DOKUZ EYLUL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

ACTIVITY-BASED COSTING ANALYSIS IN A FIRM

by
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İZMİR

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M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"ACTIVITY BASED COSTING ANALYSIS IN A FIRM"** completed by **YAKUP ZENGIN** under supervision of **PROF. DR. HASAN ESKİ** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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ABSTRACT

This thesis presents a procedure of Activity Based Costing. To follow a proper implementation roadmap, many different methodologies are analyzed. Activities are identified initially and activity costs were found before the product costing was done. After the activity costing was finished, products were cost by the help of these activity costs. ABC provides a better insight of the product costs and it also explains, "Which product consumes which activity". Addition, traditional costing method and ABC were compared in numerically and graphically. Besides, the traditional costing system leads to inaccurate costing information because of without depending production amount which is used in ABC when the costs are counted. The aim of this project is to highlight some poor points of traditional costing methods and obtaining an S-Curve that indicates the under-cost and over-cost products of the firm.

Keywords: Activity based costing (ABC), Activity based management (ABM), Traditional costing

BİR ŞİRKETTE AKTİVİTE TABANLI MALİYETLENDİRME ANALİZİ

ÖZ

Bu tez, aktivite tabanlı maliyetlendirme analizini sunmaktadır. Uygulama yol haritasını tam olarak izlemek için, birçok farklı metot analiz edilmektedir. Başlangıç olarak aktiviteler tanımlanır ve aktivite maliyetleri ürün maliyetinin bulunmasından önce hesaplanır. Aktivite maliyetlendirme tamamlandıktan sonra, ürünler bulunan aktivite maliyetleri yardımıyla maliyetlendirilir. Aktivite tabanlı maliyetlendirme ürün maliyelerine daha iyi bir bakış açısı sağlar ve aynı zamanda "hangi ürünün hangi aktiviteyi tükettiğini" açıklar. İlaveten geleneksel maliyetlendirme tekniği ile faaliyet tabanlı maliyetlendirme karşılaştırılmıştır. Bunların yanında, geleneksel maliyetlendirme sistemi, faaliyet tabanlı maliyetlendirme sisteminde kullanılan üretim miktarına bağlı olmadan hesaplandığı için doğru olmayan maliyet bilgisine götürür. Bu projenin amacı, geleneksel maliyetlendirme yönteminin zayıf yönlerine dikkat çekmek ve şirketin az ya da aşırı maliyetlendirilmiş ürünlerini gösteren bir S eğrisini elde etmektir

Anahtar sözcükler: Aktivite tabanlı maliyetlendirme, Aktivite tabanlı yönetim, Geleneksel maliyetlendirme

CONTENTS

CHAPTER ONE
INTRODUCTION

We are in the middle of an information revolution. Among the most significant changes in business in recent decades, certainly, have been the increase in the amount of information available and the rapidity with which it can be communicated. Computers and other technological innovations have made it possible to develop more information than any executive can possibly manage. The problem of information management, then, raises questions about what information to provide to managers. Briefly, it must be taken true decisions in the time.

1.1 Costing and Cost Management

Accounting is concerned with providing information to various decision makers. For example investors need financial accounting information. An investor uses this information to evaluate a company.

Regulatory agencies also use financial information. Information also is needed for local, state, and federal taxing authorities. Tax information often varies from financial accounting information. For instance, while management may feel that straight-line depreciation most accurately shows how an asset is expiring, it might use accelerated depreciation for tax purposes to get deductions earlier.

A third type of accounting information deals with internal auditing. Here, managers are concerned with the safety of the firm’s assets and with goods controls. For instance, a restaurant manager is concerned about cash receipts, and he will want information that tells him whether any employees have been dishonest. We can extend this internal auditing to areas such as inventory, where a manager wants to know how many cases of goods should be in inventory given opening inventory, current purchases, and current sales.

A fourth area of accounting is concerned with information for managerial decision making. Managerial accounting information is used by managers to plan and control company operations. Plans include types of products, pricing decisions, budgets, and equipment purchases. Controls include the comparison of plans with outcomes and the evaluation of divisional or departmental performance.

Although we have looked at them separately, these four functions are interrelated. The financial, tax, audit, and managerial functions all need a common information base and a set of systems to coordinate information flow. Costs and benefits will affect the complexity and sophistication of the accounting information system. The managers of a company are at the centre of all these flows. While only they can make decisions relating to company operations, their actions and company performance must be reflected so that external decisions makers (investors e.g.) have adequate information.

1.1.1 Traditional Costing

Traditionally cost accountants had arbitrarily added a broad percentage of expenses onto the direct costs to allow for the indirect costs.

However as the percentages of indirect or overhead costs had risen, this technique became increasingly inaccurate because the indirect costs were not caused equally by all the products. For example, one product might take more time in one expensive machine than another product, but since the amount of direct labour and materials might be the same, the additional cost for the use of the machine would not be recognised when the same broad 'on-cost' percentage is added to all products. Consequently, when multiple products share common costs, there is a danger of one product subsidizing another.

1.1.2 Activity Based Costing

Activity-Based Costing (ABC) is a costing model that identifies activities in an organization and assigns the cost of each activity resource to all products and services according to the actual consumption by each: it assigns more indirect costs (overhead) into direct costs.

