



# COSTS OF INVENTORIES AS A COMPONENT OF LOGISTICS COST OF COMPANIES IN THE LOWER SILESIA REGION

Michał Biernacki

Wrocław University of Economics,  
Wrocław, Poland

---

**Abstract:**

Logistics costs are directly related to the implementation of logistics processes such as purchasing, transport, storage, sales/costs of goods, and maintaining the necessary standards for handling the market. The paper presents empirical findings gathered from the survey of production companies operating in the Lower Silesia region in Poland. The survey was designed to examine the cost of inventories separately from other cost elements, as an important determinant in the process of cost management within entities. The research methodology was supplemented by numerous literature sources, survey analysis, and deduction/induction methods.

---

**Keywords:**

costs, costs of inventories, logistics cost.

---

## INTRODUCTION

The complexity of logistics processes affecting the operation of an entity results in certain costs of logistics. This exerts a significant influence on the economics and contributes to a decreased profit of the entire enterprise.

The costs of logistics, in the strict sense, are directly related to implementing specific logistics processes, such as material purchasing, transportation, storage, sales of finished goods, as well as ensuring the necessary customer service standards and maintaining a proper market position of an enterprise. Extraordinary costs are related to improper standards and quality of both materials and products, which translates into losses, discounts, rebates. The costs or lost profits, in turn, are related primarily to a shortage of the appropriate inventories for which there is market or production demand, as well as customer service that is incompliant with the agreement and deterioration of the entity's market position (Skowronek, 1995, pp. 230-231).

O. Duck, H. Krause and, C. Schulte, in turn, distinguish three significant types of costs which have a major effect on enterprise performance, namely:

- ◆ material costs – all costs incurred in connection with supply with raw materials, ancillary materials, fuels, semi-finished products, finished products, and goods;
- ◆ annuity capitalisation costs – interest on inventory-related capital and stored items revaluation write-offs, and storage costs;
- ◆ material overheads – costs of all departments of materials management, i.e. logistics and procurement, costs of means of transport, costs of packaging, costs of electronic data processing, and costs of waste disposal (Duck, 1997-2001, p. 1).

Correspondence:  
Michał Biernacki

e-mail:  
michal.biernacki@ue.wroc.pl



The logistics costs can be also divided in terms of their complexity into:

- ◆ transportation costs of deliveries to the warehouse of the enterprise and the customer;
- ◆ costs of warehouse maintenance and warehouse management departments;
- ◆ costs of the flow of the data regarding materials and products, transportation, and control;
- ◆ costs of availability of products, transportation and operational capabilities;
- ◆ costs of capital freezing in fixed and current assets (Twaróg, 2003, p.53).

The practical nature of logistics costs needs to allow for the achievement of a specific goal. From this point of view, the structural breakdowns of logistics costs by logistic sphases, logistics processes, use of production factors, including distinction of costs of inventory, are of the greatest practical significance.

## SPECIFICITY OF COSTS OF INVENTORIES

Inventory management is highly significant for every entity, which makes costs of inventory its indispensable and important element. These result mainly from the fact that they are a major component of total logistics costs. At the same time, what depends on the level of the inventories carried by an entity is the level of service which the enterprise can provide to its customers. Cost trade-offs regulations inside and outside the logistics system are ultimately reflected in the inventory carrying costs (Kempy, 2001).

The essence and scope of costs of inventories are three types of costs, namely:

- ◆ **inventory replenishment costs;**
- ◆ **inventory carrying costs;**
- ◆ **inventory depletion costs** (Skowronek, 1995, p. 249).

The items of the **inventory replenishment costs** include in particular

- ◆ costs of physical inventory replenishment;
- ◆ costs of the information processes related to material purchasing;
- ◆ costs of collecting supply inventories;
- ◆ costs of collecting production inventories;
- ◆ costs of collecting distribution inventories;
- ◆ costs of collecting waste inventories (Ficoń, 2001, p. 379).

