

COST MANAGEMENT IN LOGISTICS OF WAREHOUSING: THE USE OF ACTIVITY-BASED COSTING IN THE LOGISTICS SERVICE PROVIDER

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Abstract: The activity-based costing method is considered as a universal management tool that applies to flow mapping and cost behavior. The basic idea of activity-based costing is to find the true causal link between cost and performance and to display these facts in the calculation system so that the outputs are as close as possible to the reality. This method defines the structure of business processes and activities. Activity-based costing primarily focuses on improving the assignment of overhead costs, which are often allocated on a direct cost basis or direct worked hours. This method was imported to address the problems encountered by logistics service providers. The aim of this article is to use activity-based costing as a management method in a logistics service provider with regard to the cost management. The article is based on research of the world literature especially Web of Science database and Scopus database, in-depth interviews with managers that is the method of the qualitative research and an analysis of internal data of the logistics service provider. The basic advantages of qualitative research are the detailed description and insight into the study of the issue, in addition it responds well to local situations and conditions and can search for local causal connections. The article shows the possibility of using activity-based costing to better calculate the logistics costs of warehousing in a selected logistics service provider.

Keywords: activity-based costing, logistics costs, logistics service provider, cost calculation, warehousing

1. Introduction

The logistics services which are provided must be a source of value not only for the final customer but for all interested stakeholders. A prerequisite for evaluating the effectiveness of all activities is cost monitoring across the entire supply system, including logistics service providers.

Definition of company processes whose costs will be included in total logistics costs, including their allocation to cost objects (orders, services, departments, processes, etc.). It is a basic step in monitoring and evaluating logistics costs to support decision-making tasks (Kučera, Hyršlová and Sommerauerová 2017).

As stated by Richards and Grinsted (2013 and 2016) warehousing, as an integral part of the logistics system, dynamic and interactive activity is geared to the level needed to meet demand. When delivering logistics services, it is important to make efficient use of both time and warehouse or local space. According to Accorsi, Manzini and Bortolini (2012) and Accorsi, Manzini and Maranesi (2014), emphasis should be placed on planning all warehouse activities, including receipt, warehousing, assembly, kitting, picking and ordering from customers. Warehouses make it possible to unify, distribute bulk goods, transfer and collate cross-docks and provide value-added services.

The concept of logistics costs is defined by many authors. According to Straka and Malindžák (2005), logistics costs are expressed as the sum of all costs associated with the implementation of logistics processes. These costs are associated with the realization of material flows, mostly costs related to transportation, warehousing, financial reinsurance, insurance and information flows. According to Bazaly et al. (2006), logistics costs can be understood as the sum of all the costs associated with organizing, controlling and implementing the logistics process itself, within all the articles in the supply chain. Pražská and Jindra (2002) divide logistics costs into the same groups as Schulte (1994); these authors agree on the definition of logistics costs: supply costs, warehousing costs, transport costs and handling costs. Kučera (2017) argues that logistics managers are usually interested in providing high quality services to their customers at minimum cost.

2. Literature Review and Methodology

Activity-based costing provides a new approach to tracking and assigning costs. Unlike traditional calculation methods, it does not use the cost allocation of a costing unit (such as a product) through cost centres, but through activities that are necessary for the creation of performance. The reasons for this shift in cost allocation can be found in changes (high diversification of product portfolios, service differentiation, short product life cycles, growing customer demands for product diversity and quality, growth of suppliers and customers) that accompany business activity (Bokor and Markovits-Somogyi 2015; Hansen and Mowen 2007). Traditional calculations cease to provide relevant driving information in these unstable conditions. They provide an answer to the question as to what costs have been incurred and how they have been allocated to in-house centres, or how each product or product group is involved in the costs, but does not answer the question as to why these costs have arisen (Wang 2017). The activity-based costing calculation returns to the cause-effect relationship. It abandons the traditional assumption that the causal cost is mainly volume (for example: time consumption, material value) (Gros and Grosová 2012; Stevenson and Cabell 2002).

The basic purpose of the activity-based costing calculation is therefore to accurately express the relationship of costs to the cause of their occurrence, especially when the increase in costs is not due to an increase in the volume of the final outputs. From a methodological point of view, it is basically a full cost calculation (absorption method) that can be

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combined with a non-absorbent method (Mocanu 2008). Narsaiah and Chary (2017) claim that activity-based costing has become a tool in the hands of logistics service provider to surmount the problems with regard to cost management. In terms of origin, the activity-based costing is linked to the 1980s with the names of Kaplan, Cooper and Johnson. At this time in the USA, the first articles are published (dealing with the originators of the emergence of overheads and the deficiencies of traditional costing procedures in the scheduling of these overheads). At the same time, the first concepts of the activity-based costing method were presented as methods for assigning overhead costs as well as for measuring and evaluating costs and process performance (Cooper and Kaplan 1987; Cooper and Kaplan 1992; Kaplan and Cooper 1998).

