

# COST MANAGEMENT IN LOGISTICS

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## ABSTRACT

This paper aims at providing a better understanding of the concept of logistics cost in manufacturing. One of the reasons for choosing this topic was that very little research has been published on this subject. Improved information on the costs of logistics and SCM activities may assist the managers to make better decisions. For example, a realistic view on inventory holding cost may prevent over-optimistic offshoring decisions. The specific features of the concept of logistics cost in a management accounting context in a manufacturing setting and the factors contribute to how logistics cost management is organized in firms are known.

Keywords: cost holding, logistics, SCM.

## INTRODUCTION

The relevance of logistics costing and cost information:

Due to the holistic nature of logistics and supply chain management (SCM) the data of its cost are typically fragmented to various places in the organization. In the mid-1980's there were concerns that in senior management distribution is considered solely as a necessary cost and service, and its profit enhancement potential is ignored. Distribution managers were seen generally unaware of the value of financial information for improving distribution performance, and also financial and accounting resources in companies were stated not to have kept pace with the developments in distribution. (Tyndall & Busher 1985.) Even in 2013 similar issues prevail: The Finnish Association of Purchasing and Logistics Professionals (LOGY) expressed concerns that SCM professionals are lacking in the ability to demonstrate how supply chain management affects the bottom line. Consequently perhaps, the top management tends to perceive supply chain management as operational activities with little relevance to organizational strategy.

Although the labor and wage costs of the logistics costs cover the largest part of administrative costs, a more detailed itemization of to which all activities those resources are spend might evoke interest in the re-design of activities in order to streamline the processes by removing redundancies and unnecessary tasks or replacing the tasks in the supply chain. Furthermore, deficient information of the logistics and supply chain management costs hinders the negotiation and cooperation between supply chain partners. Supply chain management literature related to logistics costing and cost controlling since 1980's has concentrated predominantly on suitability and use of individual management accounting techniques such as activity-based costing, target costing, total cost of ownership or balanced scorecard in a supply chain management context, or discusses performance measurement in general, with strong emphasis on non-financial performance measurement.

## STRUCTURE

Costing systems may exist in organizations for several purposes: for external costing, to motivate and to evaluate employees, and to provide information for decision making. The *main* purpose of a costing system is to provide information for daily management of the operations as well as strategic decision-making, although other uses are briefly presented. The discussion on logistics cost management and the problems related to it takes place from the perspective of a manufacturing firm unless otherwise stated.

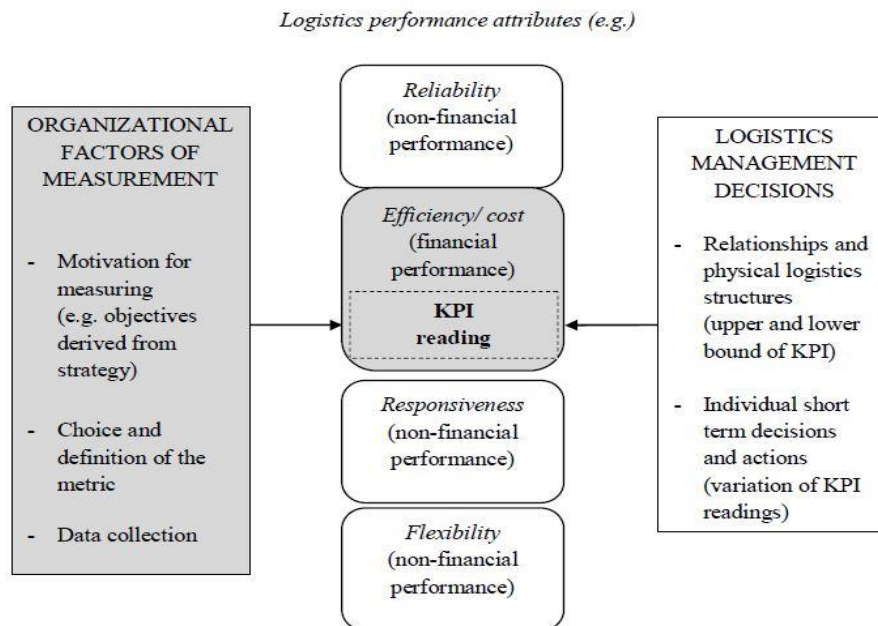


Figure 1 Focal areas of interest of the thesis indicated as shaded fields

## DEFINING THE SCOPE OF LOGISTICS

One of the general problems of costing is the scope, i.e. deciding which costs relate to specific cost object and should thus be included in the calculation (Kulmala et al. 2002; Kulmala 2003). In the context of supply chain management this means defining which activities are at the responsibility of logistics and which are the activities of purchasing, production or marketing, whether there are measurements at the supply chain level connecting these, and where to draw the boundaries of the supply chain to be measured. The definition of logistics costs in a firm is based on how the logistics activities and outputs are defined. A factor complicating the definition of logistics output is the shared use of resources such as personnel or buildings with other company functions. Defining the logistics outputs is necessary for building cost standards for ongoing costing, and might require some simplification in order not to make costing system unnecessary complicated. For large scale decisions which are made only occasionally, more specific analyses are needed in addition. Setting standards for logistics activities has been considered more difficult than for manufacturing because – depending on the production process – more activities may exist than in production, and output measures vary more than in production (Lambert & Armitage 1979).

