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Cost Accounting in
Logistics and Supply Chain
Management

by

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Cost Accounting in Logistics and Supply Chain Management

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1. INTRODUCTION

I have chosen the topic of *cost accounting in logistics and Supply Chain Management* (SCM) because of its relevance to my dissertation. The purpose of my dissertation is two-fold; firstly, to identify the potential motivators and inhibitors for the different actors in the grocery industry for initiating e-commerce solutions, and secondly to identify a possible solution whereby retailers can establish and operate a profitable e-commerce marketing channel. The latter involves uncovering the cost pools associated with e-grocery operations that contribute the most to the overall profitability.

In order to establish and operate a profitable e-commerce solution, the cost aspect must be controlled and explained. The cost aspect has continuously proven to be a deciding factor in e-commerce solutions in the grocery industry (Kornum et al 1999; Johnsson & Kornum 2001; Kornum 2002). A discussion of the best possible means of accounting for the costs incurred has therefore been pivotal in my further research. What are the relevant tools to dissect this issue?

In order to fulfil these purposes, I have chosen to describe two means of cost accounting specifically, as well as the state of logistical cost accounting. The purpose of such an account is to understand the theoretical basis of logistical cost accounting as well as finding a suitable method for my dissertation. In other words, this work is explorative.

The two approaches in question are:

- Mission Costing – introduced by scholars and researchers within the field of Logistics in the early 1970s.
- Activity-Based Costing – introduced by scholars and researchers within the field of Accounting in the 1980s.

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In describing these two approaches, firstly I will account for differences and similarities between the two. Secondly, the two approaches are interesting because of the epistemological backgrounds of the researchers who invented them, the significance of which I will be explaining in more detail later in this section. Finally, I will be looking at the applicability of a logistically oriented approach for mainstream cost accounting – to determine what kind of approach offers the best tool for my dissertation? In this paper it should be stressed that I am not looking to produce a practical guide on how to apply the two principles in practice.

More specifically, I wish to illustrate:

1. The state and origin of logistical cost accounting.
2. The close relationship between the two approaches, despite their differences, measured in researchers' backgrounds and time of introduction.
3. The applicability of Activity-Based Costing for cost within logistics.

2. COST ACCOUNTING WITHIN LOGISTICS

The following sections describe the history of logistical cost accounting in general, and the two approaches specifically, highlighting some of the difficulties associated with these. These difficulties are both of a general nature, as well as specific to the adaptation to logistical problems.

2.1. Cost accounting in logistics

The two approaches of cost accounting – Activity-Based Costing and Mission Costing – both follow the logic of tracing costs according to the specific activity or mission. Such process-oriented approaches, however, have only been applied for approximately 20 years. Some theoretical work dates back further, but practical application has not been adopted earlier. I am not suggesting that there has been no interest or research in logistical cost accounting prior to this, as methods based on information stemming from the volume-based accounting systems were utilized prior to Mission Costing and Activity-Based Costing.

The Total Cost Concept as introduced in the 1960s aims to highlight the importance of the flow of materials in connection with the profitability of an organization (Persson & Virum,

1990). This concept builds on the notion that reducing the total costs of the system can increase profitability. This notion yielded another important aspect – trade-offs: the concept that changing one factor will affect other variables (Coyle & Bardi, 1984).

Within the logistics literature, physical distribution costs are typically described as a function of inventory units. In a total cost perspective, the cost of transportation is held against the cost of inventory management and capital of products in inventory. If these can be minimized, the total cost of a system can then be brought down. In sum, the argument is that transportation costs will decrease as inventory units rise, because the cost of transportation from inventory unit to customer is more expensive than transportation to fill the inventory unit. This argument assumes that transportation to refill inventory units is carried out less frequently and with greater volumes – which is easier to plan. With more inventory units, the distance to the customer is reduced and thus transportation distances will be shorter, whereby the overall transportation costs are reduced (Abrahamsson, 1992).

Analysing logistics costs as a function of profitability has been conceptualised in the “DuPont” model (see Herold & Skjott-Larsen 1992, p. 28 and Persson & Virum 1990, p. 80). Via the DuPont model, different accounting elements are isolated from the traditional volume-based accounting information – including logistics cost information – to illustrate the effect on the overall cost structure (Persson & Virum 1990). The principle behind this model is a hierarchy of indicators starting with the Rate of Return. This is then broken down into Rate of Capital Turn-over and Profit Ratio, respectively. The breakdown is continued until factors indicating the logistical costs are found. This model is primarily used in determining significant changes in the logistical system. The advantage is the visualization of the connection between revenue, costs and assets (Herold & Skjott-Larsen, 1992).