In this way an organization can establish the true cost of its individual products and services for the purposes of identifying and eliminating those which are unprofitable and lowering the prices of those which are overpriced.

In a business organization, the ABC methodology assigns an organization's resource costs through activities to the products and services provided to its customers. It is generally used as a tool for understanding product and customer cost and profitability. As such, ABC has predominantly been used to support strategic decisions such as pricing, outsourcing and identification and measurement of process improvement initiatives.

1.2 Literature Review

A lot of research has been done about activity based costing system by now. Research done in recently years touched on parts of ABC methods generally, with only a momentary attention paid to why ABC is required or why traditional systems cause inaccurate results. Having evaluated, a comparative study of the two cost systems was done in executive and the results were compared.

In this sub-chapter we will inspect different studies made in recent years about ABC. The articles that are examined in this thesis are obtained using the database of the official web site of Dokuz Eylül University. Investigated of the articles, on-line knowledge bases like Springer, Elsevier Science Direct, Pergamon, IEEE Xplore, and Plenum Publishing were used.

ABC was used in the field of service sector after putting to use in manufacturing one. There are many studies in the literature that explain modern costing approaches in two main sectors including activity-based costing (ABC). Different Applications of ABC made in the field of production and service can be found below.

Baykasoğlu and Kaplanoğlu (2008) focused their research on the logistics and transportation applications. One of the main difficulties in land transportation companies is to determine and evaluate accurate cost of their operations and services. In this study, to improve the effectiveness of the ABC an integrated approach that combines ABC with business process modelling and analytical hierarchy approach is proposed. It is figured out that the proposed approach is quite effective in costing services of the land transportation company compared to the existing traditional costing system which is in use.

In the next study, Beck, U., & Nowak, J.W. (2000) linked ABC and discrete-event simulation to provide an improved costing, planning, and forecasting tool. Numerous point cost estimates are generated by the ABC model, using driver values obtained from a discrete-event simulation of the process. The various cost estimates can be used to produce confidence interval estimates of both the physical system and underlying cost structure. Rather than having a single point estimate of a product's cost, it is now possible to produce the range of costs to be expected as process conditions vary. This improved cost estimate will support more informed operational and strategic decisions.

In another study, Blossom Yen-Ju Lin, Te-Hsin Chao, Yuh Yao, Shu-Min Tu, Chun-Ching Wu, Jin-Yuan Chern, Shiu-Hsiung Chao, & Keh-Yuong Shaw (2007) applied ABC methodology in health care system to derive from the more accurate cost calculation compared to the traditional step-down costing. This project used ABC methodology to profile the cost structure of inpatients with surgical procedures at the Department of Colorectal Surgery in a public teaching hospital, and to identify the missing or inappropriate clinical procedures.

The paper of Carles Griful-Miquela (2001) analyzes the main costs that third-party logistics companies are facing and develops an activity-based costing methodology useful for this kind of company. It will examine the most important activities carried out by third-party distributors in both warehousing and transporting activities. The focus is mainly on the activity of distributing the product to the final receiver when this final receiver is not the customer of the third-party logistics company.

In the next paper, Chabrol, M., Chauvet, J., Féniès, P., & Gourgand M., (2006) propose a methodological approach for process evaluation in health care system. This methodology allows conceiving a software environment which is an integrated set of tools and methods organized in order to model and evaluate complex health care system as a Supply Chain.

Chih-Wei, Jeremy, & Li, C.M.Cheng (2008) investigate wafer fabrication that is the most complex process with high cost down pressure industry. Finding a precise cost model for monitor expense and then setting up a monitor cost reduction mechanism will be very critical for wafer fabrication operation field. This article will introduce a monitor cost model using Activity Based Costing, which has became the manufacturing strategy for monitor reduction.

In another paper, Fichman R. G., & Kemerer, C. F., (2002) look at component-based software development that is a promising set of technologies designed to move software creation from its current, labour-intensive, craft-like approach to a more modern, reuse-centered style. This paper proposes the adoption of a complementary management approach called activity based costing (ABC) to allow organizations to properly account for and recognize the gains from a component-based approach. Data from a large software vendor who has experience with ABC in a traditional software development environment are presented, along with a chart of accounts for a modern, component-based model.

The next paper, Gunasekaran, A. & Singh D., (1999) tried to apply of ABC in small companies, an attempt has been made in this paper to study the application of ABC in a small company, viz. G.E. Mustill (GEM) Company Ltd that produces machines for photo framing industry. The project aims to develop an ABC system that will produce more accurate cost information of a 'Four Head Foiler', and provide information to a make or buy decision about different parts of the machine and to Activity-Based Management (ABM).

Gupta, A., Stahl, D.O., & Whinston, A.B., (1997) propose the coordination of FMS activities is a complex task; this paper presents a decentralized pricing mechanism that can be used to estimate the activity–based costs and manage the activities of the FMS efficiently. The pricing mechanism described in this paper does not require system wide information to compute prices; instead, the pricing mechanism samples and uses the demand information at each CNC machine to compute rental prices at that machine. Derived the theoretical formula for rental prices supporting the optimal performance and propose simulation studies to estimate the rental prices for real-time price changes in a decentralized manner.