## PERCEPTION OF LOGISTICS

It has been suggested that the performance measurement and collection of performance information of logistics is related to how logistics or supply chain management is perceived in companies (Weber 2002; Cavinato 1992); ranging from a basic function conducted in lower organizational levels to a business strategy fulfilling orientation inherent in every-day business and strategic decision making at the senior management level. Also the firm's definition of the scope of logistics activities can be considered stemming from what is the general perception of logistics in a company.

In different stages of development from a functional collection of activities to an area of strategic management there are different expectations for supply chain or purchasing management, and consequently also different performance information needs. At the first stage, **basic financial planning** focus is on functional operation of logistics, and formal planning concentrates in budgeting by cost centers. Overriding objective is to meet the budgeted goals and the concept of cost is the lowest price, rate or cost for a given item or service. The notion of supply chain is internal and unidirectional; from materials management to outbound transportation. In the second stage, **forecast-based planning**, logistics department is perceived as the distributor, and the main goal is system efficiency, where the role of logistics is to keep organizational costs in line. Forecasts are based in historical data, but may not be updated as situations change. Cost focus is on the lowest landed cost to the firm or to the next customer.

The third stage, **externally oriented planning**, seeks lowest total cost for the part of the whole of the supply chain that the firm controls by continuous improvement and cost minimization; the focus is on total product cost. There is a shift from orientation from being merely efficient to being competitive. Supply chain management provides all inbound and outbound flow functions, and is involved in procuring from third parties and creating inter-firm relationships. In the fourth stage, **strategic management**, supply chain management provides a tailored system for each line of business, and the perspective shifts from outsourced relationships to that of network orchestration. Synergies are sought across lines of businesses for logistics costs and services. The focus is on adding customer value with the lowest total cost to the entire supply chain.

The final, fifth stage is **knowledge-based management**, and there supply chain strategy is coordinated with the firm as a whole as well as with each product line. Supply chain management is inherent in all types of business decisions. Speed of operations as well as time of new products to market is essential, cost is only one element of performance, and supply chain management is expected to anticipate the needs of the customers and to develop packages of services for them.

## PRODUCT AND PRODUCTION

Product and production process related factors also contribute to the logistics costing. The size and weight of the product affect the relative importance of logistics costs in the total product cost. For a manufacturer of heavy machinery, for example, who uses great amounts of plate steel as well as castings and forgings, which are costly to transport, receive and handle, logistics costs are a major expense (Jones 1991). Oversimplification of a costing system in this area would greatly distort logistics costs. Company thus has used a variation of an activity-based cost system, with specific cost pools for logistics. There are two cost pools for the cost of activities on shipping docks, in the receiving areas and in the storage areas for the heavy material groups, and, similarly, two cost pools for the intra-plant handling of materials as it moves through the production process.

The *nature of the production process* has long been recognized to determine the amount of direct cost that can be traced to the products, as opposite to allocating them on some criteria: the level of accuracy that can be attained in a job-shop environment with somewhat simple system is not possible in process production, where a larger part of production costs are incurred jointly by a range of final products and need to be allocated with some criteria if full costing is used.

## INFORMATION SYSTEMS

On one hand, the changes in information technology taking place in the 1980s and 1990s (e.g. personal computers and spreadsheets) have allowed the data modelling and analysis be dispersed across the organization, but on the other hand, the enterprise resource planning systems (ERP) have integrated the production and management control, making bill of materials a central lever for the control of the firm. (Granlund & Mouritsen 2003). Information systems available in a firm also influence the reliability and usefulness of the costing system. The likelihood of errors is decreased as the data is situated in one database that can be accessed by multiple users, and integrated information systems with several analysis and reporting options may remove the management accountant as the middle man and increase the speed to obtain necessary cost and information.

