and inventory efficiency indicators. The objective of the analyses is to explore the relationships between inventory levels and the efficiency of company operations, supplemented by a synthesis of the relevant literature.

**Findings** The findings indicate that an inventory strategy not devised with due rigor can lead to excessively high inventory levels and the consequent immobilization of capital, whilst offering no assurance of improved customer service. The integrated application of ABC and XYZ analysis methodologies facilitates targeted inventory management, thereby reducing inventory carrying costs and enhancing inventory turnover.

**Originality** – The study's originality lies in its interpretation of inventory management within the context of corporate competitiveness, thereby surpassing the conventional operational approach. The research is based on an empirical analysis of the total inventory of a global manufacturing company, which examines the economic implications of inventory decisions in a data-rich manner. A novel contribution is the integrated and critical application of ABC and XYZ analysis methods, which provides an opportunity to reinterpret corporate inventory practices. The study thus reinforces the strategic approach to inventory management on an empirical basis.

**Keywords:** corporate decision-making, cost control, corporate competitiveness, inventory level optimization, inventory management,

**Paper type:** Research Article

## 1. Introduction

In recent years, an integrated assessment of the suppliers, producers, distributors, and consumers that make up the supply chain components has been one of the areas that has received much attention (Ghourchiany & Bafrouei, 2017). Companies are experimenting with novel organizational solutions to operate more efficiently (Cesarelli et al., 2021). In companies, the management of assets and resources, and their use, is based on serious strategic decisions. These determine how the available

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assets are used and how (and in what quantities) finished products are stored, which serve not only the achievement of the organization's objectives, but also its effectiveness or competitiveness. Inventory management is one of the key factors in corporate logistics that helps the organization grow and generate profit. It is one of the most important elements in the supply chain, because a significant amount of companies' assets are held in their inventory; therefore, issues related to inventory management with the goal of minimizing the total cost of the supply chain and the cost of the finished product are of great importance (Glock et al., 2014).

The aim of inventory management, implemented by the purchasing and sales areas, is to ensure that sufficient quantities of goods are available at optimal cost, so that the company can maintain its operations and provide a high level of service to its customers while remaining competitive in the supply chain and maintaining the company's profitability. Efficient inventory management is very important in the supply chain to reduce total supply chain costs (Lee & Billington, 1993). When a company decides on the size of its inventory, it considers various costs, including holding, ordering, and shortage costs (Hugo et al., 2002).

Supply chain management is an innovative approach that deals with the planning and control of materials and information from suppliers to final consumers (Cesarelli et al., 2021). Effective stock management is key, as inventory affects sales, which in turn drives the business and, in turn, drives profits (Ezenwa, 2015). Through inventory, a company is able to coordinate purchasing, production, and distribution. To put it simply, if a company has high inventory, it will have to order less, but the costs will be higher because it is more expensive to maintain inventory. However, production is assured for a long time, and the level of customer service can be kept high. This is an advantage from the point of view of the availability of the finished product. On the other hand, if a company chooses to keep a low inventory level, then, of course, the inventory holding costs will decrease, but shortage costs will increase, which may result in a loss of customers. In addition to reduced service levels and unavailability, the company's profits and competitiveness will also be reduced.

Cost rationalization is now essential in all economic systems, laying the foundations for efficient and sustainable management. Managing these business and logistics systems in a competitive global market is a major challenge (Živko et al., 2019). In particular, today's macroeconomic conditions are putting businesses in a difficult position. In addition to the explosion in energy prices and rising labor costs, procurement costs are also having a major impact on how companies operate.

A well-functioning inventory management policy that keeps inventories at the right level can lead to significant cost savings. This makes the company more competitive and cost-effective. The advantage over competitors is essentially determined by those factors that can be sustained over time and cannot be offset by competitors (Porter, 1993). An inventory policy is stable, sustainable, under constant control, controllable, malleable, and difficult for competitors to track. The key to competitiveness is the combination of physical and human resources, and their efficient management to create customer value. The main objective of companies is to create customer value, and to do so requires company resources and capabilities. The creation of customer value also requires the efficient and innovative use of resources (Hope & Hope, 1997; Usman, 2024). Their efficient use increases customer value if they are available at the right time and in the right quantities. Recent research has shown that many organizations have recognized that increasing supply chain efficiency can also increase companies' competitiveness, reduce inventory levels, and improve their ability to meet customer demand (Mekel et al., 2014; Cemberci et al., 2024). From an economic point of view, it is convenient to balance the level of inventory with the rhythm of sales or the quantity of each product required by the company (Vilcapoma et al., 2020).

Managing resources efficiently is a challenge, as it is difficult to achieve optimal stock levels, thus stocks are constantly in flux. When determining stock levels, the company takes into account customer needs and makes forecasts. However, customer needs change frequently and are not always balanced. Overstocking leads to high costs and increases the amount of capital employed, but also involves a risk if the rate of turnover is reduced. A large inventory is one of the main consequences of an unsuitable estimate of production quantity and product demand (Bijaghini & Hosseini, 2018). Too low of an inventory level is also a risk, as it can lead to stock shortages, which can hinder customer service and also increase costs. Inventory management is not without problems, requires constant control, and is difficult to balance. A poorly chosen inventory management strategy can be a serious disadvantage for companies and have an additional cost burden.

Some of the literature mentions that efficient resource management is important for a company's competitiveness (Alkhlaifat & Koloszár, 2023). Thus, inventory management, rather than the efficient management of inventories, is an important means for a company to gain a competitive advantage. The combined approach allows research to link inventory strategies to measurable outcomes in competitiveness and operational efficiency. This study aims to demonstrate that effective inventory management not only stabilizes the supply chain but also directly contributes to value creation and cost control, thereby supporting a long-term competitive advantage. We believe that the inventory management strategy a company adopts and the resulting inventory levels it manages are important factors in its ability to increase its competitiveness and supply chain efficiency. Inventory management is an underlying activity in the operation of a company that strongly supports logistics processes, which provides stability and a secure basis for the supply chain to function and for customers to be served without hindrance. It contributes to value-creating processes and also has a significant cost control effect. Inventory management is an important factor and supporting activity for competitiveness. We would like to model this claim using inventory analysis techniques and the results of our primary research.