In the next paper, Homburg, C. (2004) uses simulations and mixed-integer programming to analyze the extent of the sub-optimality incurred by ABC-heuristics. The paper analyzes the effects of establishing a cost driver corresponding to a higher cost level. Specifically, a portfolio-based cost driver captures the demand heterogeneity triggered by the portfolio. This heterogeneity driver is then used to be proportional all costs due to inflexible overhead resources. One of the main findings is that such a heterogeneity driver improves the quality of ABC-heuristics significantly.

Iltuzer, Z., Tas, O. & Gozlu, S., (2007) present that although manufacturing companies have firstly used Activity-Based Costing, in fact ABC is a very appropriate cost control method for e-businesses whose almost all activities are associated with the indirect cost category. The fact that one of the reasons why many dot.com companies had gone through bankruptcy in the 2000s was not using an effective cost control system has rendered ABC more important for e-businesses. The aim of this paper is to implement ABC in an auction company, to determine unprofitable and promising customers accordingly.

Januszewski, Arkadiusz., (2005) presents in trade companies, there is no need to account for production costs because all activities are preformed to ensure the exact running of purchasing and selling processes. This seems to be a challenge for those companies that produce differentiated products or deal with customers who demand sophisticated packaging or special terms and distance deliveries (Cokins 1996). This is why proper accounting for costs of dealing with clients is of highest importance for those entities. Small and medium-sized trade companies practically analyse only their gross margin that takes into account neither costs of dealing with customers nor costs of cooperation with suppliers. As a result, it does not allow them to assess if a customer or supplier is ultimately profitable or not.

Jun, T., & Zhongchuan L., (2002) present the rapid development of IT (Information Technology) service industry causes the number of customers, contents and complexity of IT service are constantly increasing, which leads to the rapidly rise of the cost of the IT service The paper tries to analyze and research on the cost accounting of IT service based on ABC(Activity-based Costing), and builds cost accounting method of IT service based on ABC, and then makes different charging the strategies according to different types of customers.

In the another paper, Kataoka, T., Kimura, A., Morikawa, K., Takahashi, K., (2007) presents a method of integrating activity-based costing (ABC) and process simulation in human planning. The studies have already proposed a method of integrating ABC and process simulation in business process reengineering (BPR) and showed a case study of a chemical plant. In this paper, effective BPR methodologies to achieve dramatic improvements in business measures of workers' skills and costs based on ABC are discussed.

In the next paper, Lee, John Y. (2002) examines the theory development and implementation of activity based costing (ABC) in an international managerial accounting context. More specifically, each phase of ABC theory development and various aspects of ABC implementation are evaluated based on a critical review of ABC research that has been published thus far using an international perspective. This is intended to synthesize the ABC theory development and implementation delineating any international differences that potentially exist. The paper analyzes why there have been very little international differences in the ABC theory development.

In another paper, Liu W., Xiao L., Zhang J., Feng Y. and Zeng M. (2008) explained that with rising conservational and environmental pressure from the government, the tightening competitive market, and the requirement for internal management improvement, generation companies (GENCO) need to promote their cost control and the activity-based costing (ABC) model is helpful in this field. This paper uses the Guohua project of ABC management as the background, and focuses on the key steps in the research of GENCO ABC model, such as the model establishment of resource pool, the model design of activity pool, cost object and cost drivers. Through the appropriate application of ABC, the maintenance of equipment and the depth and width of costing can be improved, and therefore promotes the analysis, control and forecast of cost, while providing instructional and valuable information on cost for the decision-makers.

In another paper, Narita, H., Chen, L., & Fujimoto, H. explain that production cost associated with each machine tool is calculated from total cost of factory in general. The operation status of machine tools, however, is different, so accurate production cost for each product can't be calculated. Hence, accounting method of production cost for machine tool operation is proposed using the concept of Activity-Based Costing and is embedded to virtual machining simulator, which was developed to predict machining operation, for the cost prediction.

In the next paper, Park, J. & Simpson, Timothy W. remind that production costs are generated by production activities ranging from purchasing raw materials to distributing finished products, and those activities consume direct and indirect resources (Horngren, et al., 2000) These costs are identified and collected through management accounting systems that companies have developed for accounting purposes and used to estimate the production costs of existing products. However, many management accounting systems are incapable of providing the necessary information to support platform-based product development because many companies have developed their own accounting systems to help them remain profitable and eliminate unnecessary costs in production.

In the next paper, Qian, Li. and Ben-Arieh, David (2007) describe to succeed in globally competitive market, manufacturing firms need to have an accurate estimate of product design and development costs. This is especially important since the shorter life span of products accentuates design and development stages. This paper presents a cost-estimation model that links activity-based costing (ABC) with parametric cost representations of the design and development phases of machined rotational parts.

In the another paper, Rasmussen, Rodney R., Savory, Paul A., & Williams, Robert E. (1999) present an integrated simulation and activity-based management approach for determining the best sequencing scheme for processing a part family through a manufacturing cell. The integration is illustrated on a loop or U-shaped manufacturing cell and a part family consisting of four part types (A, B, C, and D). Production requirements for the cell demand that part batches be processed one type at a time. For example, all part A's are processed until weekly demand is met, then part B's, etc. The objective of this example is to determine the best part sequence (e.g., ABCD, DCBA or CABD). In addition to traditional measures, the simulation model produces detailed activity-based costing estimates. Analysis of cost and performance parameters that indicates part sequence CDBA provides the best overall choice. This sequence achieves a low per unit manufacturing cost, minimizes average time in the system and in-cell inventory cost, and maximizes unused production capacity.