The disadvantage of the above-mentioned is that the cost information stems from traditional volume-based accounting systems. This information does not allow for processes to be accounted for across several functional areas. There is, of course, some value in such an analysis and the model has established merits. However, further breakdown is needed, which ultimately led to the notion of the missions of logistics actions as introduced by Christopher.

2.2. Mission Costing

Martin Christopher first introduced the building blocks to the concept that would later be known as *Mission Costing* in 1971. This first attempt to develop a total cost approach to physical distribution via “The Mission Approach to Physical Distribution” came as a response to the introduction of Planning, Programming, Budgeting System (PPBS) which ultimately allowed for the examination of the horizontal cost and revenue structures as opposed to the vertical, functional structures (Christopher 1971).

According to Barrett (1982), however, the practical application of this concept held many problems. Many authors both helped develop the theoretical foundation as well as test the practical applicability in the following years of the concept’s introduction. Contributions were made by Walters (1972) and Ray et al. (1980) among others. Almost a decade passed before the issue of practical applicability progressed. This came with the work of Christopher, Schary and Skjott-Larsen in 1979. These authors pointed out that:

“...the output of the physical distribution system is not only a flow of product which has been transported through both time and space, but also the terms under which the product flow is provided, whereby these terms are the conditions of response to orders and are generally known as “service””.

“...the concept of service is capable of enlarging the concept of physical distribution from the total cost orientation to a total system orientation.”
Barrett (1982, p. 5).

The initial concept as introduced by Christopher was refined with contributions by different authors in the following decade. The most recognised problem of practical applicability appeared to be resolved, and in 1982, Barrett was able to conclude on the findings of the previous decade.

2.2.1. The concept of Mission Costing

In his account of the concept of “Mission Costing,” built on Christopher’s “The Mission Approach to Physical Distribution,” Barrett (1982) seeks to provide a framework that will allow practical applicability and utilisation of the conceptual benefits by providing

information not only on the costs, but also on the revenue aspects of providing varying levels of customer service.

Barrett describes the aim of this work as:

“The Mission Approach, therefore, provides us with an analytical framework with which we can analyse the physical distribution process. The view is that the physical distribution process comprises sub-systems, which form symbiotic relationships for the purpose of providing multitudinous service level outputs, which yield revenue. The approach provides us with both a total cost concept, which emphasises the interrelationship between subsystems, and with a total systems concept, which matches these inputs with the revenues resulting from the service levels, which they provide. Any one mission can only be appreciated by adopting such a holistic approach.” (1982, p 6)

Several elements of importance can be derived from the above statement. The physical distribution system is comprised of numerous sub-systems, e.g. transportation, warehousing etc. All of the sub-systems work together to provide time and space utilities for the products of a company. The *interaction* between sub-systems is crucial in this account.