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Based on the above, the study seeks to answer the following research questions:

- How do inventory management strategies affect inventory levels in companies?
- How does a deliberately designed inventory strategy contribute to a company's competitiveness during the 2020–2022 macroeconomic crisis?
- What relationship can be identified between inventory level optimization, the amount of tied-up capital, and on-time delivery (OTD) performance?
- How does the integrated application of ABC and XYZ analysis methods help increase inventory turnover and cost efficiency at the manufacturing company under study?

This research is based on an analysis of empirical data from a global market-leading manufacturing company, and its objective is to model the relationship between inventory management and competitiveness in the following research phases:

- Literature review: Exploring the theoretical relationships between inventory management, logistics efficiency, and corporate competitiveness
- Data collection: Retrieving primary data from the studied company for the 2020–2022 period (inventory levels, turnover, orders, average prices)
- Diagnosis and analysis: Critical examination of current inventory management practices using ABC/XYZ matrices and efficiency indicators.

## 2. Literature review

Currently, logistics management is a distinctive factor of organizations and it is part of the system approach that links the fundamental processes of a logistics system, which includes supply (purchasing management, storage, inventory management), production, distribution or sales, and reuse or reverse logistics (Chen & Bidanda, 2019). Inventory management is the technical term for the combination of inventory planning, organization and control, which aims to minimize investment in inventory while balancing supply and demand. Effective inventory management increases gross and net profit by reducing purchasing and associated operating costs (Hidayat & Saleh, 2020).

Inventory exists in the supply chain because of a mismatch between supply and demand (Chopra & Meindl, 2013; Ivanov et al., 2019). A company must maintain sufficient inventory to meet the needs of its customers, and failure to do so can result in a loss of sales (Nasution, 2020). Furthermore, maintaining optimization after balancing initial supply and demand with the correct inventory is a new factor in competitive differentiation (Vilcapoma et al., 2020).

Cost efficiency in the main functions and operations of supply chains is relevant in practical decision-making (Ivanov et al., 2019). Inventory management is one of those functions and inefficient inventory management leads to two problems: inventory surplus and/or inventory shortage. Inventory surplus freezes the enterprise's funds, while inventory shortage causes penalties, lost profits, and client loss.

The inventory risk increases significantly when there is a high inventory build-up, the extent of which depends on the value of the inventory, the obsolescence period, and the uncertainty of supply and demand. The quality factor is more in favor of low stock levels, which can typically be worsened rather than improved by stockpiling. Indeed, the longer the finished product spends in storage, the more likely it is to lose value. At the same time, the risk that the resulting low stock levels may prove insufficient in the event of a sudden surge in demand must be considered (Hauck, 2015). A good provisioning policy can achieve the general objectives of the company through good inventory management under the best conditions of supply and quality.

The role, function, stock value, and structure of inventories depend on the characteristics of the production process, the related management decisions, and the role of inventories in the production process. Stocks can be broken down into the following groups of stocks according to their role in the production process.

- Stocks in excess of the safety stock arise from the need for continuous production and are intended to meet that need. It is typical for companies to maintain a high level of safety stock as a buffer against fluctuations in demand, which is inefficient and results in high working capital requirements. Optimizing safety stock allows companies to achieve savings and increase inventory turnover (Alin, 2016).
- Safety stock allows the decision-maker to control the expected unplanned shortages, which directly helps reduce the total cost (Dey & Seok, 2022)."free" stock, which is the amount of stock that is available in relation to the timing of orders and the quantity ordered, provides the continuous production of raw material requirements over the safety stock level. It is also the closing stock for a given unit of time (e.g., at the end of a month or quarter).
- Maximum stock level, safety stock level, and total quantity ordered at one time.

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For companies, in general, the problem of profitability is more important than profit because efficiency can only be realized by comparing profits obtained with own capital and foreign capital used to generate profits. Thus, the level of profitability plays an important role, and rapid inventory turnover is expected to increase the profitability of the company (Nasution, 2020).
Inventory management costs account for a significant share of total logistics costs in supply chains. Meanwhile, storage time for different types of stock (raw materials, semi-finished, and finished goods) accounts for up to 90% of the logistics cycle time from the vendor to the end customer (Bowersox et al., 2007; Christopher, 2011; Lambert et al., 2006).
From the point of view of efficiency, supplies try to ensure that the cost of the resources used to achieve the previous objectives for various activities is as low as possible, which also indicates that the provisioning function includes three basics: provisioning, storage, and inventory management (Vilcapoma et al., 2020). Inventory holding costs (Table 1) are the costs of holding a product in stock for one year. Cost elements that are related to the physical existence of inventories or that can be linked to the value of inventories are recorded here. They include, for example, insurance, deterioration, capital tied up in fixed assets and inventories, depreciation, storage and handling costs, etc. (Krampe et al., 2012).
Storing too much inventory will increase expenses for storage, insurance, and property taxes. Furthermore, excessive inventory will increase the risk of loss due to price reductions, damage, and changes in customer purchasing patterns (Warren et al, 2005).