In another paper, Raz, T. and Elnathan, D. (1999) present a generic activity-based costing model. The model includes a cost allocation structure designed specifically for projects, and a number of cost drivers for typical project activities. A numerical example illustrates the benefits that ABC can provide.

In the next paper, Ridderstolpe, L., Johansson, A., Skau T., Rutberg, H. and Ahlfeldt, H. (2002) describe the implementation of a model for process analysis and activity-based costing (ABC)/management at a Heart Centre in Sweden as a tool for administrative cost information, strategic decision-making, quality improvement, and cost reduction. Processes and activities such as health care procedures, research, and education were identified together with their causal relationship to costs and products/services. After the ABC/management system was created, it opened the way for new possibilities including process and activity analysis, simulation, and price calculations. Cost analysis showed large variations in the cost obtained for individual patients undergoing coronary artery bypass grafting (CABG) surgery.

In the next paper, Rocha , L. S., & Bassani, J. W. M., (2004) combine Activity Based Costing (ABC) with a microprocess-based custom-made management system used to control of the medical equipment maintenance service performed by a clinical engineering group in a public health institution in Brazil. As this model can estimate how the activities affect profitability, managers can use ABC information to interpret possible strategies needed to investigate the viability of cost minimization.

In another paper, Sun Yi-ran, Zhao Song-zheng, Liu Wei, & XU Heng (2007) aim to estimate the manufacturing costs for aeronautic product by using activity based costing (ABC) method and to calculate the aeronautic product cost with Bill of Material (BOM) accurately and flexibly. Based on the existing cost framework of aeronautic product, the cost objects, activities, and resources in aeronautic product are analyzed. Then, an ABC-based cost estimation method for aeronautic product is put forward, in which the activities are divided into direct activities and indirect activities.

In the next paper, Sundin, E., & Tyskeng, S. (2003) compare ecologically and economically recycling and refurbishing of household appliances. The comparisons were conducted by using Life Cycle Assessment (LCA) and Activity Based Costing (ABC) which both are reliable methods. The results from the analysis show that the refurbishment scenario is preferable from both economic and ecological standpoint.

In the next paper, Tuncel, G., Akyol, D., Bayhan, Gunhan M., and Koker, U. (2005) represent Activity-Based Costing (ABC) as an alternative paradigm to traditional cost accounting system and has received extensive attention during the past decade. In this paper, the implementation of ABC in a manufacturing system is presented, and a comparison with the traditional cost based system in terms of the effects on the product costs is carried out to highlight the difference between two costing methodologies. The results of the application reveal the weak points of traditional costing methods and an S-Curve which exposes the undercosted and overcosted products is used to improve the product pricing policy of the firm.

In another paper, Yi-Chun Tsai, & lung-Sheng Jao., (2002) explain to improve competitiveness continuously, not only fix assets should be fully utilized but variable expense should be well controlled also. If it is needed to setup a reasonable review mechanism and minimize cost loss of indirect material excess usage or inventory shortage, which is caused by unaccomplished usage target. This article is about linking ABC's database with MESS actual events to create some usage indices for cost control.

1.3 Research Objectives

This thesis aims to present Activity Based Costing and give a detailed implementation as well as comparing the final values with the values obtained by the traditional costing methods. After the comparison, the undercost and overcost products will also be shown. Also the existence of an S-Curve that is expressed by Gary Cokins will be questioned in our implementation. Thesis requires:

- The identification of the activities in each department.
- Obtaining activity times from each department
- Refining the activity sheets and preparing proper activity time tables for each department.
- Obtaining the wage data; obtaining other conversion costs
- Matching the activities to the products and finding how much activity each of these products consume.

CHAPTER TWO

TRADITIONAL COSTING METHODS

Cost classification is a wide topic. Various classification categories of costs can be considered depending on the purpose. Some of them will be presented below (Eski, 2006):

1) Time of computation:
   a) Historical costs
   b) Budgeted or predetermined costs (via cost prediction)
2) Short-term costs according to breakeven analysis
   a) Variable-costs
   b) Fixed-costs
   c) Average costs (Average Fixed costs, Average Variable costs)
   d) Marginal costs
   e) Semi-Variable costs, Semi-Fixed costs
3) Degree of averaging
   a) Total costs
   b) Unit costs
4) Management function
   a) Manufacturing costs
   b) Selling costs
   c) Administrative costs
5) Ease of traceability to some object of costing
   a) Direct costs
   b) Indirect costs
6) Costs connected with making decision
   a) Opportunity costs
   b) Incremental costs
   c) Sunk costs

If the costs are classified according to the time of computation, two sub classifications are possible. One of these sub classifications (historical costs) considers the costs incurred in the past and the other sub classifications points the costs that are expected to be incurred in the future.