Bokor and Markovits-Somogyi (2015) present that, given the general characteristics and the current adaptation of the activity-based costing method, the costs of certain logistics services consist of four parts (see Figure 1):

- direct costs derived from the accounting system,
- variable indirect costs from primary activities, the allocation is based on performance,
- fixed indirect costs arising from primary activities, the allocation is based on time consuming,
- indirect costs from secondary activities, the allocation is time-based.

Time consuming is the total duration of logistics services (transport, warehousing and sometimes other activities).

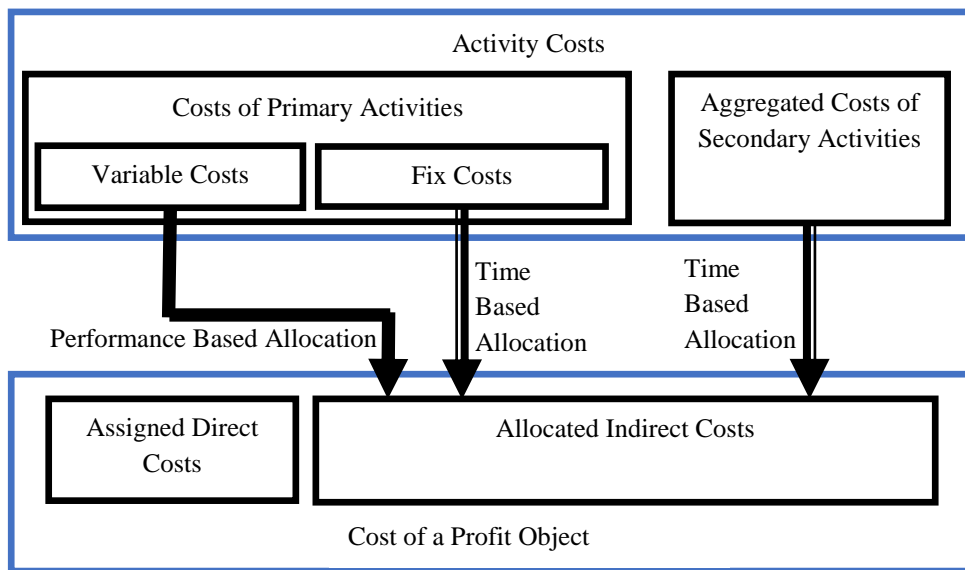


Fig. 1.

Activity-based costing model

Source: Bokor and Markovits-Somogyi (2015)

Primary activities are indexed as $i = 1 \dots n$, while profit objects, i.e. logistics services, are indexed as $j = 1 \dots m$. The formula (1), which consists of four components, is used to calculate costs.

$$C_j = C_j^d + \sum_{i=1}^n C_{v_i} \frac{P_{ji}}{P_i} + \frac{T_j}{\sum_{j=1}^m T_j} \sum_{i=1}^n C_{f_i} + \frac{T_j}{\sum_{j=1}^m T_j} C^{sa} \quad [CZK] \quad (1)$$

Where:

- C_j Cost of profit object j [CZK]
- C_j^d Direct cost of profit object j [CZK]
- C_{v_i} Variable cost of primary activity i [CZK]
- P_i Performance of primary activity i [differently expressed power units]
- P_{ji} Performance consumption of profit object j at primary activity i [differently expressed power units]
- T_j Time consumption of profit object j [hours]
- C_{f_i} Fix cost of primary activity i [CZK]
- C^{sa} Aggregated costs of secondary activities [CZK]

The four components can be merged into three components:

- assigned direct cost,
- allocated variable indirect cost, allocation is based on relative performance consumptions,
- allocated fix indirect cost, allocation is based on the relative time consumption:

$$C_j = C_j^d + \sum_{i=1}^n C_{vi} \frac{P_{ji}}{P_i} + \frac{T_j}{\sum_{j=1}^m T_j} \left(\sum_{i=1}^n C_{fi} + C^{sa} \right) \text{ [CZK]} \quad (2)$$

The cost efficiency, i.e. the average cost of a primary activity (as service generator) can be calculated as follows:

$$c_i = \frac{C_i}{P_i} = \frac{C_{vi} + C_{fi}}{P_i} \text{ [CZK/differently expressed power units]} \quad (3)$$

Where:

C_i Cost of primary activity i [CZK]

Hansen and Mowen (2007), Mocanu (2008) Langfield-Smith et al. (2015) and Watanapa, Pholwatchana and Wiyaratn (2016) emphasize that the activity-based costing method helps businesses to improve cost management through two views, namely cost and management view (process view).