Most cost accounting, management accounting and cost management approaches generally are supported by higher-end ERP (enterprise resource planning) systems such as SAP or Oracle (Deshmuk 2005, 255). ERP software supports traditional cost accounting tools such as various methods for product costing and allocating overheads, and most ERP systems also support or have add-on modules for advanced cost accounting techniques like activity-based costing. ERP systems allow for the calculation of unit costs, definition of costs for each batch, and automatic allocation of overhead expenses using different allocation bases or cost drivers. Analytical tools of the system also enable comparison of budgets and standard costs with actual costs, simulating different cost scenarios and what-if analysis. Also cost estimation across the supply chain is supported.

For example, the properties of Oracle ERP software include

**product costing:** e.g. cost roll up for bill of material and various routings; assigning overheads to items; updating of costs to revalue inventory and work in process;

• **allocating overheads,** e.g. by multiple bases, fixed or relative to value; and

• **inventory, manufacturing and maintenance costing,** e.g. using rule based accounting for revenue and cost of goods sold, automatically re-valuing inventory after standard or average cost changes.

As activity-based cost accounting support features in Oracle software are presented (Deshmuk 2005, 255):

• **cost assignment and mapping:** assigning costs multiple ways, to departments or activities; assigning costs using multi-stage mapping;

• **hierarchies:** e.g. defining activity hierarchies (such as batch or channel); assigning activities, materials and cost objects to bill hierarchies;

• **cost drivers:** e.g. assigning multiple drivers to the same activity;

• **calculations:** e.g. activity rates; material unit cost; cost object unit cost; activity cost roll up; and

• **visual tracing:** e.g tracing cost components back to their source department accounts.

## LOGISTICS CONTROL AND MANAGEMENT

Based on a survey by Weber and Blum (in Weber 2002, 99–100), several tasks of *logistics controlling* are listed. The given alternatives included both ‘intuitively’ cost management related tasks, such as calculation of logistics costs and generating a logistics costing system, but also tasks that could be considered as the responsibility of logistics management (e.g. generating logistics strategy, organizing the logistics, or logistics benchmarking, and indeed it was indicated which department the respondents saw the task belonging to.

The five most commonly named tasks of logistics controlling were:

- The control of logistics costs, (performed amount of) logistics activities, and logistics budgets;
- compiling of logistics costs;
- planning of logistics costs, logistics activities, and logistics budgets;
- Management of logistics performance metrics; and
- Financial reporting of logistics.

Pohlen et al. (2009) also use the term *supply chain costing*, and define that as

*“...the collection, expense assignment and analysis of cost information across all of the work activities comprising a supply chain for the purpose of identifying opportunities to obtain a competitive advantage through a combination of reduced costs or improved performance.”*

This definition is also suitable for logistics cost management, when ‘supply chain’ is replaced with ‘intra-company supply chain’:

The aim of a *logistics costing system* (or *logistics control system* (Schary1985)) is considered to be to ‘determine the total cost of specific logistics objectives (outputs) by quantifying the various logistics inputs’, i.e. to quantify the resources used in logistics activities (in a given period).

Drawing on this and the other definitions presented here, *logistics costing (/cost management) system* can therefore be defined as

*“...a system comprising the rules, routines and responsibilities for registering, calculating and reporting all logistics costs, which are caused by the business between the dispatch ramps of the suppliers and the receiving ramps of the customers.”*

If a cost analysis extends the legal company borders and includes suppliers or customers, it may be considered supply chain costing.

## **TOTAL COST**

Logistics costs here are understood as expenses incurred from performing logistics activities, and from having the infrastructure, capacity or the readiness to perform logistic activities during a certain period of time.

Gudehus & Kotzab (2009, 131) provide an all-encompassing definition of logistics costs:

*“The logistics costs are the total operating costs of a single logistic performance station, a logistics profit center, the logistics network of a company or a of a logistics service provider.”*

This definition aptly describes the broad range of possibilities for organizing logistics costing. On the one hand, ‘a single logistics performance station’ is probably the smallest unit in a company where costs are measured and recorded; but on the other hand the logistics network of a company or a LSP is likely to extend outside the legal borders of the company and may include dozens of independent organizations. Also, implicit in the part ‘a logistics profit center’ is the assumption that also the revenues of logistics activities are monitored, whereas an individual logistic performance station may as well be organized as a cost center (i.e. only costs are attributed to it, but no revenues).

There is also a more practical definition of company logistics cost that is suggested for market surveys and comparisons between companies (Gudehus & Kotzab 2009, 131):

*“...the total company logistic costs comprise all logistics costs between the receiving ramps of the company and the receiving ramps of their customers.”*

## TYPICAL COMPONENTS OF LOGISTICS/SCM COSTS BY ACTIVITIES AND COST TYPES

### TRANSPORTATION COST

The most common cost that is understood as logistics cost is probably transportation, along with the inventory and inventory-keeping related costs. In a survey from the end of 1970's, 87% of the 300 North American respondents reported having transportation cost information readily available, and in mid-1980's it was estimated that together transportation and warehousing represent about 80% of overall distribution cost in most companies.