One of the most common ways of classifying costs is to separate them according to their relation to Short-term costs according to breakeven analysis. Costs that change directly proportional with the amount of production which are named as variable costs. Most of the raw material costs are typical elements of this kind. On the other side, there are some costs, which are never affected by the production volume in a certain range of time such as the depreciation cost. Such kinds of costs are known as fixed costs. Average fixed cost is a per-unit measure of fixed costs. As the total number of goods produced increases, the average fixed cost decreases because the same amount of fixed costs are being spread over a larger number of units. Marginal cost at each level of production includes any additional costs required to produce the next unit. If producing additional vehicles requires, for example, building a new factory, the marginal cost of those extra vehicles includes the cost of the new factory. In practice, the analysis is segregated into short and long-run cases, and over the longest run, all costs are marginal. At each level of production and time period being considered, marginal costs include all costs which vary with the level of production, and other costs are considered fixed costs. However some costs are not easy to be classified as variable or fixed. Such kinds of costs may change according to the production level but this change is not directly proportional. This kind of cost is known as semi-variable costs or some costs are fixed between certain activity levels but then changes with a jump (Eski, 2006).

Total cost (TC) describes the total economic cost of production and is made up of variable costs, which vary according to the quantity of a good produced and include inputs such as labour and raw materials, plus fixed costs, which are independent of the quantity of a good produced and include inputs (capital) that cannot be varied in the short term, such as buildings and machinery. The unit cost of a product is the cost per standard unit supplied, which may be a single sample or a container of a given number.

In the production system, management has some functions that make production possible. Each of these functions causes costs. The costs can be classified as manufacturing, selling and administrative costs.

Direct Costs, however, are costs that can be associated with a particular cost object. Not all variable costs are direct costs, however; for example, variable manufacturing overhead costs are variable costs that are not a direct costs, but indirect costs.

Opportunity cost or economic opportunity loss is the value of the next best alternative foregone as the result of making a decision. Opportunity cost analysis is an important part of a company's decision-making processes but is not treated as an actual cost in any financial statement.

Incremental costs may cause any kind changing during all business activity which is executed by corporations such as purchasing a new machine.

Sunk costs which are not connected to taking decisions and not affected on the alternatives interested the decisions that were formed by applied activities in the past, such as depreciation costs.

2.1 Manufacturing and Service Costs

Three terms with widespread use when we describe manufacturing costs are direct materials costs, direct manufacturing labour costs, and indirect manufacturing costs (Horngren et al, 2001).

a) Direct material costs are the acquisition costs (inward delivery charges, sales taxes, and custom duties) of all materials that eventually become part of the cost object (WIP or finished goods) and that can be traced to the cost object in an economically feasible way. Examples include the aircraft engines on a Boeing 777, the Intel processing chip in a personal computer, the blank video cassette in a pre-recorded video, and a radio in an automobile.

b) Direct manufacturing labour costs include the compensation of all manufacturing labour that can be traced to the cost object in an economically feasible way. Examples include wages and fringe benefits paid to machine operators and assembly-line workers.

c) Indirect manufacturing costs are all manufacturing costs that are considered part of the cost object, units finished or in process, but that cannot be traced to that cost object in an economically feasible way. Examples include power supplies, indirect materials, indirect manufacturing labour, plant rent, plant insurance, propert taxes on plants, plant depreciation, and the compensation of plant managers, miscellaneous supplies such as rivets in a Boeing 777; salaries for supervisors. Other terms of this cost category include *manufacturing overhead costs* and *factory overhead costs*.

There is also an important distinction between period and product (inventoriable) costs (Horngren et al, 2001).

Period costs include all selling costs and administrative costs. These costs are expensed on the income statement in the period incurred. All selling and administrative costs are typically considered to be period costs. These costs are treated as expenses of the period in which they are incurred because they are presumed not to benefit future periods (or because there is not sufficient evidence to conclude that such benefit exists). Expensing these costs immediately, best matches expenses to revenues. For manufacturing-sector companies, period costs include all nonmanufacturing costs (for example, research and development costs and distribution costs). For merchandising-sector companies, period costs include all costs not related to the cost of goods purchased for resale in their same form (for example, labour cost of sales floor personnel and marketing costs). The absence of inventoriable (product) costs for service-sector companies means that all their costs are period costs.

Product costs include all the costs that are involved in acquiring or making a product. Consistent with the matching principle, product costs are recognized as expenses when the products are sold. For manufacturing-sector companies, all manufacturing costs are product costs. Cost incurred for direct materials, direct manufacturing labour, and indirect manufacturing costs create new assets, first work in process and then finished goods. Hence, manufacturing costs are included in work in process and finished goods inventory to accumulate the costs of creating these assets. When finished goods are sold, the cost of the goods sold is recognized as an expense to be matched against the revenues from the sale. This can result in a delay of one or more periods between the time in which the cost is incurred and when it appears as an expense on the income statement. For merchandising-sector companies, product costs are the costs of purchasing the goods that are resold in their same form. These costs are the cost of the goods themselves and any incoming freight costs for those goods. For service-sector companies, the absence of inventories means there are no product costs. The discussion in the chapter follows the usual interpretation of GAAP (Generally Accepted Accounting Principles) in which all manufacturing costs are treated as product costs.