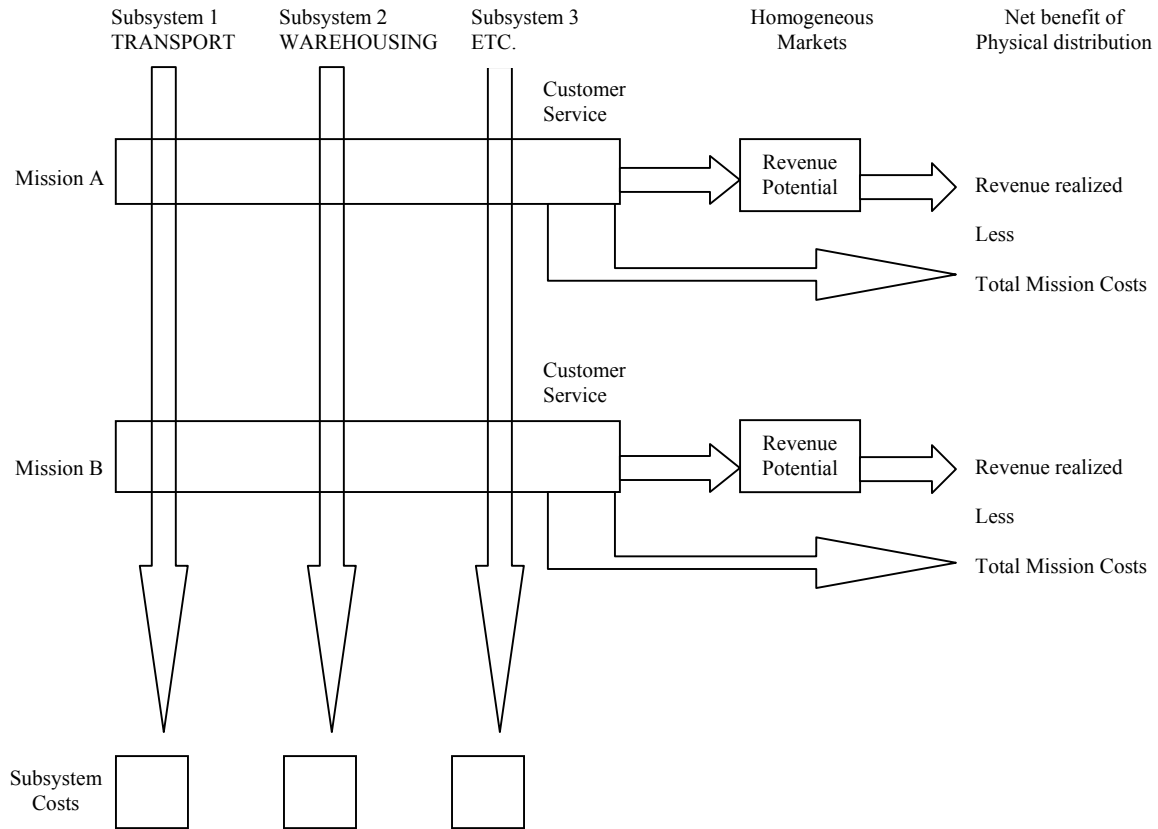
If sub-systems are observed isolated, then sub-optimum decisions are likely to be considered. Sub-systems should be viewed as providing input to the total distribution system, hereby performing symbiotic relationships – in other words, they are mutually supportive. Adopting such a holistic view of the sub-systems and their interaction will allow for a broader understanding of the physical distribution system (Barrett, 1982).

Below, Figure 1 illustrates how Barrett (1982) envisioned the Mission Approach. It explicitly accounts for the cost vs. revenue issue as well as the role of service.

The idea behind the Mission Costing approach is the ability to trace costs back to “missions” instead of observing the costs of sub-systems. In other words, it concerns the ability to focus on the output of distribution systems and the identification of the associated costs of those outputs. Christopher (1998) defines “mission” in the context of logistics as a set of service goals that the system aims to achieve within the framework of a specific product/market context.

Elaborating on this notion, an effective logistics system is said to seek the determination of the total systems cost in meeting the sought logistical objective as well as the costs of the different components required in meeting these outputs.

Figure 1 – The principles of Mission Costing



Barrett (1982, p.7)

2.2.2. Why Mission Costing?

The benefit of this approach is the ability to determine the ratio of inputs used to outputs generated. It effectively matches the resources applied to the process with the resulting revenues created by this very same process. In other words, it provides a measure of the physical process itself. Measuring the inputs in terms of costs and the outputs in revenue yields the possibility of looking and evaluating the efficiency of the process in terms of a profit concept vs. the traditional cost per unit of output. In effect, this allows for the eventuality of service itself affecting revenue, because of the profit-based measurement over a cost-based measurement. Furthermore, this approach allows for the possibility of quantifying service level elasticity (effect on demand by service level) and in doing so, the

possibility of adopting the service level that will optimise the net benefit of the company – the profit of the company (Barrett, 1982).

The framework presented by Barrett can therefore be used not only to analyse the current situation (static), but also in decision-making (dynamic). From a static analysis view, this approach allows managers to see through the cost structure of different missions in physical distribution – thereby allowing them to reengineer, optimise or shut down missions.

2.2.3. Applying the principles of Mission Costing

Acknowledging the validity of the Mission Costing approach, Christopher claims the following:

“This approach requires firstly that the activity centres associated with a particular distribution mission be identified, e.g. transport, warehousing, inventory, etc. and secondly that the incremental costs for each activity centre incurred as a result of undertaking that mission must be isolated” (1998, p. 76).

Barrett (1982) finds that corresponding issues need to be overcome when applying the framework outlined by the author. These two issues involve the identification or definition of the particular physical distribution mission of a company and secondly the measurement of the costs associated with customer-service levels.

Although the two authors work within their own terminology, they are still referring to the same two issues; what is the unit that needs to be analysed and how is this unit measured correctly? In his work, Barrett (1982) provides a comprehensive account of how to apply the framework in practice, i.e. how to implement and overcome the two issues mentioned. As mentioned in chapter 2, this paper does not seek to provide a practical guide on implementing cost accounting, so the account on practical implementation will not be described here.