Table 1

Main warehouse activities and cost drivers

Activities	Cost Drivers
Order receipt	Order volume and order source (electronic data interchange, fax, phone, internet, or post)
Unload incoming goods	Quantity and packaging (pallets or cartons)
Palletize	Quantity of cartons
Check incoming goods	Quantity and quality of supplier (including returns)
Put away incoming goods	Quantity and number of returns
Picking	Number of visits to pick location and percentage of back orders

Source: Griful-Miquela (2001)

Griful-Miquela (2001) stated in his article that the cost structure of logistics service providers to third parties was analysed with particular regard to warehousing. Activity-based costing has been shown to be a useful tool for assessing the operating costs of logistics service providers. Main warehouse activities and cost drivers are shown in Table 1.

3. Results and Discussion

The aim of this article is to use activity-based costing as a management method in a logistics service provider with regard to the cost management. The basic advantages of qualitative research are the detailed description and insight into the study of the issue, in addition it responds well to local situations and conditions and can search for local causal connections. The use of an activity-based costing method will be presented on a real case study based on the processes used in the decision-making process of a particular company.

The chosen logistics provider ensures transport services for many customers. In addition to transport, it also provides other logistics services. Such as activities related to warehousing, receipt of goods including their inspection, warehousing according to customer-required systems, or delivery of material and its transportation directly to the customer's production lines.

In recent years, logistics service provider (LSP) has been using a new approach to logistics warehousing cost calculations in connection with increased competition in the provision of logistics services. From the entire calculation system, it uses only preliminary calculations and, within the framework of the calculations, serves to support pricing decisions (for price negotiations, for price advocacy, for deciding whether LSP is interested in accepting the order, whether due to limited warehousing capacities for LSP interesting). The calculations always reflect customer requirements (the specific type and scope of service provided). There is a single cost structure in the calculation of the cost of warehousing (see Table 2). The calculation unit is always one product that customer requires to warehouse. Calculation costs are structured to accommodate all customer requirements for the service provided.

The calculation includes the items: personal costs, handling equipment, transportation costs, facilities costs, information technology costs, other costs, operating costs and eventually overtime costs.

The LSP has monthly personal costs calculated per worker in a particular job position. In addition to wage costs, welfare costs, statutory insurance and liability insurance, costs include protective equipment, training, contributions to cultural and sporting events, and other company benefits.

Assignment of costs to handling equipment is based on customer requirements for product warehousing and necessary handling equipment that need to be handled with the product. The allocation of transportation costs to order is based on the fact that the LSP has the cost per km and the number of kilometres travelled by the various means of transport per month assigned transportation costs. The allocation of facilities costs is based on a cost per square meter and adequate warehouse equipment. Costs associated with information technology (IT) are focused on printing labels, printer traffic, cartridge costs, costs of IT connection, costs of maintaining IT and costs of communication.

Other costs consist of 100% external warehouse maintenance and the other costs include unexpected costs, which may be costs associated with the delay of the start of production or with the unexpected situations that may arise.

Assignment of costs to operating is based on floor tape labelling in warehouse, operation margin in 1% and corporate margin in the height of 10% and the last item is insurance (liability).