**Table 1.** Stocking costs

| Cost elements | | |
|---|---|---|
| Procurement costs | The cost of placing the order | • Purchase value of goods ordered<br>• Delivery cost of goods ordered, freight charges<br>• Customs clearance costs |
| Costs of stockholding | The cost of the physical existence of stocks, tied-up capital, deterioration and obsolescence, and the cost of storage space | • Cost of stocks warehouse rent, operating costs<br>• Insurance premium<br>• Labor costs |
| Costs of stock shortages | Loss of profit due to inability to meet demand | Amount of undelivered orders, lost demand |

**Source**: Silver et al., 1998

With higher inventory turnover, more costs can be suppressed, resulting in greater profitability for a company. Conversely, if there is slower inventory turnover, there is a smaller profit gain. Achieving a high level of inventory turnover is not as easy as one might imagine; many factors must be considered in a company's operations. Among them are processing inventory regularly and efficiently, improving the quality of goods, and meeting consumer demand (Brigham & Houston, 2001).
Inventory management is one of the most important logistics functions. It is aimed at solving the following tasks:

- determining the optimal stock (current, safety) levels of all inventory items
- determining the optimal order quantity and selection of appropriate inventory management strategies
- organizing the control (monitoring) system of stock levels and its timely implementation (Lukinskiy et al., 2020)

The fundamental questions for inventory management strategies are when (time) and how much (quantity) to order (Ravinder & Misra, 2014). The ordering interval depends on whether orders are to be placed at fixed 't' intervals, or whether stock replenishment is decided when the stock level falls to some 'S' minimum stock level (reorder point).

- A continuous review system can examine stock levels at any moment of operation and make decisions when necessary, based on the characteristics of that moment. In this case, the decision variables are the order quantity (q) and the indicator stock (s), i.e., the stock level at which the order is placed for the predefined quantity. This inventory mechanism is called the (s, q) mechanism.
- In a periodic review system, the stock level is checked only at certain predetermined intervals (e.g., weekly, monthly) (t p), and the order quantity is decided on this basis. The order quantity placed under this mechanism varies over time and depends on the actual stock level measured during the review period. The order quantity in this case is the difference between the maximum possible stock level (S) and the current stock level (I a) at the time of observation. This mechanism (t p, S) is called the stock mechanism.

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Once a reliable demand forecast is available, companies can take a number of measures to ensure uninterrupted supply and prevent shortages and stock-outs (Cogan et. al., 2018).
Inventory management is a tool for a company to be competitive and increase its competitive advantage. In recent years, the role of the supply chain has become very critical in creating and maintaining an organization's strategic competitive advantage through strong customer relationships, increased customer satisfaction, and improved business profitability (Mentzer, 2001). Inventory is a process with input (source) and output (sink) sides that the firm controls as demand fluctuates randomly due to supplies from sources, which are essentially a response to demand from output. The input side has an inventory-increasing effect, while the output side has the opposite effect, i.e., it is inventory-depleting. Between the two, the order is a link, which can be of two types:

- feedback: the company orders based on a change in stock
- feed forward: the company orders according to expected demand (forecast)

The nature of the market is also very important, so the emergence of demand can be highly predictable or very hectic, depending on the different responses the company makes. On the input side, the company fills its stocks, driven by the stock level as a baseline. Ordering controls the replenishment process, but they need to add in the uncertainty of suppliers and the carriers they use, which means that the order lead time can vary around a value. Once again, an important feature is how well a company can plan with suppliers; moreover, how stable they are in completing the delivery as planned. A key factor of competitiveness is the right corporate strategy. As Kurucz (2010) points out, the relationship between performance and strategy should be two-way, not merely cause-and-effect, since the relationship between supplier and buyer is crucial to competitiveness. Furthermore, this has a major impact on the company's inventory policy and strategy. Adequate manufacturer stockholding establishes the availability of the firm, which is reflected in the continuous supply of production, but also affects the commitment of resources and capital (Fructher et al. 2006).
Increasing market competition motivates the continuous improvement of logistics strategies, including inventory management. Companies' inventory management practices involve both strategic and operational decisions, but in many cases, however, strategic and operational decision models for inventory management are incomplete (Winston, 1944; Waters, 1992). Stock management strategies are summarized in Table 2.

**Table 2.** Stock management strategies

| | How much?<br>Quantity of the order | When?<br>Date of the order |
|---|---|---|
| For orders with a predefined parameter | Orders for constant-size lots „q" | Orders dispatched at the same time interval „t" |
| When ordering with actual data calculated from actual data | Order items „S" (Qmax) calculated to reach maximum stock level | Orders „s" (Qmin) dispatched when minimum safety stock level is reached |

**Source**: Silver et al., 2017

In an economic environment as unpredictable as the one we live in today, a "cushioning" ordering mechanism allows a company to adapt flexibly to demand (Figure 1). Using this strategy, the stock level is filled to the maximum when the minimum stock level is reached. There is no shortage of goods between receipt and order. However, the question is how the supplier can keep up with this hectic pace, since this method protects against both overstocking and shortages, and errors can only occur due to estimation errors between order and delivery. It is well adapted to demand, and order quantity and time are also functions of demand. The disadvantages are that it requires continuous stock monitoring, is not automatic, requires continuous stock control, and is a complicated, expensive system. In addition, it requires a high degree of flexibility and availability from the supplier.

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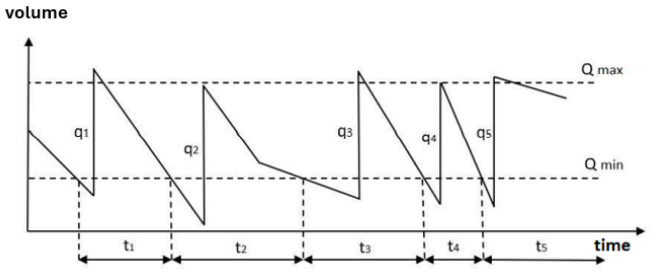


**Figure 1.** The damping ordering mechanism
**Source**: Chikan, 1983

Stock and Lambert (2001) summarized a list of clear signals a company receives due to poor stocking:

- Large quantities of obsolete goods
- Increasing number of canceled orders
- High customer turnover
- Increasing number of missing articles
- Constant number of shortages with increasing stock investment
- Temporary storage capacity shortage
- Deterioration of customer relations due to inadequate availability