Illustrating the flow of inventoriable costs and period costs (Horngren et al, 2001, 37)

Manufacturing-sector example

The income statement of a manufacturer, Cellular Products, is based on the firm. Revenues of Cellular are $210,000. Revenues are inflows of assets (almost always cash or accounts receivable) received for products or services provided to customers. Cost of goods sold in a manufacturing company is often computed as follows:

$$\begin{pmatrix} Beginning \quad finished \\ goods \quad inventory \end{pmatrix} + \begin{pmatrix} Cost \quad of \quad goods \\ manufactured \end{pmatrix} - \begin{pmatrix} Ending \quad finished \\ goods \quad inventory \end{pmatrix} = \begin{pmatrix} Cost \quad of \quad goods \\ sold \end{pmatrix}$$

For cellular products, the corresponding amounts:

$$\$22,000 + \$104,000 - \$18,000 = \$108,000$$

Cost of goods manufactured refers to the cost of goods brought to completion, whether they were started before or during the current accounting period. These costs amount to $104,000 for Cellular Products that classifies its manufacturing costs into the three categories described earlier:

a. *Direct material costs*. These costs are computed by being based on the firm data as follows:

$$\begin{pmatrix} Beginning \\ direct\ \ materials \\ inventory \end{pmatrix} + \begin{pmatrix} Purchases\ \ of \\ direct\ \ materials \end{pmatrix} - \begin{pmatrix} Ending \\ direct\ \ materials \\ inventory \end{pmatrix} = \begin{pmatrix} Direct \\ materials \\ used \end{pmatrix}$$

$$\$11,000 \quad + \quad \$73,000 \quad - \quad \$8,000 \quad = \$76,000$$

b. *Direct manufacturing labour costs.* It is reported these costs as $9,000.

c. *Indirect manufacturing costs.* It is reported these costs as $20,000.

Note how the cost of goods manufactured of $104,000 is the cost of all goods completed during the accounting period. These costs are all inventoriable costs. Such goods completed are transferred to finished goods inventory. They become cost of goods sold when sales occur, which depends on the nature of the product, business conditions, and types of customers.

The $70,000 for marketing, distribution, and customer-service costs are the period costs of Cellular Products. They include, for example salaries to salespeople, depreciation on computers and other equipment used in marketing, and the cost of leasing warehouse space for distribution. Operating income of Cellular Products is $32,000. *Operating income* is total revenues form operations minus cost of goods sold and operating costs.

Newcomers to cost accounting frequently assume that indirect costs such as rent, telephone, and depreciation are always costs of the period in which they are incurred and are not associated with inventories. However, if these costs are related to manufacturing per se, they are indirect manufacturing costs and are inventoriable.

There are two figures for product and period costs about a manufacturing and a merchandising company (Horngren et al, 2001):

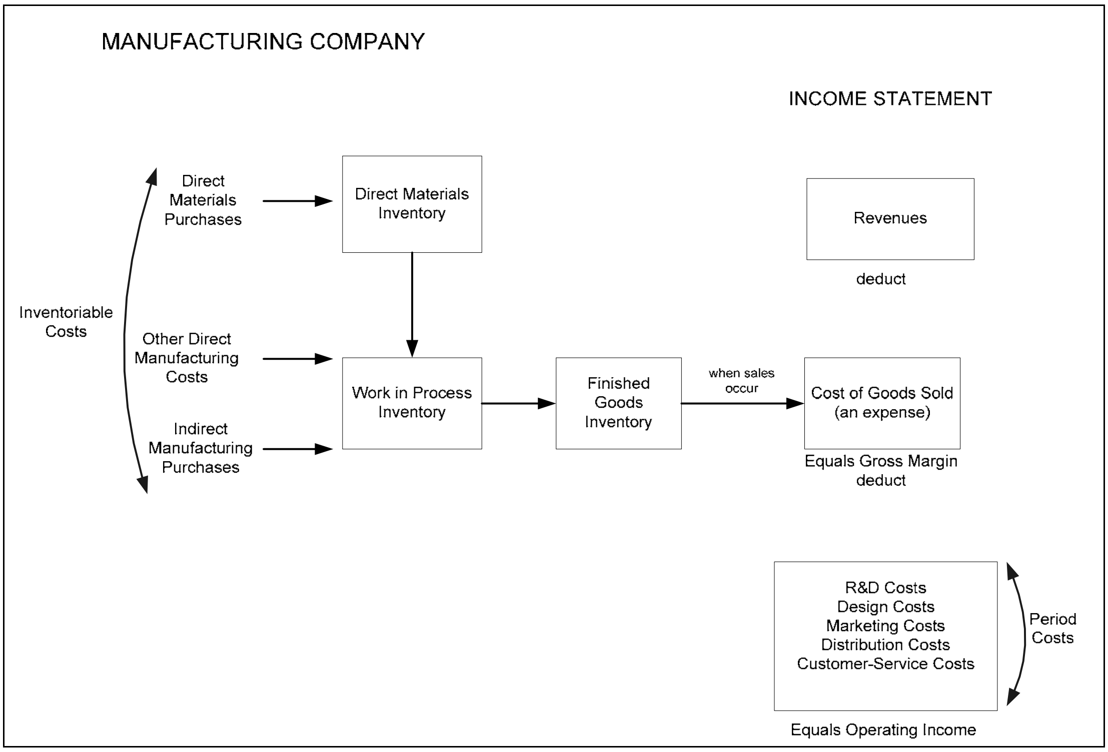


Figure 2.1 An example for inventoriable and period costs about a manufacturing company