At the same time, it needs to be indicated that the following costs are distinguished as part of information costs of inventory replenishment:

- ◆ costs of selecting the supplier;
- ◆ costs of preparing orders;
- ◆ costs of conducting negotiations;

- ◆ costs of opening an order;
- ◆ costs of preparing an order (Ficoń, 2001, p. 380).

**Inventory carrying costs**, also called costs of inventories in the strict sense, are the fundamental cost category in the inventory costs structure, and are divided into the costs of inventory storage, frozen capital, and inventory ageing. The first of the enumerated cost types is a “binder” between warehouse management and warehouse process technology, where two basic phases are distinguished: the static storage phase and the dynamic handling phase. The following relevant costs are assigned to these phases:

- ◆ costs of physical inventory storage
- ◆ costs of inventory handling (Ficoń, 2001, p. 381).

Apart from that, the costs of warehouse cubage occupation, the costs of complying with warehousing requirements, the costs of inventory security and safety, and the costs of maintenance works are also distinguished here.

According to D.M. Lambert, there are four types of inventory carrying costs, namely (Lambert, 1993, pp. 113-116):

- ◆ capital costs – the costs of interest rate or the cost of lost opportunity determine how much it costs the entity to freeze its capital in inventories and what the hidden value of the capital frozen in the inventories is. It is a variable cost. It is expressed by a product of the value of inventories and the average interest rate:

$$KF=MZ * S \quad (1)$$

where

KF – the cost of capital commitment;  
 MZ – the average inventory level in a given period,  
 S – the average interest rate.

- ◆ storage costs – warehousing costs, warehouse maintenance costs include administration costs related to handling products “to” and “from” the inventory, and storage costs (rent, heating, lighting). Broken down into types, they are divided into:

- depreciation of property, plant and equipment committed in warehouses;
- consumption of the materials, fuels and energy serving the warehousing function;
- remuneration for warehouse workers, including mark-ups;
- third-party services;
- other costs, such as property and vehicle taxes.

They are calculated based on the following formula:

$$KM=MZ * SM \quad (2)$$

where

KM – total warehousing costs;  
 MZ – average inventory level in a given period,  
 SM – empirically determined indicator of warehousing costs in % of the inventory value.



- ♦ inventory management costs – they include costs involved in insuring inventories against consequences of fire, flood, theft and other acts of God, and taxes on the value of the carried inventories;
- ♦ risk costs – they are an effect of the lost value of inventories for reasons beyond the entity's control.

They are divided into two basic groups:

- the costs of physical ageing of inventories;
- the costs of economic (moral) ageing of inventories (Lambert, 1993, pp. 113-116).

The last of the major types of costs of inventories (**inventory depletion [shortage] costs**) expresses the loss of profit which has been or could be incurred by a given entity as a result of shortage of inventories at the moment when a customer wants to purchase them. At the same time, a shortage of material inventories in a production enterprise might cause disturbances in the production process, which could translate into imbalanced production and additional costs. Enterprises can minimise the costs of inventory depletion through streamlined logistics process management. This can take place by combining forecasts of demand for products and goods with demand for raw materials and materials in the whole entity.

It also needs to be noted here that, apart from the three major types of purchasing costs, there are other, related costs, namely:

- ♦ costs of deliveries – they are involved in obtaining products by entities in order to replenish inventories. They include costs of ordering products from external entities or costs of change-over in order to manufacture a given inventory;
- ♦ costs of lost sales – the so-called unrealised gain on both current sales and the ones which will not be finalised in the future. The volume of the revenue not generated from current sales is assessed based on the number of withdrawn orders;
- ♦ costs of late deliveries – they involve additional costs incurred by an enterprise when processing back orders. They are composed of additional office costs, sales costs, transportation costs, transshipment costs;
- ♦ costs of carrying inventories in transit – they are rare. Found mainly in distribution activity and delivery of products to customers by one's own means of transport. They can comprise e.g. additional costs of transshipment, hotel costs (Ficoń, 2001, p. 393).