High stock levels and the removal of stock-outs increase the sales of an item and the profit of the inventory system per unit of time; however, inventory costs are also increased (Levin et al., 1972; Silver et al., 1998).
The real goal is to define the value of the inventory that supports a high level of customer service in which the company maximizes customer satisfaction and optimizes financial performance (Alin, 2016; Uvet, 2020).
Inventory management is characterized by a fundamental trade-off: higher inventory levels improve product availability, customer service, and operational continuity, while simultaneously increasing holding costs, capital lock-up, and the risk of obsolescence. Conversely, lower inventory levels reduce costs but increase the likelihood of stockouts and lost sales. Therefore, the key challenge for firms is to determine an optimal inventory level that balances service performance and cost efficiency.
The findings of this study reinforce the idea that proactive and systematically designed inventory strategies outperform reactive approaches in terms of cost efficiency and operational stability. Similar patterns have been identified in other complex systems, where lifecycle-based analyses demonstrate that regular, planned interventions result in significantly lower long-term costs and improved sustainability performance compared to irregular, ad hoc responses (Eisinger et al., 2022). This parallel highlights that resilience in inventory systems is closely linked to the ability to anticipate and structure responses to uncertainty.
From a quality perspective, lower inventory levels are preferable, as products may lose value during prolonged storage. However, this creates the risk that inventory may not be sufficient to meet sudden surges in demand, potentially leading to stockouts and lost sales.
A similar contradiction can be observed in the case of safety stock. While maintaining high safety stock levels provides protection against demand uncertainty, it is often considered inefficient due to the high working capital requirements it generates. At the same time, an optimally determined safety stock level can reduce total logistics costs by mitigating the impact of unexpected shortages.
Furthermore, higher inventory levels and the elimination of stockouts contribute to increased sales volume and higher profit per unit of time. Nevertheless, these benefits are accompanied by increased inventory holding costs, including storage, insurance, and capital costs.
Finally, adaptive inventory control mechanisms, such as the so-called "damping" mechanism, enable firms to respond flexibly to demand fluctuations while simultaneously avoiding both overstock and shortages. However, these systems are complex and costly to operate, require continuous monitoring, and demand a high level of flexibility from suppliers.
These contradictions highlight that inventory management decisions are not linear but involve balancing competing objectives, where the optimal solution depends on the firm's strategic priorities and operating environment.

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## 3. Methodology

The research was conducted using a primary research method based on analyses conducted at a global market leader (who wanted to remain anonymous), complementary data, and information from the literature.
The material thus produced is a review of our views, primarily in the form of a description of the procedures and methods that can be implemented in practice and are currently in use. Furthermore, it is presented as a guideline approach through the formulation of our proposals. This is complemented by the use of secondary research and quantitative methods of analysis, which provide factual insight into certain studies.
The question that always arises for practitioners: "What is a good stock?" This can be further broken down to when and how much stock a company should have. In an ideal environment, a continuously producing company will have a pre-defined inventory strategy adjusted for seasonal periods. But what if customers' orders are unpredictable, triggered mostly by a rapidly changing economic environment?
Stocks must be converted into cash because, without it, the organization will not have enough working capital to operate. Good inventory management allows organizations to run their businesses in the most efficient and profitable way possible. This is essentially why sales are made.
The research is based on a combined methodology that integrates primary and secondary research methods.
The study is based on real data (inventory levels, sales, orders, average prices) from an anonymous, global market-leading manufacturing company. The research focuses specifically on the 2020–2022 crisis period. The methodology includes integrated ABC and XYZ analysis, as well as an examination of inventory turnover and inventory efficiency metrics.

In our study, we used the following analytical techniques:

- ABC analysis (Pareto principle): Grouping the product portfolio based on contribution to revenue (A: 80% revenue, B: 15%, C: 5%)
- XYZ analysis: Examination of demand volatility and predictability (X: stable, Y: volatile, Z: erratic demand)
- Inventory efficiency metrics
- Inventory turnover (in days): A measure of how many days' worth of inventory is sufficient to cover average daily sales
- Inventory turnover ratio: An analysis of the ratio of sales to units in stock
- OTD (On-Time Delivery) metric: A measure of customer service quality based on the percentage of deliveries made by the contractual deadline
- GAP analysis: Identification of market gaps between customer expectations and actual inventory availability
- Cost function analysis: Examining procurement, inventory, and shortage costs to support strategic decision-making

This comprehensive methodology allows us to view inventory management not merely as an operational task, but as a fundamental pillar of corporate strategy and competitive advantage.

## 4. Results

### *4.1. Stocktaking*

Hadley and Whitin (1963) pointed out as early as the 1960s that an adequate level of knowledge and valuation of company stocks is an essential part of successful company growth. Silver et al. (1998) highlighted the effective use of inventory valuation by automotive manufacturers and suppliers, but it can be argued that its adoption in the formulation of corporate inventory strategies remains uncommon today.
Stockholding provides security against market changes and fluctuations. The amount of stock to be held depends on the inventory strategy and optimization of the company. If the level of inventory is too high, the capital tied up will be high, which can be a disadvantage for the company, and the cost of holding inventory will also increase. Where is the balance in inventory management? What is the optimum point above which we overstock and below which we hinder customer service and the smooth functioning of the supply chain? In their research, Bijvank and Vis (2012) point out that a poor inventory strategy creates obstacles for the firm, limiting its competitiveness and efficiency of resource misallocation.
By using well-known models in inventory management, we can highlight the cornerstones of inventory management. In terms of inventory reviews, sales volume analysis plays an important role, so it is important to see what proportion of total turnover a particular product represents, which raises the questions: what is the turnover of that product, and what is the revenue from its sales? ABC analysis is often used by companies to analyze their inventory and the proportion of products sold as a proportion of revenue. ABC analysis (Pareto analysis) is a widely used method and can also be successfully applied

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to determine purchasing priorities. This technique is based on the value of annual consumption and applies the Pareto principle to inventory classification, commonly known as ABC analysis, which is widely used in inventory systems and processes (Silver et al., 1998). The analysis follows the Pareto principle, which states that 80 percent of revenue is derived from about 5-15% of the product categories traded. Therefore, firms should take this into account when considering their inventory.