More specifically, in the reviewed literature in transportation cost are included inbound and outbound transportation<sup>16</sup>, and pilferage or damage during transportation. Gunasekaran et al recommend trucking cost plus local delivery cost [incurred by the focal company] to be treated as total transportation cost.

Weber (2002) discusses the recording of transportation costs in a great detail, and differentiates between company internal (e.g. transport from one warehouse to another) and external transportation; transportation with own fleet and third party transport services; and regular and as-needed transport. It depends by the company, what kind of transport cost classification is required; also a closer examination by transport mode may be needed.

### INVENTORY-RELATED COSTS

Although costs related to inventory are one of the best known components of logistics costs along with transportation costs, slightly differing classifications of inventory-related costs exist. Typically the definitions include costs of warehousing activities: handling (receiving, moving, order picking, packing, shipping, and inventory counting) of the goods; as well the costs of keeping inventory.

As a general rule, Lambert (1994) instructs that *inventory carrying costs* should include only the costs that change as the level of inventory changes, i.e. are variable with the inventory volume *in storage*.

*Warehousing costs*, on the other hand, should include those costs that vary with the number of (the firm's own) stocking locations or warehousing facilities – i.e. those incurred from running the warehouse, regardless of the level of inventory – and those occurring from the throughput or moving the goods into and out of the warehouse. In contrast, the cost of storage space provided by third party logistics service providers are assigned to inventory carrying cost, as they typically are charged based on the volume of the goods. (Lambert 1994).

Packing cost and the costs of reconditioning (i.e. altering the packaging for consumer needs, e.g. repackaging into smaller units, adding address stickers or inserting operating instructions (van Amstel 1985) have sometimes been treated as a separate categories, but here they are included in warehousing costs. However, if reconditioning is extensive (e.g. installing software or pressing of clothes) and adds value to the extent that customer is willing to pay extra for it, the reconditioning costs may be best treated as a separate category, to better match the costs to revenues of the value added service.

According to another classification, the *total cost of holding inventory* (Timme 2003) consists of

1) *the inventory non-capital carrying cost* (including warehousing, obsolescence, pilferage, damage, insurance, taxes, administration and other), and

2) the inventory capital charge (i.e. the capital tied in inventory): the inventory value and the cost of capital (Timme 2003).

Lambert (1994) classifies *inventory carrying costs* as

- 1) *inventory service costs* (taxes and insurance paid as a result of holding inventory;
- 2) *storage space costs* of the firm's own or leased warehouse;

- 3) **inventory risk costs**, including obsolescence, damage, pilferage, shrinkage and relocation (shipping from one warehouse to another to avoid obsolescence) and
- 4) **capital costs**. All these costs are expected to correlate with the amount of units in inventory.

## ADMINISTRATIVE COST

In the literature reviewed, administrative cost is a somewhat vague cost category, and is seldom itemized in detail. Discussing distribution costs, Lancioni (1991) divides them into two areas: line/operational costs and staff/administrative costs. **Operational costs** are defined as those cost centers dealing with the functional areas of logistics, whereas **administrative costs** are the cost centers associated with supporting the line or operational functions. Examples given of the distribution staff's administrative functions include customer service, forecasting, scheduling of production and transport, planning of inventory and distribution, and vendor, systems, transport and analysis.

Order processing and purchasing, however, are classified as operative costs, along with transportation and the inventory related costs discussed above. (Lancioni 1991, 12.) According to this classification, then, planning, scheduling and analysis as well as problem solving (customerservice20) are administrative functions, and the daily material flow related activities are operational functions. Correspondingly, the related costs can be considered either administrative or operative. Although order processing is a daily activity, and overlaps transportation and inventory control in addition to logistics administration, Mentzer & Konrad (1991) recommend measuring it separately.

Tasks included in (customer) order processing are order entry and editing, scheduling, shipping and billing (Mentzer & Konrad 1991, 43) With enterprise resource planning (ERP), electronic data interchange (EDI) and other IT systems becoming more common, the costs of order processing have probably fallen generally and lost in significance. However, a routine order may take much less time and have a more simple ordering process than a custom order, so in order to evaluate customer profitability it is good to have at least a rough estimate of the cost of ordering. service20) are administrative functions, and the daily material flow related activities are operational functions. Correspondingly, the related costs can be considered either administrative or operative.

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## PURCHASING COST

Purchasing cost in academic literature is often treated as a different concept from logistics cost; on the other hand cost items such as purchasing freight and costs from receiving and inspection may be regarded as typical logistics cost as well. In these cost categories there is overlap between the purchasing and the logistics management, in some cases also between purchasing and manufacturing.