The issues associated with implementing the Mission Costing framework are noteworthy when comparing to the ABC approach of cost accounting. The empirical evidence when comparing practical implementation, however, is overwhelmingly in favour of ABC. This approach has found much more widespread application than Mission Costing.

2.3. Activity-Based Costing

Robin Cooper and Robert S. Kaplan first introduced the notion of an activity-based cost accounting system in the 1980s. Activity-Based cost accounting was developed because of the lack of a proportional connection between the number of activities performed and the bulk of goods produced, in the traditional accounting systems. The need for this information arose out of increased competition.

It involves resource consumption (time, machinery cost etc.) to move units from receiving to manufacturing, writing of invoices, manufacturing etc. If the number of activities performed per finished output is always the same, then traditional volume-based accounting systems would suffice very well – the problem is that this is rarely the case. Activity-Based Costing represents an accounting system designed to avoid arbitrary allocation of costs to functions. Moreover, it seeks to determine costs associated with activities or specific processes.

2.3.1. The concept of Activity-Based Costing

In most literature concerning cost management systems, one system is favoured and its particular advances are therefore highlighted. Alternatively, only one system is discussed without recognising others – this last type of literature can allow for criticism of this one system in question. Kaplan and Cooper (1998) recognised the need for more than one system depending on the purpose of the accounting being performed. Specifically, they identified three primary functions costs systems need to perform for an organisation:

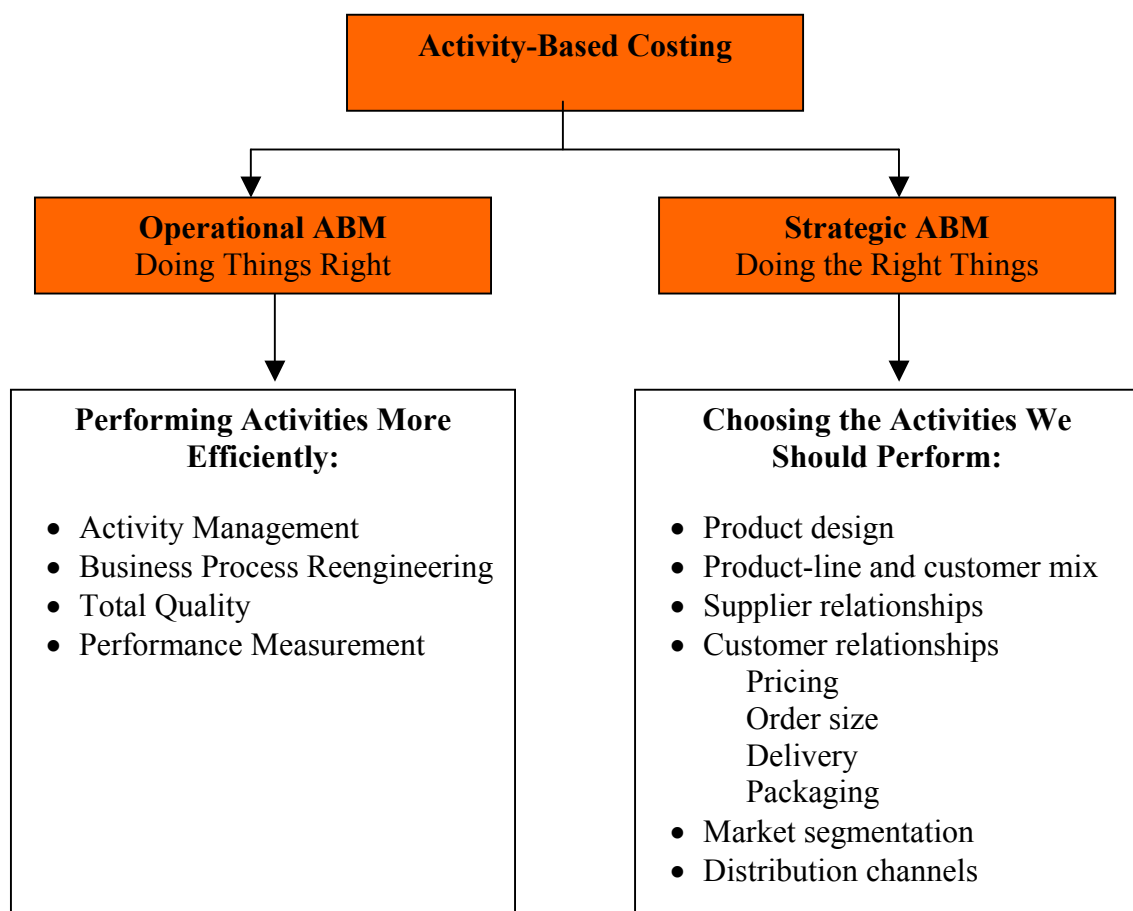
1. Valuation of inventory and measurement of the cost of goods sold for financial reporting.
2. Estimation of the costs of activities, products, services and customers.
3. Providing economic feedback to managers and operators about process efficiency.