The companies participating in the research listed nearly 60,000 items, of which a lot had a lower value (more than $50,000 were only $0.1). Out of this set, about 48,000 items were active in the last year, so these products were actually ordered. These products were analyzed by value–this typically gives a more accurate picture than a quantitative analysis, where very small parts valued at a few cents can easily produce incorrect results. The result of the ABC analysis was that a classic Pareto curve was drawn, with 80% of the revenue being made up of about 8% of the turnover of the product types (these were the items in Group A); Group B, which accounted for 15% of the revenue and included about 16% of the assortment; the last group (C) included about 76% of the items and in total was responsible for only 5% of the revenue. It was very important to conduct this analysis because it showed that only 24% of the company's revenue was generated by the items. It is worth noting that there were also materials with completely irregular use.

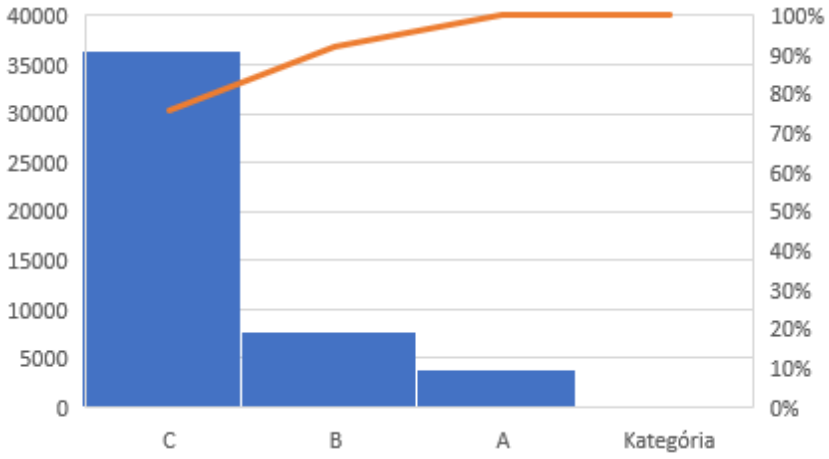


**Figure 2.** Pareto diagram
**Source***:* own editing based on company data

The XYZ analysis is standard practice in companies, which is applied to a company by looking at the last 12 months, and where an order was observed in a month; it has a value of one, so if there were a demand for a product in all 12 months, the result would be 12. This method differs from the standard XYZ analysis, where the average of the past period's demand and the average deviation from the average for each product is looked at. It is concluded that, of the two analyses, the chosen method to be used in the company is better than the original analysis. However, the original purpose of the XYZ analysis is to show the fluctuations in demand; therefore, the result of the aggregated ABC analysis and the monthly observation of demand cannot be used to draw a proper conclusion about the distribution of the quantities sold. The results of the analyses are given in Table 3.

**Table 3.** Results of the XYZ analyses

| Analysis | PCS Version 1 | PCS Version 2 |
|---|---|---|
| X | 2210 | 594 |
| Y | 6516 | 3183 |
| Z | 53683 | 58626 |

**Source***:* own editing, based on the results of a company example

Table 3 presents aggregated results, and the raw measurement data for individual items are not shown due to the extremely

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large number of items in the inventory (several thousand). Including the detailed data would overload the document, while the primary purpose—illustrating the categories and the aggregated PCS values—is fully achieved. The summarized figures in the table are based on the company's example and calculated according to the described methodology, highlighting the differences between Version 1 and Version 2.

The company's methodology (Version 1) exhibits a more permissive approach compared to standard industry practices. To enhance the validity of this example, an alternative methodology (Version 2) was also applied. However, the fluctuation category limits were not established based on a general category value but were instead defined as follows: category ‚X'—fluctuation of up to 30%; category ‚Y'—fluctuation between 30% and 80%; and category ‚Z'—fluctuation above 80%. The results of the company's analytical exercise indicated that category ‚X' contained nearly four times the number of items identified in our analysis, while category ‚Y' was twice as large as our findings.

From this simple analysis, a warning sign can be seen: the company's results, presented as a practical example with the correct application of the "ABC" or "XYZ" analyses, indicate that the company's inventory start-up strategy and inventory levels require significantly more tied-up capital than they need.

The combined use of the "ABC" and "XYZ" analysis methods allows for the possibility to group all products in a matrix (Table 4), which gives a realistic picture of how to manage the inventory of each product.

**Table 4.** ABC-XYZ matrix

| ABC / XYZ | X | Y | Z |
|---|---|---|---|
| A | „A" Class | „A" Class | MTO |
| B | „B" Class | „B" Class | MTO |
| C | „C" Class | „C" Class | MTO |

**Source***:* own editing

The company interprets the classifications as follows:

- Class A: "Class A" refers to the company's most valuable products, which are treated as high priority. These may include A-X (stable demand, high value) and A-Y (moderately fluctuating demand, high value). Both involve scheduled, forecast-based procurement. The difference lies in volatility, but from an inventory management perspective, the company classifies these as the same "Class" because both are critical products, and high availability must be ensured. For products in this class, the company uses historical data to forecast and takes into account the needs of existing orders, which the buyers use to place scheduled orders with suppliers.
- Class B: "B Class" refers to medium-value products, which the company categorizes into the B-X and B-Y cells. B-X: predictable demand, medium value. B-Y: moderately fluctuating demand, medium value. Inventory management is also important for these, but safety stock and a smoothing mechanism are used.
- Class C: Consists of low-value, less frequently sold products, which generally cover the C-X and C-Y categories. For these, inventory risk is lower, and MTO (Make-to-Order) or a smoothing mechanism is sufficient. For this classification, only the "cushioning" inventory mechanism is used, because these are typically low-value parts with hectic demand, which are less costly to keep in stock than the cost of ordering in small quantities. When the stock level reaches the reorder point, the purchasing department issues an order for the quantity of material that will fill the stock to the maximum.
- MTO (Make-to-Order): All Z categories (A-Z, B-Z, C-Z) and very high-volume products are subject to make-to-order production because keeping them in stock is not cost-effective. This group is the easiest to manage. The company does not hold any stock of these products, and procurement is only initiated by a specific customer order for a part manufactured by the supplier.

