IMPLEMENTING ACTIVITY-BASED COSTING IN
AN ENTERPRISE RESOURCE PLANNING SYSTEM

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ABSTRACT

The main objective of this study was to examine how activity-based costing would be carried out by a standard Enterprise Resource Planning (ERP) system. According to Cooper and Kaplan the requirements for operational-control and ABC systems have fundamentally different purposes and a single, fully integrated approach cannot be adequate for both of these. Nevertheless, the purpose was to extend the standard costing routines by treating indirect factors of production as direct resources in an Enterprise Resource Planning system. The procedure was tested in a case company.

The results of the study show, undoubtedly, that the idea of activity-based costing seems to be applicable to the ERP system. However, the cost management tools have their own role in modelling corporate’s functions and in applying a multiphase process of allocating resources to end products. The model achieved is modified for the corporation’s ERP system. The method used is described and analyzed. In addition, restrictions and deficiencies of the method are pointed out.

Key words: Activity-Based Costing, Enterprise Resource Planning, Cost Management
1. INTRODUCTION

1.1 Background

In recent years activity-based costing (ABC) has come into fashion, exemplified in the software companies moving their strategic focus towards integrated ABC and Enterprise Resource Planning (ERP) system. In September 1998 SAP AG invested in ABC Technologies company and strengthened its know-how in ABC (see e.g. Shaw, 1998, p.56; McMillan, 1998; Williams, 1998). Also many other ERP manufacturers have also brought out ABC parts that fit their own systems.

Numerous articles presenting models and cases of implementing ABC have been written. In these cases the ABC system has always been created alongside existing Material Resource Planning or ERP systems as a management system (see e.g. Gunasekaran et al., 1999, pp.286-287; Bonsack, 1991, p.48; Greeson & Kocalulah, 1997, pp.17-19). Benefits in such systems have generally been induced comparability to former systems, maintenance and sustaining the flexibility of cost accounting.

Mangan (1995) has reported one successful implementing project in which the aim was to create an integrated ABC system. Later this case, has been described also by Dedera (1996). The lack of both articles is that they do not describe in detail how the project has been conducted. It seems that the most of the reports and articles of implementation projects are written in general level. The detailed depictions, where is accurately described how in practice the ABC can be implemented in existing conventional cost system, does not exist.

On the other hand, Cooper and Kaplan (1998, p.110) claimed that ABC and operational cost accounting should not be confused because they have different purposes and uses. They state, that the real-time information may distort the activity-based cost information and even give the decision-makers a totally erroneous impression about the costs of the operation.

1.2 Objective of the study

The main objective of this study was to examine how activity-based costing would be carried out by a standard ERP system. The aim is to extend the standard costing routines by treating indirect factors of production as direct resources in an ERP system.

We have used an action-analytical approach. Also, we assume in this study that the firm either already has or has decided to obtain an ERP system. We do not consider which kind the ERP system should be or indeed whether company obtain that system at all.
2. PARTS APART

2.1 Activity-based costing

The traditional overhead allocation system does not provide managers with the types of information and level of detail needed to make good decisions. The traditional approach is geared to satisfying external reporting requirements. The use of only a few allocation bases could result in product cost valuations that do not reflect true product costs. Activity-based costing (ABC) provides more accurate costs than traditional cost systems.

Activity-based costing is a method of measuring the cost and performance of activities and cost objects. The idea behind activity-based costing is that cost objects, which may be products, services, jobs, projects, units, batches, customers, distribution channels or anything the management accountant is trying to cost, consume activities. In turn, activities consume resources. Activity drivers measure the activities consumed, and resource drivers measure the resources consumed. Activity-based costing systems try to determine what is really driving costs and charge a cost object for only the overhead it actually consumes. (Burch, 1994).

One can say that ABC is a fashionable topic at the present time. However, the question is not merely one of the fashion. ABC identifies the key activities performed in an organization, providing a defensible and transparent measure of their associated costs and causes. Products consume activities, and activities cause costs. The following Figure 1 illustrates the situation.

Figure 1. Main principle of activity-based costing method. (Uusi-Rauva & Paranko, 1998)
All activities of the ABC model are combined with the final cost object using cost drivers. The cost driver is the main reason for the activity and also the main reason for costs. The system should be designed with sufficient cost drivers to provide reasonably accurate product costs. The system provides cost information on each process so that the costs of different designs can be compared. (Cooper & Turney, 1990)

2.2 Features of activity-based costing softwares

There are a lot of activity-based costing softwares having almost the same features. The softwares' most common features are ability to measure performance, efficiency, quality, customer and product profitability, increase organizational profitability and eliminate non-value added work. These can also be used for improving operations by managing activities that cause incurred cost, and for making effective decisions on product lines, market segments and customer relationships. In addition, it is possible to understand the real cost structure of the company and identify how the business really works.