When considering costs of inventories, the so-called **cost trade-off** cannot be ignored. It is the so-called separate mortgage account, which presents correlations between costs of inventories and includes:

- ♦ calculation of variable capital costs in accordance with estimates for various levels of interest rates;
- ♦ variable costs of storage;
- ♦ variable costs of management and risk;

- ♦ variable costs of deliveries;
- ♦ costs of lost current sales and, if need be, estimates of sales losses in the future;
- ♦ costs of processing back orders;
- ♦ calculation of the costs of carrying inventories in transit (Twaróg, 2003, p. 72).

At the same time, it is suggested that the calculation be supplemented with inventory models analysis and trade-offs analysis, considering the following alternative cost groups:

- ♦ costs of carrying inventories and costs of ordering (changing over);
- ♦ costs of carrying safety inventories and costs of inventory shortage;
- ♦ costs of carrying inventories and costs of ordering versus costs of inventory depletion;
- ♦ costs of carrying inventories in transit and costs of transportation to the customer (Twaróg, 2003, p. 72).

What also plays a crucial role in inventory management are the so-called costs of **replenishing and carrying amoving inventory**. The classical optimisation is provided by Krzyżaniak (Krzyżaniak, 2002, p. 160). It relies on the function of total costs involved in replenishing and carrying inventories and inventory shortages. It is expressed using the following formula:

$$KZC = SKUzZR + ZKUzZR + SKUtZR + ZKUtZR + SKUtZB + ZKUtZB + SKBZ + ZKBZ \quad (3)$$

where:

- SKUzZR – fixed cost of replenishing a moving inventory;
- ZKUzZR – variable costs of replenishing a moving inventory;
- SKUtZR – fixed cost of carrying a moving inventory;
- ZKUtZR – variable cost of carrying a moving inventory;
- SKUtZB – fixed cost of carrying a safety inventory;
- ZKUtZB – variable cost of carrying a safety inventory;
- SKBZ – fixed cost of inventory shortage;
- ZKBZ – variable cost of inventory shortage.

## RESEARCH FINDINGS

The research was conducted in June and August, 2017, by means of online surveys collected from the representatives of manufacturing companies in the SME (small and medium-sized enterprise) segment, operating in the Lower Silesia region in Poland. A total of 89 surveys were dispatched, out of which 46 received a response. The survey comprised the following questions:

1. Does your company distinguish costs of inventories?
2. If not, are there any plans for introducing such an approach within the coming 12 months?
3. If so, do you distinguish the inventory replenishment costs, inventory carrying costs, inventory depletion costs?

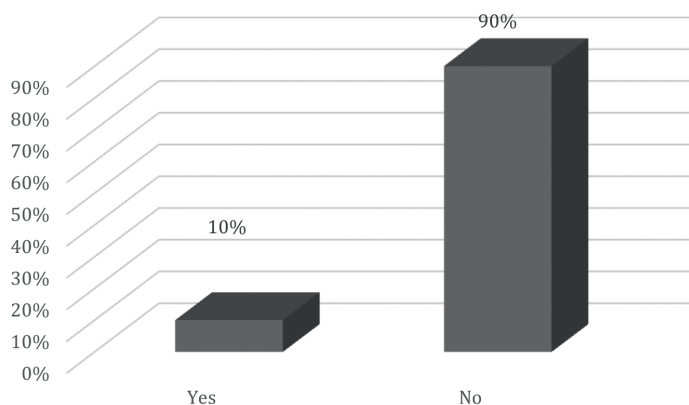


4. Do you apply inventory management methods?
5. Can distinguishing costs of inventories have a positive influence on operations management in the company?
6. Can distinguishing costs of inventories have a positive influence on the cost management procedures in the company?