The first function is oriented towards external parties, whereas the latter two are oriented towards internal decision-making by management. As mentioned in the introduction, the topic of this paper emerged as a result of the work on my dissertation. As the problem at hand involves costs systems aimed at managers performing informed decisions and/or process improvements, thus the aim here is not to differentiate between the purposes of these cost systems; rather, it is finding the most appropriate approach for the work at hand.

The validity of other cost-systems is fully recognised, but ABC and Mission Costing have been chosen because of their relevance within logistics cost accounting for managerial decision-making.

Having directed the focus onto activity-based costing systems, using the information provided by such analysis was the next logical step. *Activity-Based Management* (ABM) was a natural progression hereof (Kaplan & Cooper, 1998). Below, Figure 2 illustrates how ABC encompasses ABM on both an operational and strategic level.

Figure 2 – Definition of ABC vs. ABM



Kaplan & Cooper (1998, p.4)

Kaplan and Cooper describe the relevance of ABM as follows:

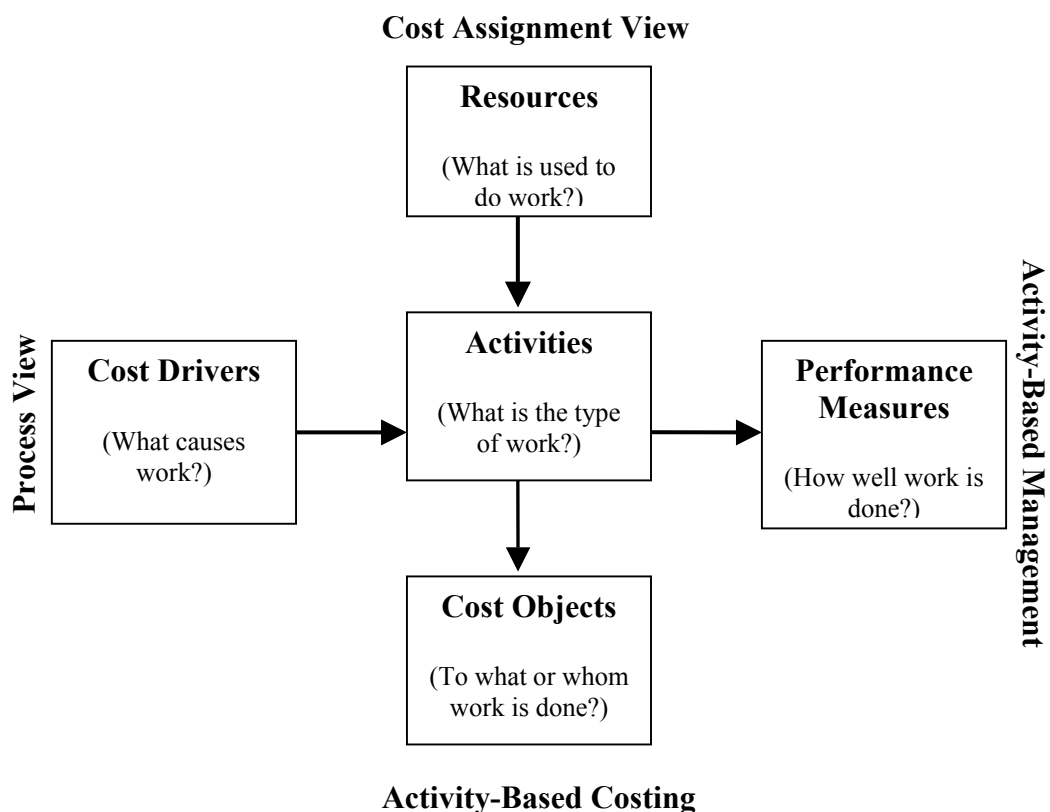
“ABM enables the organization to accomplish its outcomes with fewer demands on organizational resources; that is, the organization achieves the

same outcome at a lower total cost. ABM accomplishes its objective through two complementary applications: operational and strategic ABM” (1998, p. 4)

Following the definition of Kaplan & Cooper in recognising both the operational and strategic aspect of ABC gives the most comprehensive account of the phenomenon of ABC. Furthermore, applying this definition creates the best basis for comparison between ABC and Mission Costing. In the literature concerning ABC, such a clear distinction is not always apparent. Some authors use the concepts of ABC and ABM interchangeably with little or no distinction. Others adopt a view, where ABM represents the *strategic* view and ABC the *operational* view. In this paper, I will follow the above definition, where ABC encompasses both a strategic and operational aspect: Strategic AMB and Operational ABM respectively.