An ABC software is used to model a firm's processes and activities in logical order. It is especially important to be able to model and allocate costs flexibly. Cost objects may include products, customers, suppliers. Also, there are several ways to allocate costs, resources and activities. Costs are allocated by using resource drivers and normally in ABC softwares every resource driver can be defined separately.

Similarly, activity cost drivers can be defined separately and in a versatile manner. Furthermore, it is necessary to define an allocation rule for an activity. An allocation rule describes how total costs are divided to the cost object. Costs can be divided per a unit, a batch or a volume. These alternative ways of allocating make ABC software flexible and easy to model real-life operations. In addition, in activity-based budgeting managers can determine the supply and practical capacity of resources in forthcoming periods.

Normally, those packages are planned to be stand-alone systems. Glad & Becker (1996, pp.197-201) have aggregated the characteristics of the stand-alone and integrated systems. The chosen solution may be determined by the need for information. There seems to be a tendency to measure in real-time. Measuring costs in real-time may also be feasible.

It has often been said that an effective activity-based costing system offers a company a solid basis for profitable business management and development. Most of the ABC softwares can be used successfully by several types of organizations, from large international corporations to universities, hospitals and government agencies.

2.3 Characteristics of Enterprise Resource Planning softwares

An Enterprise Resource Planning (ERP) system has been an ambitious attempt to create one system which will handle all the company functions. A typical ERP-package
provides a lot of information which includes e.g. sales figures, financial results, information on the customer/client of the company, information on the suppliers of the company, inventory levels, distribution flow, production volumes and procurement volumes. In order to make business more efficient, this information gives managers a clearer overview and detailed understanding of their current performances in real-time. Most of these systems are constructed by having a central database. Figure 2 below presents the anatomy of an enterprise system.

Figure 2. Anatomy of an enterprise system. A heart of an enterprise system is a central database that draws data from and feeds data into a series of applications supporting diverse company functions. Using a single database dramatically streamlines the flow of information throughout a business. (Davenport, 1998, p.124)

There is available a huge number of ERP packages and a company choosing one of them should attempt to decide which is the most suitable. In principle, the ERP systems can be divided in three categories: the traditional systems, the systems supporting process management and the systems including their own separate ABC module. Several systems are designed to be module-based and it is feasible to select needed modules and combine them to create the desired ERP system. The problem's of the broadest systems are that they are so generic, which makes them quite rigid and arduous to modification. In the past, companies decided how they wanted to do business and the information systems were tailored for their needs. With enterprise systems, the sequence is reversed. The business must be modified to fit the ERP system (Davenport, 1998, p.124-125).
2.4 Strategic or operational?

Cooper and Kaplan (1998, p.110) make a clear distinction between strategic and operational cost accounting. According them ABC is a strategic system which aims to steer business. Its duty is to support product's and customer's profitabilities analysing and steer strategic decision-making. Porter (1996, pp.61-64) also distinguishes between operational effectiveness and strategy.

In comparing ABC and ERP systems there is one basic difference: the systems define costs differently. According to Cooper and Kaplan (1998, p.111) ABC's definition of cost of resources is based on standard activity cost driver rates and the practical capacity of organizational resources while in operational systems costs are expenses actually recorded in the financial system. Cooper ja Kaplan (1998) make a detailed distinction regarding operational activity and ABC. They conclude that ABC cannot use continuously updating real-data because it reflects the production's normal fluctuating. In that case, management may have distorted information production trends. However, they admit that despite the fact that systems are different, proper links between them promise to deliver benefits far greater than the systems could provide if operated independently.

Making use of unused capacity is one of the differences between these systems. In an operational system the status of operations is normally known and can be monitored, for example capacity usage rates crucial to production's decision-making. Knowing the costs of unused capacity enables its utilization in making product and production strategy decisions.

The relationship between cost accounting and strategy has also been examined by Järvenpää (1998, pp. 103-130). Depending on the point of view, cost accounting has been considered, however, to start from the needs of practice and developed to respond to these. Without judging the operationality or strategicality of cost accounting, we can ascertain that there clearly is the need for activity-based costing arising from practice. There is thus one existing call for calculation methods which can give answers to the these needs.