Based on the analyses carried out, 13 % of all articles of the company under investigation were kept in stock at all times, according to the current situation. Looking over a longer period, the proportion was approximately constant.

Looking at this stock holding rate, it is also necessary to consider how much the limited availability determines the sales volume of the company. A low inventory ratio can have a counterproductive effect on the company's turnover. Important considerations are whether the time inventory is in rotation and the amount of capital tied up in inventory.

Several initiatives to improve competitiveness were launched in the company under review. One of these changes was to meet customer needs in a timely manner. This metric, called On-Time-Delivery (OTD), shows the percentage of products

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ordered in a contract that are delivered by the contractually agreed date. One of the most important performance indicators is measuring the timely fulfillment of customer needs, defined in the literature as the OTD metric. OTD indicates the percentage of ordered products that a company can deliver by the deadline specified in the contract.

The OTD metric is a key indicator of supply chain and inventory management efficiency, as it directly reflects the company's service level and customer service capability. A high OTD value indicates that the company is reliably meeting customer expectations, while a low value may be due to delays, stock shortages, or an inadequate inventory strategy. There is a close relationship between inventory management and OTD: excessively low inventory levels increase the risk of late deliveries, while appropriately determined inventory levels can contribute to meeting deadlines. At the same time, due to the cost-increasing effect of excessive inventory, companies must optimize inventory levels to achieve the desired service level.

For the company under study, the expected OTD was 75%, which represents a moderate level of performance. Empirical results, however, showed that significant differences exist among the individual ABC categories. For products in Category "A," which generate the highest sales, the average OTD value was the lowest (34%), while higher performance was observed in Categories "B" (49%) and "C" (44%). This result points to a contradictory situation: although demand for products in Category "A" is more predictable and they are of strategic importance, the service level is still the lowest for these products. This may indicate that current inventory management and procurement practices are unable to adequately support the availability of the most important product range, which could directly impact the company's competitiveness. The split ratio of the OTD indicator and the ABC analysis is illustrated in Figure 3.

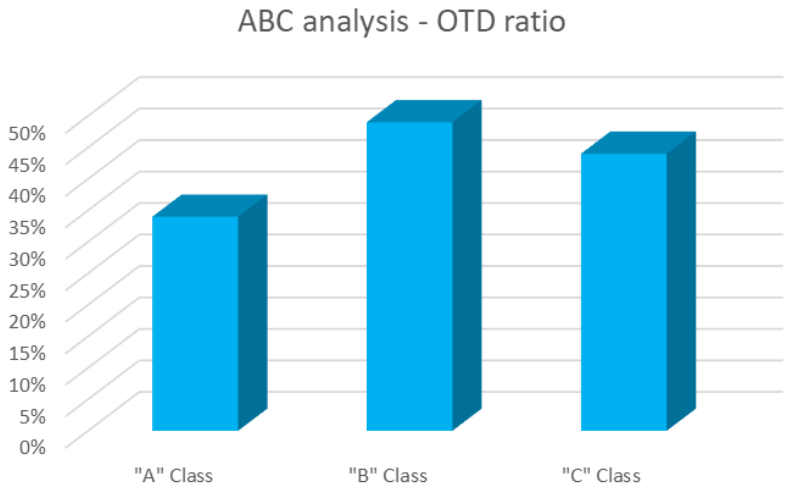


**Figure 3.** Average on-time performance rate
**Source**: own editing, based on company results

The reason for these ratios needs to be examined, because, as a global, dominant large company, neither service levels nor company performance are close to the real company performance, and therefore its competitiveness is not maximized.
To increase delivery accuracy, availability, and competitiveness, we need to examine the results of ABC and XYZ analyses, and perform forecast and supplier accuracy analyses to obtain an accurate picture to determine the product inventory strategy. The data from these tests are not presented in this publication due to its length, but we have identified three categories based on the results (Table 5).

**Table 5.** Stocking options

| Synchronized material supply | Triggering mechanism (s-S) | Two-story mechanism (s-Q) |
|---|---|---|
| Highest value products | Medium value products | Lowest value products |
| Stable demand | High battery count | Low supplier accuracy |
| Supplier accuracy | Large capital employed | Simple stock keeping |
| High rotation speed | Optimum stock size | Constant reorder level |
| Calculable stock changes | Charging to maximum stock level | Constant order quantity |

**Source**: Silver et al., 1998

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After developing the stocking options, we again classified the products into categories A, B, and C and obtained the distribution according to Table 6.

**Table 6.** Recalculated "ABC" analysis

| í | Proposed stockholding mechanism | Number of products pcs) |
|---|---|---|
| „A" | Synchronized material supply | 836 |
| „B" | Triggering mechanism (s-S) | 4532 |
| „C" | Two-story mechanism (s-Q) | 2820 |

**Source**: own editing

The results of the "ABC" analyses show a significant difference between the method used by the company under investigation and the calculation method we have modified (Table 7).

**Table 7.** Comparative table of "ABC" analyses

| Analysis | PCS<br>Current method version | PCS<br>Rethought version |
|---|---|---|
| A | 1477 | 836 |
| B | 614 | 4532 |
| C | 6097 | 2880 |

**Source**: own editing

It can be seen that among the various classifications, the volume of products in class A has decreased by 57%, while the number of products in class B has increased by 738%, and the number of products in class C has decreased to 47%. This changes the number of products held in permanent stock and the amount of capital tied up in stock.