Turney (1994) proposes that the ABC model is two-dimensional, consisting of a *Cost Assignment View* and a *Process View*.

Figure 3 – Assigning costs or looking at processes?



Gupta and Galloway (2003, p134)

Here, we find the distinction between ABC and ABM as operational and strategic views, respectively. The model suggested by Gupta & Galloway (see Figure 3 above) is based on the assumption of a shift in focus – from the *Cost Assignment View* to the *Process View*. Turney proposes that an ABM (Strategic ABM according to Kaplan & Cooper) system takes information gleaned from ABC (Operational ABM according to Kaplan & Cooper) and applies it to the organisation in a continual push for identifying improvement opportunities for the company's processes.

Regardless of the terminology used, the idea to distinguish between the process of applying the framework of ABC to perform an analysis on process cost structure and then using this information in a managerial context is common for all authors.

2.3.2. Applying the principles of ABC

The ABC system can be shortly described as follows:

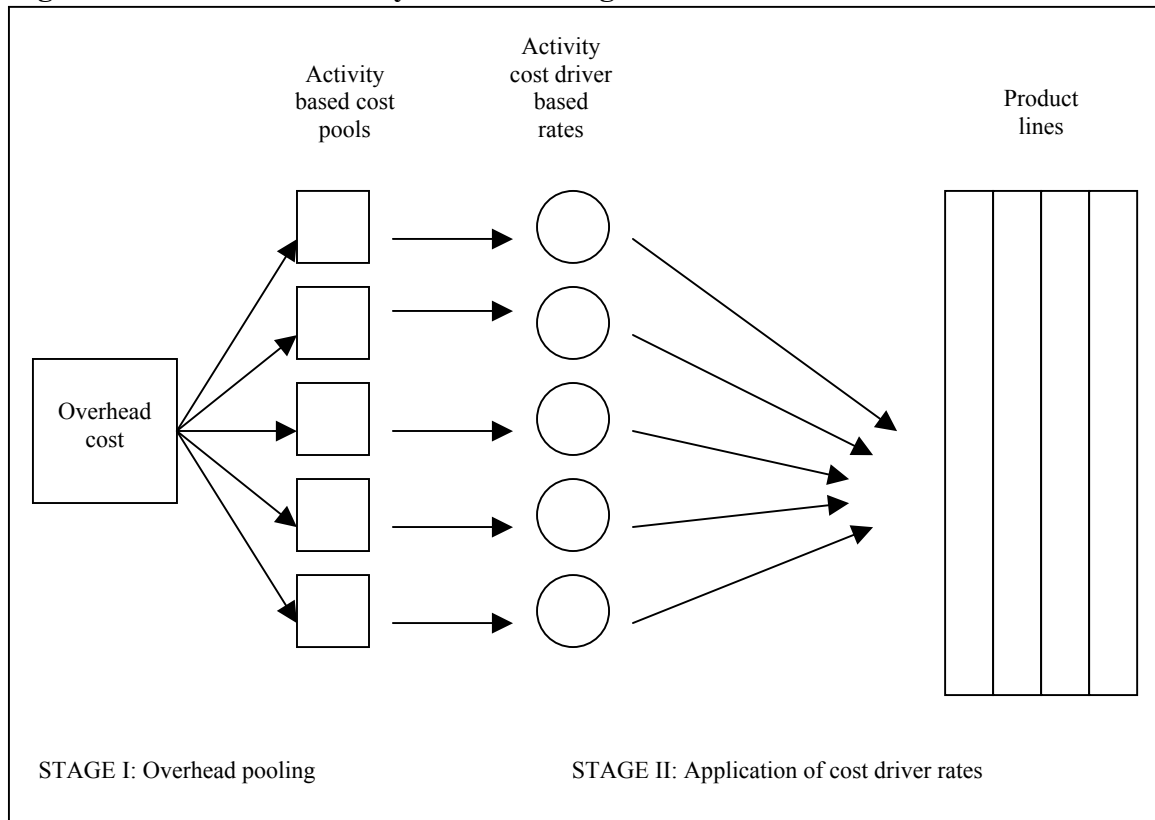
“ABC/M systems are designed and implemented on the premise that products consume activities, activities consume resources and resources consume costs. ABC/M systems assign costs to activities based on their consumption of resources and then activity costs are assigned to products or services in proportion to a selected measure to their individual workloads. ABC/M systems examine all processes (or activities) that are actually relevant to the production of a product and attempt to determine exactly what proportion of each resource is consumed i.e. which activity a particular product uses. Gupta and Galloway (2003, p. 132).