3. PUTTING PARTS TOGETHER

3.1 Introducing the case

The case company is an engineering workshop with a wide product range. It produces highly tailored products from simple welded components to complex steel structures (and mobile machines). Measured by turnover (ca. 16.5 MEUR, 1999) it is in the category of small and medium-sized enterprises in Finland. The company employs 170 people. Production layout is functional and the organization is rather traditionally
hierarchical. Organization consists of management, administration, sales, procurement, design, labor management and workers.

The company had bought new Enterprise Resource Planning (ERP) software just before this study was started. The cost accounting module was not in active use. The company wanted it to be improved and developed. The intention was to implement activity-based accounting (ABC) into ERP.

The case company’s ERP system is Industrial Financing System (IFS, http://www.ifsab.com). It has a few distinctive characteristics compared with other ERP systems. Different cost tables can be constructed. Different tables make it possible to look at costs from different perspectives. One table can, for example, present the product’s direct costs only. The other may also include overheads. Each table has its own work center hour costs. This method yields different product costs from different perspectives. Routing sheet can have operations which are calculated only in certain cost tables. Many ERP systems (like SAP) are very large and clumsy and they are built to work in all kinds of environments. Due to their large size they cannot be tailored according to a company’s special needs and the company must change its processes to comply with the ERP system. IFS does not suffer from this. It is almost totally tailored from the customer’s point of view. IFS does not have a separate ABC module and is therefore a conventional ERP system.

### 3.2 Activity-based costing and ERP system cost accounting

In Figure 3 below is demonstrated how activity-based costing and ERP system cost accounting works. ABC is on the left and ERP on the right of the figure. Arrows indicate the direction of cost accumulation.

![Diagram showing structures of ABC and ERP](image)

*Figure 3. Structures of ABC and ERP compared with each other.*
The figure should be read bottom up. The object of costing (1) is traditionally a product in both systems. In ABC the object is not restricted to being just a product. Nowadays customer and supplier costs have become more and more important factors to know. ERP systems do not technically prevent choosing the costing object, but in practice it has always been the product.

In ABC every costing object has a unique activity structure. The activity structure is built from those activities (2), that the costing object requires. Every activity has a unit cost. In ERP systems the same idea is carried out by routing. Each costing object has its own routing, which tells how and in which order the object is made. A single operation is done by a specific work center (2).

A work center has a cost per hour which is used as a unit cost in routing. In calculations ABC’s activity and ERP system’s work center are equivalent, as they have a unit cost that is directly used by the costing object. ABC is more flexible in creating resources (3) that perform activities. Resources include machines, people, buildings etc. Resources also have unit costs which come from cost factors (4). Cost factors have the total costs which are distributed over resources. Resources’ unit costs are not tied to hours as they are in the ERP system.

ERP systems include bookkeeping and purchasing. They contribute valuable information. ABC systems must get this information from outside. The strength of the ERP system is in up-to-date information. Materials are supplied with current prices from purchasing every day, and through bills of material, products get correct information. Bookkeeping provides important knowledge regarding cost factors, but it is rarely in a useful form. In the figure the dotted line indicates this gap. Bookkeeping’s way of categorizing costs by cost elements (materials, direct work etc.) is not detailed enough from the cost accounting perspective.

ERP handles bills of material and routing efficiently. ABC software does not bring anything new to them. Direct product costs are calculated quickly and correctly. This calculation power must be applied in a new and fresh way if ABC is to be accomplished in a traditional ERP system like IFS. ABC’s powerful allocation of cost factors first to resources and then to activities cannot be done as well, but the idea can be transferred to the ERP system.

### 3.3 Building activity-based costing into IFS

With the help of the ideas mentioned above new work centers were built into the company’s ERP system, IFS. (see Table 1). These work centers represented indirect work done by white collar workers. The hour costs of work centers were calculated in a separate ABC software. The hour cost of IFS can be thought of as any other unit cost, but an hour was appropriate in this case. One operation that a product goes through in manufacturing can be described as an activity done by a resource i.e. work center. The unit cost of an operation is the same as the work center’s unit cost.
Table 1. Work center information in IFS.

<table>
<thead>
<tr>
<th>Work Center Name</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreman</td>
<td>40 EUR</td>
</tr>
<tr>
<td>Designer</td>
<td>35 EUR</td>
</tr>
</tbody>
</table>

The activities accomplished by these work centers can be allocated to products through routing. There the name of one operation is the name of the activity, like Make routing, Organize work, Supervise lead time. Each operation consumes a specific amount of work center time. It can be allocated either to each unit produced or to each batch produced. Below in Table 2 is an example of this kind of routing. There these indirect activities are combined with the direct work, drilling and sawing.