Table 2

Logistics cost calculation of warehousing and other logistics services

Volume of the Product			Price Unit	Price All	
120000 / Year	#		Price Unit	Price All	
	Unit #	Unit €	Price/Month	Price/Year	per Product
PERSONAL COST					
Sequencing operators	1	6,50 €	3 978 €	47 736 €	0,398 €
Forklift truck drivers	1	7,20 €	4 406 €	52 877 €	0,441 €
Warehousing operators	1	6,10 €	3 733 €	44 798 €	0,373 €
Team leader - Resident	1	9,00 €	1 377 €	16 524 €	0,138 €
Social resources, Food vouchers	1	100,00 €	100 €	1 200 €	0,010 €
TOTAL PERSONAL COST			13 595 €	163 135 €	1,3595 €
HANDLING EQUIPMENT					
Forklift - Bidder - Extern, Rent/Month all include	1	820,00 €	820 €	9 840 €	0,082 €
Others Movement Equipment	1	300,00 €	300 €	3 600 €	0,030 €
Maintenance - Equipment	70%	1120,00 €	784,00 €	9 408,00 €	0,078 €
TOTAL HANDLING EQUIPMENT			1 904 €	22 848 €	0,1904 €
TRANSPORTATION					
Stuttle Extern Warehousing - (one day)	1	55,00 €	1 650 €	17 325 €	0,144 €
Truck drivers	1	8,00 €	4 896 €	58 752 €	0,490 €
Maintenance - Transport - Truck	8%	55,00 €	4,40 €	52,80 €	0,000 €
TOTAL TRANSPORTATION			6 550 €	76 130 €	0,6344 €
FACILITIES					
FG - Sequence Warehousing m2 - extern	2050 m2	2,70 €	5 535 €	66 420 €	0,554 €
FG - Sequence Area m2 - preparation	180 m2		486 €	5 832 €	0,049 €
FG - Empty	450 m2		1 215 €	14 580 €	0,122 €
FG - Full	250 m2		675 €	8 100 €	0,068 €
OFF m2	120 m2	3,70 €	444 €	5 328 €	0,044 €
Building maintenance	-	40,00 €	40 €	480 €	0,004 €
Facilities cleaning	-	850,00 €	850 €	10 200 €	0,085 €
TOTAL FACILITIES			9 245 €	110 940 €	0,9245 €
INFORMATION TECHNOLOGY (IT)					
IT - Labels - container 1x	1	295,00 €	295 €	3 540 €	0,030 €
IT - Labels small - Tanks 1x	1	185,00 €	185 €	2 220 €	0,019 €
Printer Zebra 2x	2	255,00 €	510 €	6 120 €	0,051 €
Cartridge	1	105,00 €	105 €	1 260 €	0,011 €
Print out	1	120,00 €	120 €	1 440 €	0,012 €
Communication equipment - Mobile telephone	2	39,00 €	78 €	936 €	0,008 €
IT - Connection	1	711,00 €	711 €	8 532 €	0,071 €
Maintenance - IT	100%	294,00 €	294,000 €	3 528,000 €	0,029 €
TOTAL INFORMATION TECHNOLOGY			2 298 €	27 576 €	0,2298 €
OTHERS					
Maintenance - External warehouse	100%	95,00 €	95,00 €	1 140,00 €	0,010 €
Unexpectedly cost	1	500,00 €	500 €	6 000 €	0,050 €
TOTAL OTHERS			595 €	7 140 €	0,0595 €
OPERATING COST					
Rack Labelling, Floor Layout - floor tape, labelling	-	500,00 €	0 €	0 €	0,000 €
Operational margin in %	1%	100,00 €	1,00 €	12,00 €	0,000 €
Corporate margin in %	10%	100,00 €	10,00 €	120,00 €	0,001 €
Insurance/liability	1	225,00 €	225 €	2 700 €	0,023 €
TOTAL OPERATING COST			236 €	2 832 €	0,0236 €
OVERTIME COST					
Overtime - daily	1	9,50 €	10 €	114 €	0,001 €
Overtime - afternoon	1	11,00 €	11 €	132 €	0,001 €
Overtime - night	1	12,00 €	12 €	144 €	0,001 €
Overtime - holiday	1	13,00 €	13 €	156 €	0,001 €
TOTAL COSTS			34 423,0 €	410 601,0 €	3,422 €

Source: author

4. Conclusion

The chain of logistics activities ensures the smooth running of the production process and logistics costs are associated with each logistics activity. These costs are not negligible items that affect to a large extent the overall profit or loss of an enterprise. The need to monitor costs in terms of logistics activities is a prerequisite for identifying rationalization measures in logistics activities and optimizing the logistics costs of an enterprise.

In order to ensure the synchronization of the individual logistics processes, the availability of the information needed for the individual managerial levels, the assessment of the work of the employees, feedback from the customers and the flexible operation in the event of deviations from the financial plan, in today's competitive environment, provided the required information to the users, i.e. the management of the company. This article showed the possibility of using activity-based costing as the case study in the selected logistics service provider with regard to the warehousing.

Acknowledgements

The work was created in connection with the scientific research project of the University of Pardubice no. SGS_2018_023. The author is grateful for their support.

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