There are different ways to illustrate the nature of Operational ABM. The general acknowledgement is that the process is one of two steps. Below, Figure 4 represents one way to depict this.

The below model illustrates the statement of Gupta and Galloway (2003). Costs are allocated from resources to activities and thereafter from activities to products. The distribution of company resources onto activities can in principle be performed to a fully disaggregated level, e.g. specific activities such as “writing of invoice” would be assigned as a spending of resources (Pohlen & La Londe, 1994). Although a fully disaggregated account is possible, it is hardly desired, as it would require extensive work to define and program all of the activities involved. In practice, the identification of groups of activities

is sought. The characteristic of these groups is a common spending of resources and the fact that this spending can be attributed to a single cost-driver – single cost-pool. Such an approach – although still resource consuming – is much less demanding for company accountants and company information systems. Decreasing the complexity of the task and the resources required to perform it increases the likeliness of it succeeding.

Figure 4 – Process of Activity-Based Costing



Innes & Mitchell (1998, p. 9)

2.3.3. ABC and logistics/Supply Chain Management

ABC was quickly embraced by the manufacturing discipline, but this was not so within the field of logistics (Pohlen & La Londe, 1994). ABC does appear to be a suitable means of measuring the performance of logistics processes. Applying ABC in this area would allow visibility of the linkage between corporate profitability and logistics costs and performance. Pohlen & La Londe express the suitability of ABC in logistics as follows:

“Logistics confront many of the same conditions that make manufacturing enterprises good ABC candidates: diversity of resource consumption, and product and resource consumption not correlated with traditional volume-based allocation measures.

Logistics can benefit from the costing and measuring of performance at the activity level. Activity analysis may identify opportunities where process reengineering could reduce operating costs or improve service performance". (1994, p. 11).

Perttilä & Hautaniemi (1995) argue for the benefits of ABC in logistics via the accuracy of cost information. An accuracy that, if applied correctly, ABC can provide. The cost information is more accurate than traditional systems can produce and therefore aids managers in decision-making within several areas: logistics strategy and policy decisions, control of logistics activities, marketing strategies and policies, and finally, pricing decisions. All areas are affected by the logistical set-up and hence make for potential areas of improvement via ABC.

Using the application of ABC in logistics provides a vehicle to extend the use across the supply chain. In this setting, ABC could aid in the discovery of opportunities like the elimination of redundant activities within the supply chain, excessive resource consumption patterns of channel members, or alternative proposals for channel structure. An entire supply chain could be reengineered in its interorganisational processes, achieving competitive advantages through cost reductions and/or service differentiation with the help of ABC (Pohlen & La Londe, 1994).

2.3.4. Issues in ABC implementation

A number of issues have been raised in connection with the implementation of ABC systems. These contributions are both of a general nature and specific to the implementation within the field of logistics and SCM.

Issues in Logistics and SCM

Pohlen & La Londe (1994) highlight some of the differences between implementing ABC in a logistical environment versus the manufacturing environment. They argue that output is harder to define, activity in response to service requests may be less predictable and that joint capacity represents a high degree of total cost and is difficult to link to output related activities. Perttilä & Hautaniemi (1995) argue that ABC can provide more accurate cost information on transportation, although it does not help in assessing transportation cost to any cost object. Their concerns regard the value of information mostly:

“Especially in distribution logistics cost information can be very fragmentary, and information can be too coarse”. (1995, p. 333).

The potential pitfalls are not lessened when looking at supply chains. Dekker & Van Goor (2000) argue that while the principles of ABC are applicable to supply chains, the practical application has been internally oriented. The logic needs to be remodelled for supply chains before it can be applied here. Their criticism concerns the lack of development of tools and models for the application of ABC to supply chains and that practitioners should not be led to believe the current tools will suffice for supply chains.