Table 2. Routing of the final product

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Work Center</th>
<th>Usage in units</th>
<th>Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make routing</td>
<td>Designer</td>
<td>1.00</td>
<td>batch</td>
</tr>
<tr>
<td>Supervise lead time</td>
<td>Foreman</td>
<td>1.50</td>
<td>batch</td>
</tr>
<tr>
<td>Sawing</td>
<td>Work Center 1</td>
<td>1.25</td>
<td>unit</td>
</tr>
<tr>
<td>Drilling</td>
<td>Work Center 2</td>
<td>0.75</td>
<td>unit</td>
</tr>
</tbody>
</table>

The system calculates these work center costs correctly. This was tested and the results were identical with the ABC software.

In IFS one must know the unit cost of each work center in advance. Due to the powerful cost factor allocation in ABC, this unit cost should be obtained with the help of ABC software. IFS takes work center unit cost as input data.

In the total cost view of a product IFS accumulates all the costs occasioned by work centers in one field. The user can choose from the list of pre-defined cost tables which perspective to use. This allows, for example, the salespersons to see the product cost from different angles.

3.4 Calculating cost factors in an ERP system

Earlier it was mentioned that work centers take unit cost as input data. ERP systems such as IFS have properties that enable the calculation of cost factors if desired. ERP systems handle bill of materials very well. Cost structure can be built analogous to bill of material (Figure 4). One cost structure would be built for each resource i.e. work center. ERP calculates the cost for this structure automatically. This value can be transferred to the work center as a unit cost.
Figure 4. The Cost structure of a Foreman.

Above in Figure 4 there is a cost structure built for a Foreman. To clarify the idea a few cost items have been created. Salary, office space and computer and office supplies are all cost factors. They have unit costs and the foreman resource uses them as shown in the connecting lines. For example, the foreman uses 12 m\(^2\) of office space. Each square meter costs 0.10 euros / hour. All these factors added up show that one hour of foreman resource costs 28.90 euros. The cost structure can be as complicated as desired and can have several hierarchical steps.

4. DISCUSSION AND CONCLUSIONS

Combining ABC and ERP system seems to be possible according to this study. The model formerly presented has been implemented partly in this study, and was successful. Thorough implementation of the model was not conducted. The most interesting findings of the study were several observations made of the characteristics of ABC and ERP. In the next chapters these aspects will be discussed shortly.

ERP makes it possible to define the concept of work center more widely than earlier. This makes it possible to treat indirect resources in the same way as direct resources, thereby yielding more accurate product costs. With this procedure alone it is possible to improve the quality of cost information in many companies.

Including indirect resources, for example, in routing sheet has an important implication: from the cost perspective it does not matter if work was done by a person paid by the month or by the hour. Regardless of the pay-roll system, work is still work and it induces costs.

The traditional ERP system requires ABC software as a partner. Flexible cost allocating is not possible in an ERP system. In an ERP system versatile allocating suffers: allocating of resources is possible on one allocating principle only. In the ABC softwares a resource can be allocated to every activity on its own allocating basis. In addition, activities can be allocated in another way to a cost object. In an ERP system a resource is allocated directly to a cost object. The routing only reveals the reason for allocating – the name of the activity. In reality the resource is allocated in accordance with usage.
Comparing ABC and ERP, ABC is clearly more versatile in allocating costs to resources. ABC does not enable allocation of resources directly to cost objects but allocating is possible through activities. The cost object is not only the product.

The good features of ERP systems include that it is real, familiar and used tool. In addition, it is easy to update information because there is no separate system. For example, costs of materials are updated automatically by the purchase system. Because ABC does not bring anything special to treating materials it is natural to preserve it merely in ERP.

The life cycle of a cost model consists of building and utilizing it. ABC software's versatile allocating features and flexibility are essential in constructing the model. The results of a separate model can be transferred to ERP system. Updating of the model must be done in the ABC system and then the updated information can be automatically transferred to ERP.

Accounting the products' total costs is most effective in ERP because there bills of material, production times, material costs and consumptions are already exactly known. Also, this information will be updated often. When activity-based costing is to be transferred to an ERP system there is no need for two totally separately functioning systems. By updating routings it is easy to update the facts on indirect resources. Larger regular updatings to cost information can be moved to the system by database transmission. Thus, the model constructed is not completely real-time.

In summary, it seems that ERP and ABC have both their own roles in modelling the corporation's functions. The indisputable advance in the model is that it improves the company's cost awareness. When the costs of operations are better known, management can develop the company's processes more efficient.
5. REFERENCES