The common points in approaches to purchasing cost appear to be that it includes the material price, the purchasing freight, and that the cost of distributing the product to customer is excluded. An accounting textbook (Drury 1990) recommends that freight charges made by suppliers would be charged as direct costs of the purchased material, allocated by weight or value between the different SKUs, if there are various materials in the shipments.

As a more simple alternative, though, the book suggests charging transportation costs to factory overhead account, and allocating these "as part of the factory overhead procedure", especially if the costs are small in proportion. (Drury 1990, 58–59). Biggs et al. (1990) discuss the costs of placing a purchase order as a relevant cost of purchasing activities: the tasks include amongst other things supplier selection, inquiring quotations for price, as well as follow-up and expediting of the order.

However, the relevance of the ordering cost may depend on the complexity of the ordered product, as well as the type of purchase (repeat or first-time purchase) and the relationship with the supplier (e.g. long-term contract or spot market).

Additionally, with supply chain management advancements such as EDI (electronic data interchange) and Kanban gaining popularity, the purchase ordering cost may in many cases be marginal only. Relative importance of each cost was found to be affected by the nature of production process (e.g. continuous process or batch manufacturing,) and the cost and nature (perishability and availability) of the raw material. The timeframe at which the material price was monitored was shortened by the increased volatility of the material price. The prices of commodities with fluctuating market prices were monitored continuously, whereas items with long-term contracts were monitored less frequently.

## LOGISTICS COSTS BY COST TYPES

Another way to classify the logistics costs is by cost type. This corresponds with accounting perspective ('natural accounts' or typical expense accounts), and cost information is likely to be found in many companies classified this way in the accounts: however, to sort out the logistics part in the account from e.g. manufacturing or marketing functions may be tricky, depending on the organization.

**Personnel or labor cost** probably forms a large part of the logistics, whether in the purely operative logistics task in warehouse or in logistics administration. Warehouse staff may be outsourced in many organizations, in order to make this cost group more variable with the volume handled. **Facilities cost** include the buildings used for logistics activities, either leased or owned. Land cost may be included in this or be a separate item. (Mentzer & Konrad 1991; Kivinen & Lukka 2003)

**Equipment** includes the shelving, forklifts, pallets, and other equipment used for logistics operations. **IT-systems** and computers may be a part of this, or nowadays a separate category. **Running cost** include items such as fuel, electricity, water, maintenance, insurance, telephone expenses, printing and photocopying etc. (Kivinen & Lukka 2003). Depreciation of logistics assets (buildings, machinery and transportation fleet) is also an expense influencing the profit-loss statement. Different companies may use different depreciation methods, which affects the comparability of logistics costs between companies.

## COST OF QUALITY

Cost of quality (COQ) may be considered largely as belonging to complexity costs, although part of the costs is actually incurred costs from a use of resources (e.g. scrap and rework). Cost of quality framework attempts to put in monetary terms all the costs that are attributable to nonconforming operations, i.e. failures in production or other order fulfillment processes, and their prevention. COQ includes four categories,

- **Prevention costs:** actions in the process to ensure that defects do not occur, e.g. preventive maintenance, stable product design, supplier audits and development;
- **Appraisal cost:** costs associated with measuring the level of quality attained by the system, such as incoming inspection, statistical process control, cost accounting for production variances, quality data gathering, analysis and reporting;
- **Internal failure costs:** costs incurred to rectify output before it reaches the customer, including scrap, rework, failure analysis and downtime caused by defects, as well as opportunity cost of lost sales due to having fewer units on hand; and
- **External failure costs:** costs associated with delivering defective output to the customer, such as investigation of defects, warranty repairs, returns or discounts, and loss of sales due to the loss of customer goodwill.

Prevention and appraisal costs may be also considered as the cost of conformance, and internal and external failure costs as the cost of non-conformance (Thorne 1990.) COQ framework is partly similar to or overlapping with the total cost of ownership (TCO) framework (see Chapter 4.3.4.), as COQ also takes into examination cost incurred before the transaction as well as the costs incurred after the sales. The main difference is perhaps the

level of aggregation: TCO analysis typically takes place at an item, an item group or a supplier level, whereas COQ is conducted at the level of individual location, business unit or for the entire firm (Shank & Govindarajan 1993).