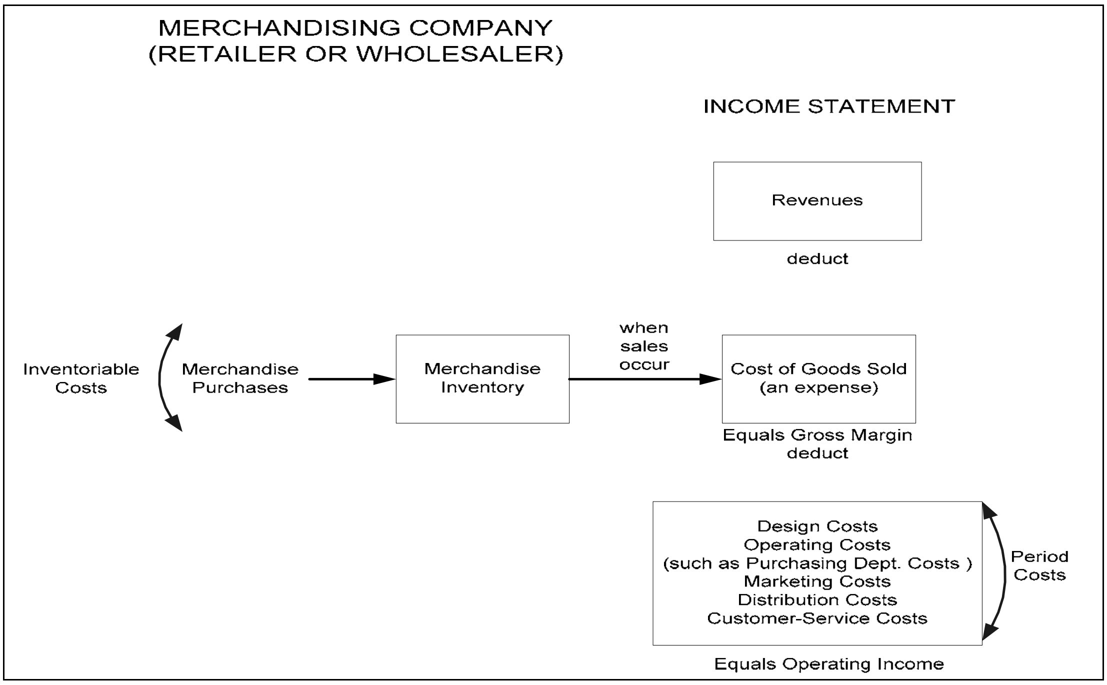


Figure 2.2 An example for inventoriable and period costs about a merchandising company

Two more cost categories are often used in discussions of manufacturing costs—prime cost and conversion cost. *Prime cost* is the sum of direct materials cost and direct labour cost. As information-gathering technology improves, companies can add additional direct-cost categories. For example, power costs might be specific areas of a plant that are dedicated totally to the assembly of separate products. In this case, prime costs would include direct materials, direct manufacturing labour, and direct metered power (assuming there are already direct materials and direct manufacturing labour categories). Computer software companies often have a 'purchased technology' direct manufacturing cost item. This item, which represents payments to third parties who develop software algorithms included in a product, is also included prime costs. *Conversion cost* is the sum of direct labour cost and manufacturing overhead cost. The term conversion cost is used to describe direct labour and manufacturing overhead because these costs are incurred to convert materials into the finished product.

Some manufacturing companies have only a two-part classification of costs—direct materials costs and conversion costs. For these companies, all conversion costs are indirect manufacturing costs.

2.2 The Main Purposes of Accounting System

According to the Chartered Institute of Management Accountants (CIMA), Management Accounting is "the process of identification, measurement, accumulation, analysis, preparation, interpretation and communication of information used by management to plan, evaluate and control within an entity and to assure appropriate use of and accountability for its Resource (economics)resources. Management accounting also comprises the preparation of financial reports for non management groups such as shareholder's, creditor's, regulatory agencies and tax authorities" (CIMA Official Terminology). The American Institute of Certified Public Accountants (AICPA) states that management accounting as practice extends to the following three areas:

- Strategic Management: Advancing the role of the management accountant as a strategic partner in the organization.

- Performance Management: Developing the practice of business decision-making and managing the performance of the organization.

- Risk Management: Contributing to frameworks and practices for identifying, measuring, managing and reporting risks to the achievement of the objectives of the organization.