General issues in ABC implementation

The challenge in using ABC is the (correct) identification of cost drivers (Christopher, 1998). Cobb et al. (1995) build on this notion and the shortcomings of ABC. It should be noted that although finding empirical difficulties associated with ABC, they (Cobb et al.) still recognise the value of this approach. As with everything else, nothing is flawless – I still maintain that ABC represents the best tool for the purpose at hand. According to Cobb et al. (1995), three conditions are pivotal in acquiring adequate cost information for decision-making:

1. Total cost can be partitioned into cost pools, each of which depends solely upon one activity.
2. The cost in each cost pool must be strictly proportioned to the level of activity.
3. Each activity can be partitioned into elements that depend solely upon each product.

Cost pools (Cobb et al., 1995) or cost drivers (Christopher, 1998) are essential in applying the ABC principles. That is, the correct breakdown of activities into the entities where cost drivers can be contributed directly.

Through a comprehensive empirical study, Cobb et al. (1995) have uncovered several problems encountered by organisations in working with ABC. The listing below highlights some of these findings:

- Installing ABC is labour intensive – particularly a problem in smaller companies.
- Other competing uses for resources are prioritised higher than ABC.
- Lack of suitable accounting staff resources.
- Scarce computer resources.

- Difficulties selecting suitable cost drivers.
- Reluctance by management (local and parent) to adopt ABC.

The issue of cost driver selection is the most far-reaching problem of the above listed problems. The reason for this is that it concerns the very logic behind ABC. Conceptual issues such as this can be characterised as case specific. The complexity of process set-up and the desire for level of disaggregation are both issues specific to a given company.

3. CONCLUSION

Although developed in different decades and by researchers rooted in different disciplines, the concepts of Mission Costing and Activity-Based Costing have many similarities. Both approaches adopt a process view compared to the traditional functional view of cost systems. Both, though with different semantics, trace costs back to activities/missions, and finally, both meet the same challenges when applied to organisations – selecting the correct level of disaggregation of activities. Christopher (1998) recognises these similarities between the 2 concepts.

ABC was not developed for the specific field of logistics, but all areas of an organisation can seek to adopt the principles to their area. As stated, manufacturing was quick to adopt this means of accounting. The applicability for logistics has been highlighted and with the ever-growing advances in information systems (hardware as well as software) and continued learning of the practical application of the principles, ABC surely has a role in logistics cost accounting.

Below, Table 1 summarises the advantages and disadvantages of each approach for logistical cost accounting. The list of disadvantages for Mission Costing could presumably be as long, if not identical to that of Activity-Based Costing. The lack of empirical application yields a proportionally lesser account of potential shortcomings.

The similarities – both when observing the benefits and the shortcomings – are notable. The framework for both approaches is indeed very similar. For the purpose of logistical cost accounting, ABC could be favoured over Mission Costing – not necessarily because it is a better method, but because it is promoted by the Accounting discipline. Whatever problems both approaches may have, the learning curve will simply be overcome faster with ABC because of the number of people working with it. This includes both

accountants and logistical people, whereas only few, if any, accountants could be expected to take up Mission Costing.

In reality, it could prove fruitful for advocates of ABC within logistical cost accounting to observe the framework and details of Mission Costing. Any difficulties in applying ABC to the field of logistics could be overcome given the origin of the Mission Costing concept.

Table 1 – Suitability of approach on logistical cost accounting

Mission Costing		Activity-Based Costing	
Pro	Con	Pro	Con
Accounts for interrelationship between sub-systems Ration of input to output generated Missions or process accounting Quantify service level elasticity Management decision support Logistically oriented	Identification of activity centres Isolating incremental cost of each activity centre Lack of experience in practical application	Operational analysis supports managerial decision-making Ratio of input to output generated Activity-based or process enabled accounting Suited for logistical purposes – not fitted for Relationship between product, activity, resources and costs	Determine level of activity aggregation Identification of cost drivers Difficult to predict service requests Output difficult to define when applied to logistics Identifying fragmented distribution logistics cost information Lack of tools for multi-organisational application Labour intensive

Own representation

Applying this concept of Mission Costing in practice will be difficult because it has not been sufficiently tested. Whereas the concept of *Mission Costing* offers an overall understanding and logistics specific framework, *Activity Based Costing* (ABC) provides the operational tool to dissect and quantify the extent of the required activities and associated costs. As is so often the case, a hybrid of both approaches would be ideal. However, further application research and analysis is needed to conclusively solve the problem of... noget I den retning for lige at få rundet ordentligt af... Og så skal det vel også lige bindes sammen med dit sidste formål: “finding a suitable method for my dissertation” – hvad er konklusionen på dette spm? Der er jo ingen tvivl om valget nok mest falder på ABC, men det kan godt staves lidt mere ud (summeres op).

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