## **COST INFORMATION NEEDS AT DIFFERENT MANAGERIAL LEVELS AND POSITIONS**

The requirements for logistics cost information are bound to differ by the different organizational levels, functional positions, timeframe of the decision to be made and the purposes of use (e.g. analysis of past performance, planning and forecasting, setting performance targets or managerial evaluation). From the supply chain perspective a costing system should help answer the questions such as what causes costs to vary, which costs are under the firms control, which costs are driven by suppliers' and customers' actions, and what the costs are of using a particular distribution approach. (Pohlen et al. 1999, 56)

Schary (1985) presents that the logistics control system operates at three levels:

- Level I, the functional activity center;
- Level II, logistics system management; and
- Level III general management,

where first level deals with operations and levels II and III with strategy. The focus of level I managers is on controlling specific operations and completion of routine schedules, whereas level II management is concerned with planning, directing and controlling the logistics system as an integrated unit, but with the given resources.

Control includes also the use of selected aggregate indicators to indicate whether the conditions for which the plans have been made still hold, and whether the activities and resources are in balance as intended. Finally, level III, general management, is in connection with the markets of the company, and evaluates their contribution to the company's profit. Consequently, the requirements of cost and control information are divergent at the different managerial levels of the system.

## **ON-GOING COST CONTROLLING VERSUS SPECIAL COST ANALYSES**

The same cost management techniques that are used in other areas of business are useful for logistics as well, namely planning and budgeting, standard costing and variance analysis, responsibility accounting and reporting, and the use of performance measures. The costing systems and tools may be used for example for the purposes of continuous cost monitoring and the evaluation of the employees or responsibility centres. On the other hand, for strategic, seldom recurring and large-scale decisions a costing tool is likely not readily available but needs to be developed or adapted, and data is likely to be needed from different sources. Some of it may be future estimates instead of historical performance data, and qualitative data such as estimates of market development and supplier information is likely to be required to contextualize the numerical information and to account for possible trade-offs.

The information requirements for on-going control differ from those of decision making. The purpose of control is to monitor (the performance), to sense the need for a change, and signal the need for decisions. (Schary 1985) This takes place by creating a model of intended future operations (e.g. performance measure targets) based on past data, continually updated for comparison. Decision making for e.g. budgeting or resource allocation may utilize some of the same data but are oriented towards future targets.

Adaptive control is emphasized: comparing the current outcome with a planned future, not (only) with the historical data.

Control therefore should not simply assume the continuation of the past, but also conduct contingency planning both for emergencies and reasonable expectations of change. (Schary 1985.) Cost data for decision making requires future costs, i.e. costs adjusted for anticipated price changes, and only the costs relevant for the specific decision, i.e. those that will change as the result of the decision, should be included in the calculation. (Drury 2004, 41.)

In addition to monitoring the performance of a responsibility centre, the logistics *budget* can also be an integrating tool, as it integrates logistics activities with the company-wide profit plan. (Tyndall & Bushner 1985) Depending how it is used, budgets and budgeting may also aid in balancing the needs for efficiency and flexibility inherent in supply chains. Frow, Marginson and Ogden (2010) present a case of reconciling budgetary control and budget flexibility. Managers had personal budgetary targets, which they were expected to adhere, but if the strategic priorities demanded it, were able to compensate exceeding some part of the budget by finding savings in another part.

Often this required collaboration with and help from managers from other areas of accountability. If the target nevertheless was not attained, it was acceptable, as long as the manager was able to demonstrate s/he had done everything that was reasonably possible to fix the problem. For this way of budget use to work, however required good understanding of the cause effect relationships of the costs, common understanding and agreement of the strategic priorities of the company and good relationships within the company.(Frow et al. 2010.)

**Variance analysis**, i.e. comparing actual performance (financial or output) to the budgeted is valuable to the extent that the causes of variances are resolved, that is, the analysis helps in problem solving and is not merely used for evaluating the performance of employees against a pre-set target (Emsley2001).

Variance analysis may also aid in identifying causes and cost impacts over the cost centre borders or outside the company, i.e. extend the variance analysis beyond the traditional responsibility accounting perspective to problem solving (Ansari 1979). The special cost analyses are situation specific and even existing guidelines for such need to be adapted for the particular context. For the purposes of supply chain management may include well documented methods such as target costing in product development, landed cost, total cost of ownership or life-cycle costing in purchasing, activity-based costing in e.g. warehousing or distribution.

Activity-based costing may also be conducted with various levels of detail and complexity, and also in 'stripped-down' analysis forms, namely activity analysis and activity cost analysis (Askarany et al. 2010) in different organizational contexts. Activity analysis is the first stage of activity-based costing, which identifies the necessary activities; activity cost analysis identifies the costs of activities, but does not assign them to individual products and services. (Askarany et al. 2010).