### *4.2 Stock efficiency study*

The objectives of our research were to derive why the inventory analysis methods presented are of great importance at the firm level, and why keeping inventories at an appropriate level and monitoring them are a competitiveness factor. We expected to obtain results through stock efficiency studies that would show where to intervene at a product level with regard to stocks. Our stock analysis aims to make stock ratios visible, to see the proportion and value of immobile stocks, and where it could and would be appropriate to increase stocks, especially for strategic items. By comparing stock value to turnover, we calculated the stock rotation rate, which, when projected to the product level, provides a good indication of where intervention is needed. Using the analysis, we can filter out products in categories A or B, applying the results of our previous ABC analysis, and focus specifically on low-inventory category A products, which are strategic items for the company in terms of turnover.
Inventories are physical resources whose efficient use contributes to a company's competitiveness; therefore, they should be examined. Inventory efficiency is the amount of turnover per unit of inventory, or the amount of inventory needed per unit of turnover. Inventory efficiency increases if inventory decreases for a fixed level of turnover, or if turnover increases for a given level of inventory, or if turnover increases faster for both. For the company under study, we counted the items in stock and calculated their value. It was previously found that the company keeps 13 % of its products in stock. For our calculations, we looked at the closing stock of the items in question and, alongside this, the moving average price of the items. From this, we obtained the closing stock value of the items in question.

"moving average price" x "closing stock" = "closing stock value"

The closing stock value is important because it tells us the product rotation rate, i.e., how many days' supply of products the company has. To calculate this, we also needed average daily turnover data. In this study, due to the large number of article items, we did not detail closing stock values or turnover and rotation rates per article. Still, we presented an aggregated analysis based on the above calculations. Based on the rotation rate calculated for each product, the products were grouped into 4 categories.

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**Table 8.** Rotation speed categories

| Categories | |
|---|---|
| A - Low | 0-14 calendar days |
| B - Normal | 15-45 calendar days |
| C - High | 46-179 calendar days |
| D - Very high | 180+ calendar days |

**Source**: own editing

The first category (group A) included products with a stock of less than 14 calendar days. The items in group B were considered to have normal stock levels, with a maximum stock of 45 calendar days. Above this category are levels "C" and "D," which we categorized as high stock levels for items with more than 50 days of stock. The stock levels for items in these categories were examined and are shown in the table below (Table 9).

**Table 9**. Stock ratio

| Categories | Stock ratio by value (billion EUR) |
|---|---|
| A - Low | 526 855 728 |
| B - Normal | 2 765 206 585 |
| C - High | 1 121 947 224 |
| D - Very high | 713 255 483 |
| SUM | 5 127 265 020 |
| Categories | Stock ratio (%) |
| A - Low | 10.28% |
| B - Normal | 53.93% |
| C - High | 21.88% |
| D - Very high | 13.91% |
| SUM | 100.00% |

**Source**: own editing

For stock efficiency, the focal point of the analysis was the turnover per unit of stock. Thus, based on the closing stock value and the turnover data, we obtained the rotation rate of all the stocks in the company's warehouse and the number of days of available stock. From this figure, we could determine whether this level of stock was adequate based on the categories mentioned above.

**Table 10**. Rotation speed of stocks

| | Total closing stock value (billion EUR) | Average daily turnover (EUR) | Rotate |
|---|---|---|---|
| SUM | 5 127 265 020 | 150 878 646 | **34** |

**Source**: own editing

The figures show that the company was working with high stock levels. The high inventory level may be explained by the current uncertain economic environment. The high inventory level may mean that the company is preparing for possible "rush purchases" and trying to avoid shortages by keeping high inventories. Alternatively, consumer spending may have fallen, which could be due to inflation, as excessive and sudden increases in costs are forcing households to cut back on purchases. As a result, the company's inventory movement has stalled and sales volumes have fallen short of previous levels. Therefore, it is essential to intervene. From the above analysis, it is very clear how much capital is tied up in excessively high, i.e., non-moving, immovable inventories. Categories C and D amounted to almost € 2 billion, almost 40% of the total value of stocks. This was close to half of the stock's value, a high proportion (Table 11).

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**Table 11**. Slow-moving stocks ratio

| | |
|---|---|
| C - High | 1 121 947 224 (euro) |
| D - Very high | 713 255 483 (euro) |
| Value of high stocks (EUR) | 1 835 202 707 |
| Total stock value (EUR) | 5 127 265 020 |
| Slow-moving stocks ratio | 36% |

**Source**: own editing

At this point, the company can intervene and reduce costs by reducing and releasing these inventories. The timeframe within which the product can be sold needs to be assessed to determine whether sales are expected to increase. The market situation is also important to consider: does the company have the option to sell back, or, if it is a self-produced product, does the production schedule need to be changed? If high inventories are liquidated, the company can not only reduce costs by eliminating these inventories but also free up significant warehouse capacity.
The calculations also show that it is worth intervening in low-stock categories to increase efficiency. Stock levels for products in this category should be increased in line with normal stock ratios. In addition, it is worth examining what A, B, and C grades the low-stock products are and what can be expected in terms of turnover. Henceforth, stock levels can be adjusted accordingly.
In the context of stock optimization, the 34-day rotation rate should be reduced, as 20-23 calendar days would indicate a more profitable stocking rate. This is optimal if market conditions also justify a normal inventory level and the company is not affected by external economic events that would justify holding higher inventory.
If the inventory strategy, the proper management of stocks, is working well, it is essential to meet customer needs quickly. To be sure, the company keeps products in stock for which there is a ready market for a fast-moving commodity. This helps increase revenue and optimize the company's costs. It will reduce shortage costs and inventory holding costs. We will no longer have immobile inventories that tie up capital, strain warehouse capacity, and create scrap costs. When analyzing inventory efficiency, turnover is an important data point for the company. From a competitive point of view, the first step in determining inventory levels is to forecast demand, the expected evolution of turnover. The starting point for the ABC and XYZ analyses of inventories is the customer, with their expected demand (and fluctuations) and purchases. Customer information must be coded and translated into inventory planning. An attempt should be made to anticipate the expected needs of customers, taking into account factors, trends and seasonality that influence purchases, and to compare them with historical sales data. In the case of deterministic needs, there needs to be an accurate picture of future demand trends, so that both consumption and the necessary restocking can be planned effectively, and the stock level itself can be forecasted. Another possibility is to decide which products to keep in stock and which to liquidate, as well as which strategic items to prioritize. This helps management plan the whole spectrum of their business processes. The entire supply chain and company logistics are affected by the results. Overall, customer service levels will improve, and customer satisfaction and confidence will increase. If demand forecasting is inaccurate or if fluctuations in customer demand are tracked in the ordering process, a well-known phenomenon known as the "whiplash effect" kicks in. Inventory levels will rise unjustifiably, thus increasing the cost of holding inventory. The company's costs will increase and the use of resources will be inefficient. High inventories may be created, which will later become scrap costs due to their immobility. It is important to minimize the costs associated with stockholding. Costs should be considered from several angles, which are crucial for competitiveness:

- low purchase prices
- consistency and predictability of outgoing orders over time
- reducing the number of deliveries
- lower stock levels in warehouses, less capital tied up
- reduce costs from shortages, minimize stock shortages
- liquidation of immovable inventories

The results of the inventory efficiency study will contribute to the company by:

- managing a well-structured assortment for which there is a real customer need and demand
- incorporate fast-moving products into finished product planning
- being informed about slow-moving items that have become immobile, so changes in demand can be spotted

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- reducing costs, inventory costs, shortage costs
- improving the overall level of customer service

## 7. Conclusions

We compared the results of the "XYZ" analysis used by the company with the calculation method proposed in the literature and then with our own analysis. Based on the results, if the company under investigation implements our analysis method, significantly fewer products are placed in the "X" and "Y" categories. This is because the company is not accurate when determining fluctuations in demand. When a company classifies products in category "Z" as "Made-to-Order," the introduction of the new system will reduce inventory levels and, consequently, service levels. In order to increase service levels, availability, and competitiveness, higher category limits should be set for the analysis. The second step is to re-examine the product range.

According to Silver, Pyke, and Thomas (2017), XYZ analysis enables companies to classify products by demand variability, thereby helping determine optimal stock levels. Incorrect categorization, as observed in the company, leads to excessive inventory and tied-up capital, which aligns with our findings.

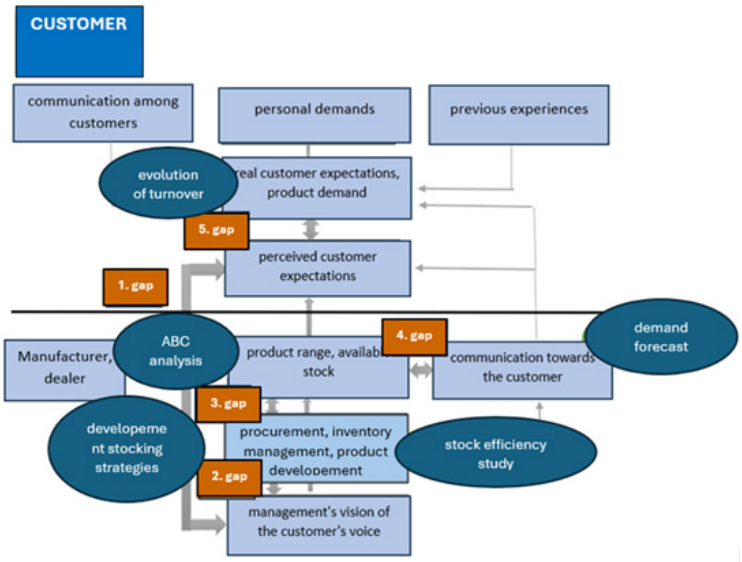
Our analysis (Table 3) shows that applying the revised XYZ classification reduces the number of products in the X and Y categories, confirming that the company's current method results in unnecessarily high inventory levels.

Based on the results of the forecasting system, it can be said that the method used is not accurate, so in many cases the company does not have sufficient quantities of raw materials to meet its customers' orders in time. In other cases, it has too much stock of certain products that are not necessarily needed to meet orders.

Proper supplier cooperation is important, so it is worth exploring the possibility of Vendor Managed Inventory (VMI). This should be the focus for higher-value products, replacing the synchronized supply of materials. At the same time, the supplier becomes responsible for developing the availability and appropriate stock for the company under review. This system is only feasible if we constantly share our forecasts and expectations for the product. This was also pointed out by Disney and Towill (2003).

When it comes to stocking, it is important to monitor information from customers, specifically their demand and needs. Failure to do so may result in building up excessively high stocks of certain products that are in less demand, and not holding stock or holding low stock levels of products that are in demand. GAP analysis, based on the difference between actual stock levels and optimal customer demand, can help identify market gaps, increase competitiveness, and improve inventory composition and levels (Figure 4).

**Figure 4.** GAP model considering stock management




**Source**: Parasuraman et al., 1985, based on own editing

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Based on the research steps and results presented, it can be concluded that market-leading companies do not always pay sufficient attention to and use proper methods for their inventory management system. This means that a company is underperforming its potential because it is not accounting for the resources invested in inventory, and thus the quality and competitiveness of its service are not fully exploited.

In conclusion, both theoretical frameworks and empirical results indicate that the company's current XYZ classification method is overly permissive, leading to excessive inventory levels for certain products and shortages for others. Adjusting category limits and adopting more accurate demand-based classification, complemented by closer supplier cooperation (e.g., VMI for high-value products), can optimize stock levels, reduce tied-up capital, and improve service levels.

Overall, this research provides companies with actionable insights into inventory optimization, enabling more precise stock classification, reduced tied-up capital, and improved service levels, ultimately enhancing operational efficiency and competitiveness in the market. The research could be further developed by collecting more detailed product and demand data, testing the implementation of Vendor Managed Inventory (VMI) for high-value items, improving demand forecasting methods, and analyzing the impact of these changes on inventory levels, service quality, and operational efficiency.

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