The received results demonstrate that 10% of the companies distinguish costs of inventories in their records systems (Fig. 1). Out of the remaining companies, 20% plan to

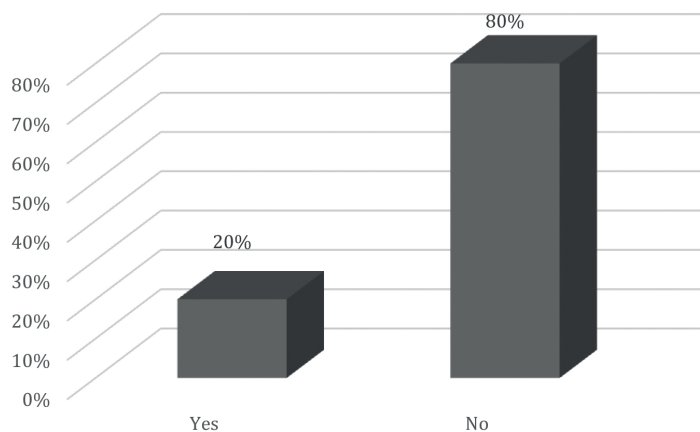
introduce such a system (Fig. 2). From among the enterprises which distinguish costs of inventories, only 20% distinguish inventory replenishment costs, inventory carrying costs, inventory depletion costs (Fig. 3). Other companies distinguish costs of inventories based on their own criteria (Fig. 4). The last two questions addressed the assessment of distinguishing purchasing costs. 70% of the enterprises admitted that this could have a positive effect on operations management, and only 50% were inclined to support the thesis that this will streamline cost management (Fig. 5, Fig. 6).

Figure 1. Company distinguish costs of inventories



Source: Author's research based on the survey results.

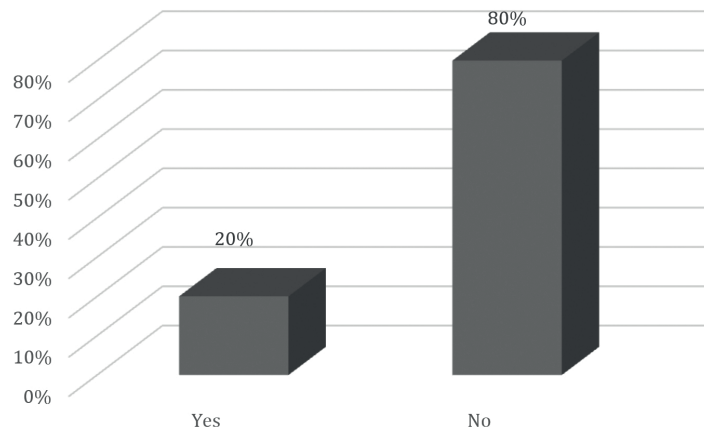
Figure 2. Plans for introducing costs of inventories within the coming 12 months



Source: Author's research based on the survey results

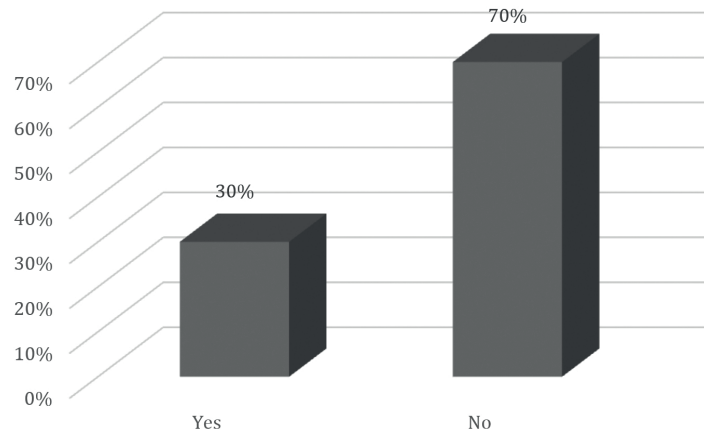


Figure 3. Distinguishing the inventory replenishment costs, inventory carrying costs, inventory depletion costs