Also typical text-book cases such as make-or-buy analysis, off-shoring decisions and deciding warehouse locations can be included in special analyses. Although the structure of the problem may be familiar, context specific cost data is needed, often estimated at an (average) unit level, but simultaneously other performance as well as qualitative considerations need to be accounted for.

## **CHARACTERISTICS OF INTRA-COMPANY LOGISTICS/SCM CONTROL SYSTEMS**

The Figure below presents a conceptual model for unbundling (i.e. describing in detail) management innovations. With some modifications it is used here to sum up the earlier discussion of logistics cost management related aspects in organizations. It is also suggested as a framework for empiric research to describe and structure the characteristics of logistics control systems such as logistics cost management system in firms.

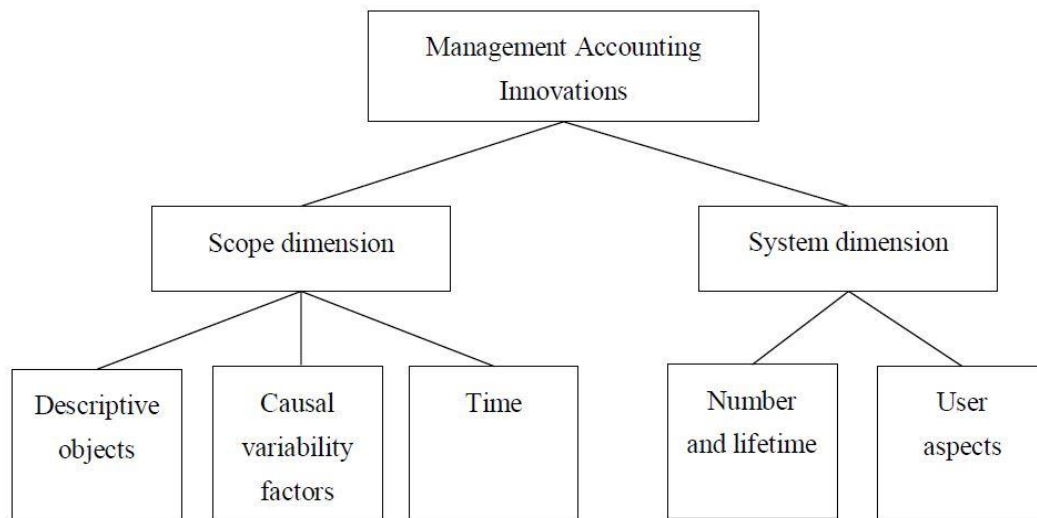


Figure 11 A generic model for unbundling management accounting innovations (Bjørnenak & Olson 1999)

Bjørnenak & Olson (1999) include in their model two main dimensions: scope and system dimension.

**Scope dimension** covers the basic management accounting problems: what should be accounted for, for what period of time and how the costs should be allocated. Scope dimension thus includes the following sub-dimensions (Bjørnenak & Olson 1999):

- **Descriptive objects:** the number and scope of the objects whose performance or cost varies. These can be cost objects such as products, activities or departments, but in addition to cost also other data such as revenue or non-financial performance may be related to the descriptive object.
  - **Causal variability factors:** factors that describe the causes such as production volume, number of orders, shipments etc. These are also called cost drivers in activity-based costing. Cost drivers or causal variability factors can also be understood in the broader sense of the strategic management literature, e.g. learning curve, interrelationships between SBUs, linkages in the value chain, vertical integration, location and institutional factors (Bjørnenak & Olson 1999, Hergert & Morris 1989, 184).
  - **Time:** the timeframe for accounting, traditionally a reporting period, but with IT-systems a shorter time frame is possible if needed; and for example in total cost of ownership time frame is the life-time of a product. The dimension also includes the aspect whether the data is historical, e.g. cost standards based on past periods (ex post) or future oriented (ex ante), e.g. budgeted costs or target costing.
- The second dimension is the **system dimension**, which focuses on the link between the users and the design of the system. It includes the system attributes (Bjørnenak & Olson 1999):
- **number and lifetime of the systems:** instead of conventional perspective of an accounting system with very long lifetime, there may be systems designed for specific situational problem-solving purposes (e.g. excel sheet solutions), or an accounting system may combine data from many different systems (e.g. balanced scorecard with data from production systems); and

**user aspects:** how the system corresponds to local information needs and enables learning, as opposite to traditional perspective of top down design of accounting system for decision-making purpose.

## AN APPROACH FOR ESTIMATING TOTAL LOGISTICS COSTS AT A COMPANY LEVEL

The paper problematizes the concept of logistics cost their comparability between different firms. Indirect costs of logistics are often classified in other cost centers such as manufacturing and marketing, and may be assigned various ways which affect the comparability between firms. Typical logistic cost categories are presented, and examples provided of differing definitions of inventory-related costs. With divergent category definitions and the different cost categorization of three distinct survey researches the paper illustrates how the comparability of logistics cost is complicated by differences in cost categories and category definitions.