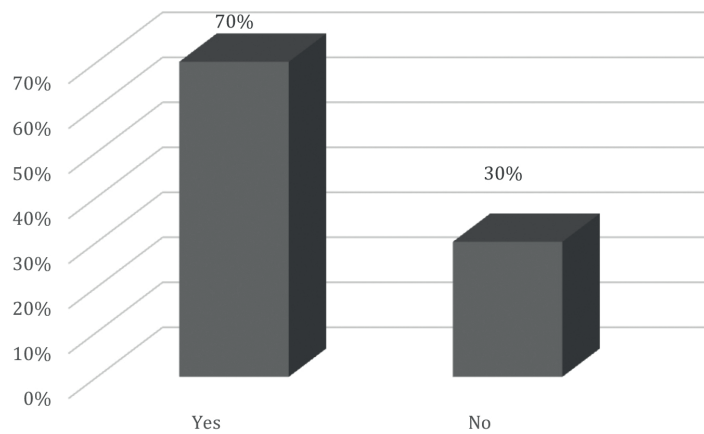
Source: Author's research based on the survey results

Figure 4. Applying inventory management methods



Source: Author's research based on the survey results

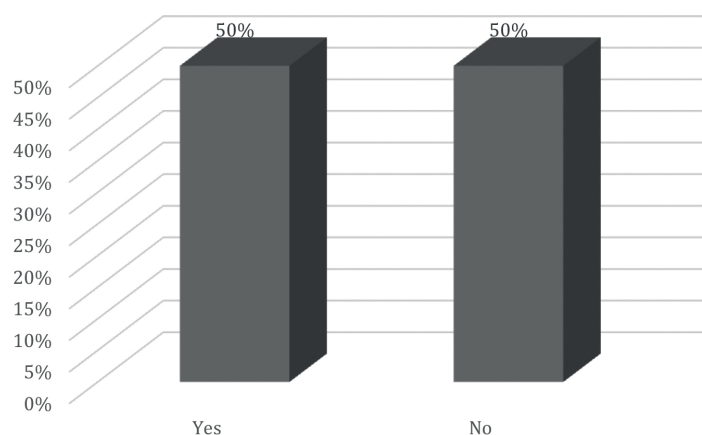
Figure 5. Distinguishing costs of inventories have a positive influence on operations management in the company



Source: Author's research based on the survey results



Figure 6. Distinguishing costs of inventories have a positive influence on cost management procedures in the company



Source: Author's research based on the survey results

## SUMMARY

In summary, it needs to be remembered that as regards inventory management, the decisions made are conditioned on the cost level and the required service level. The material purchasing profitability analysis can be carried out also with the ABC method. The level of inventories should be minimised where the highest purchasing costs generate the costs of warehousing and inventory and maximised where the most important item in the activity based costing is the costs of purchasing and transportation. Reasonable management of the material flow system requires that the costs accompanying the flow be monitored in the enterprise. As can be seen from the survey questionnaires, entrepreneurs are hardly aware of this state of affairs and despite their declarations on the implementation of inventory management and distinction of costs of inventories, one needs to be sceptical about that. Introduction of a broad educational action should improve the state of knowledge of the benefits of distinguishing, analysing and managing costs of inventories.

## LITERATURE

- DuckO., Krause H., Schulte C. (1997-2001) *Gospodarka materiałowa. Praktyczny poradnik, rozdział 7.2 Koszty logistyki*, Warszawa: Wyd. ALFA - WEKA Sp. z o.o.
- Ficon, K. (2001). *Procesy logistyczne w przedsiębiorstwie*. Gdynia: Wyd. Impuls Plus Consulting.
- Kempny D. (2001), *Logistyczna obsługa klienta*, Warszawa: PWE
- Krzyżaniak, S. (2002). *Podstawy zarządzania zapasami w przykładach*. Poznań: ILiM.
- Lambert, M.D., & Stock J.R. (1993). *Strategie Logistic Management*. Boston: R.D. Irwin Inc.
- Skowronek Cz., Sarjusz -Wolski Z. (1995) *Logistyka w przedsiębiorstwie*, Warszawa: PWE
- Twaróg, J. (2003). *Koszty logistyki przedsiębiorstw*. Poznań: Biblioteka logistyka.