The paper presents common cost analysis frameworks used for analysing different parts of the company internal supply chain, divided in methods for analyzing inbound logistics costs on one hand (total landed costs and total cost of ownership), and outbound logistics (cost-to-serve and direct product profitability) on the other. The output of the paper is condensed in a model of factors that obscure the concept of total intra-company logistics costs and complicate the comparability of total logistics costs between firms. These include the purchasing and sales terms determining the payer of freight and transportation insurance as well as the ownership of the in-transit inventory in the supplier/customer interface, the valuation method of the inventory, the allocation method used for assigning indirect costs, and the scope of the cost analysis conducted.

### **THE AVAILABILITY OF LOGISTICS COST: A COMPARISON BETWEEN FINNISH MANUFACTURING, TRADE AND LOGISTICS SERVICE PROVIDERS**

The paper IV (Hälinen, Solakivi & Ojala 2013) examines factors possibly related to the detail and availability of logistics cost information. Availability of operative and administrative costs of logistics were operationalized by asking whether the IT-systems of the respondents company provide sufficient and up-to-date information on the costs of operative logistics activities and on the costs of managing and planning logistics activities. Monitoring logistics costs by product, customer and distribution channel is already considered in the paper a rather detailed cost information and an indication of somewhat sophisticated costing system or analysis, as it is likely to include collecting cost data from multiple sources or from various expense accounts, and possibly allocating them at different levels of cost objects (assuming that the respondents did not agree to some of the three aggregation levels, but monitoring all of them).

The *operative costs* of logistics appeared to be better available than the administrative costs in all the three industry groups examined (manufacturing, trade and logistics service providers; these were, however, not statistically tested). In trade there was a significant difference between small and other company sizes in the availability of administrative cost of logistics. Contrary to expectations, industry (manufacturing or trade) was not associated with the detail of monitoring logistics costs – in trade the monitoring of logistics costs by product, customer and distribution channel might be more relevant for the contribution margin than in manufacturing. Company size, however, appeared to be related to the detail of logistics costs.

It would seem that the detail of assigning logistics costs to different cost objects increases as the company size increases both in manufacturing and trading industries. Based on the sample, large manufacturers monitor their logistics costs at a greater level of detail than medium-sized manufacturing companies, so one may conclude that the detail of assigning and monitoring logistics cost appears to increase as the company grows sufficiently large. In trade there was a difference especially between the detail of cost assignment of small and large companies.

This may be explained by two things: larger companies may have better resources at their disposal and are thus able to employ cost management specialists and develop more sophisticated cost systems. On the other hand, small companies probably have fewer or a smaller variety of customers, products and distribution channels, and therefore formal and consistent cost information on a detailed level is not perceived necessary, as more aggregated information on the profitability may be sufficient.

## MULTIPLE PERSPECTIVES ON LOGISTICS COSTS: FACTORS RELATED TO INFORMATION PROVISION

This discusses measurement of logistics cost and provision of logistics cost information from multiple perspectives in the context of manufacturing industry. Different levels of aggregation and accuracy of logistics cost information are required depending on the use of cost information: national or competitor benchmarking, strategy implementation, product and service costing, organizational control: responsibility accounting and monitoring the efficiency of operations. Scope and strategic level of logistics cost information needed in an organization are proposed to be dependent on how strategic company perceives supply chain management; ranging from logistics as a support function performing routine tasks to supply chain management as a strategic orientation.

It is suggested that analysis from an alternative strategic perspective, i.e. supply chain strategy that integrates procurement, manufacturing and distribution within the organization, as well as external supply chain partners and service providers could be beneficial in examining the fit of management control system. Emphasis is on managing the efficiency of operations, i.e. financial performance metrics and their construction; non-financial performance elements such as time, technical quality and customer service are outside the focus of the paper. The use of logistics cost performance measurement and information is discussed from the enabling versus coercive formalization perspectives with the example of budgeting and variance analysis.

## CONCLUSION

The contribution comprises the conclusion – based on extant research – that for simple operations simple systems may be sufficient, but as the complexity of operations and the resulting decisions increases, both the need and use of performance information increase in complexity. When supply chain management is perceived as a strategic initiative, logistics performance measurement and logistics costing system need to be aligned both vertically with company strategic objectives, as well as horizontally along the actual processes taking place. Therefore, in an organization with or aiming for a highly integrated intra-firm supply chain the use of logistics cost information and performance indicator may be viewed as a ‘package’ of management controls. The study aim is then to understand how the systems operate as an inter-related whole.

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