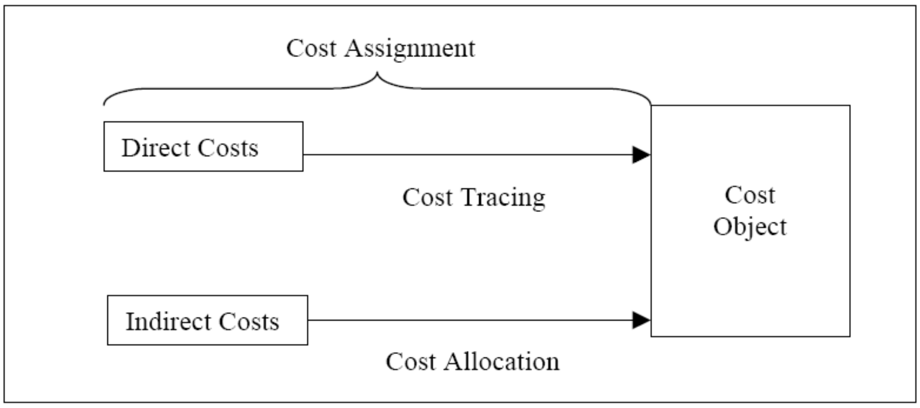


Figure 2.3 Cost relations (Horngren et al, 2001)

The Institute of Certified Management Accountants (ICMA), states "A management accountant applies his or her professional knowledge and skill in the preparation and presentation of financial and other decision oriented information in such a way as to assist management in the formulation of policies and in the planning and control of the operation of the undertaking. Management Accountants therefore are seen as the "value-creators" amongst the accountants. They are much more interested in forward looking and taking decisions that will affect the future of the organization, than in the historical recording and compliance (scorekeeping) aspects of the profession. Management accounting knowledge and experience can therefore be obtained from varied fields and functions within an organization, such as information management, treasury, efficiency auditing, marketing, valuation, pricing, logistics, etc."

Aims of accounting systems are;

1. Formulating strategy/strategies
2. Planning and constructing business activities
3. Helps in making decision
4. Optimal use of Resource (economics)
5. Supporting financial reports preparation
6. Safeguarding asset

2.3 Process and Job Costing

Two basic types of costing systems are used to assign costs to products or services (Horngren et al, 2001):

2.3.1 Process Costing

In a *process-costing system,* the unit cost of a product or service is obtained by assigning total costs to many identical or similar units. In a manufacturing process-costing setting, each unit is assumed to receive the same amount of direct materials costs, direct manufacturing labour costs, and indirect manufacturing costs. Unit costs are then computed by dividing total costs by the number of units.

The principle difference between process costing and job costing is the *extent of averaging* used to compute unit costs of products or services. In a job-costing system, individual jobs use different quantities of production resources. Thus, it would be incorrect to cost each job at the same average production cost. In contrast, when identical or similar units of products or services are mass-produced, and not processed as individual jobs, process costing averages production costs over all units produced.

Illustration: Global Defence, Inc., manufactures thousands of components for missiles and military equipment. These components are assembled in the Assembly Department. Upon completion, the units are immediately transferred to the Testing Department. We will focus on the Assembly Department process for one of these components, DG-19. Every effort is made to ensure that all DG-19 units are identical and meet a set of demanding performance specifications. The process-costing system for DG-19 in the Assembly Department has a single direct-cost category (direct materials) and a single indirect-cost category (conversion costs). *Conversion costs* are all manufacturing costs other than direct materials cots. These include manufacturing labour, indirect materials, energy, plant depreciation, and so on. Direct materials are added at the beginning of the process in Assembly. Conversion costs are added evenly during Assembly.

The following graphic summarizes these facts:

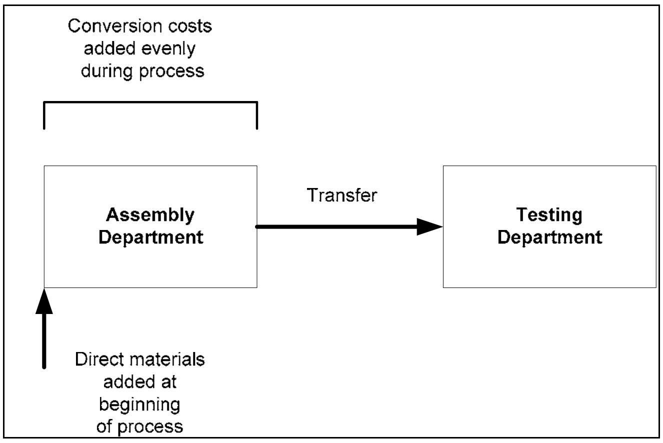


Figure 2.4 Process-costing system procedures

Process-costing system separate costs into cost categories according to the timing that when costs are introduced into the process. Often, as in our Global Defence example, only two cost classifications, direct materials and conversion cots, are necessary to assign costs to products, since all direct materials are added to the process at one time and all conversion costs are generally added to the process uniformly through time. If, however, two different direct materials are added to the process at different times, two different direct materials categories would be needed to assign these costs to products. Similarly, if manufacturing labour is added to the process at a time that is different from other conversion costs, an additional cost category (direct manufacturing labour costs) would be needed to separately assign these costs to products. We will use the production of the DG-19 component in the Assembly Department to illustrate process costing in three cases:

Case 1- Process costing with zero beginning and zero ending work-in-process inventory of DG-19 that is, all units started and fully completed by the end of the accounting period. *This case presents the most basic concepts of process costing and illustrates the key feature of averaging of costs.*

The case shows that in a process-costing system, unit costs can be averaged by dividing total costs in a given accounting period by total units produced in that period. Because each unit is identical, we assume all units receive the same amount of direct materials and conversion costs. This approach can be used by any company that produces a homogenous product or service but has no incomplete units when each accounting period ends. This situation frequently occurs in service-sector organizations. For example, a bank can adopt this process-costing approach to compute the unit cost of processing 100,000 similar customer deposits made in a month.

Case 2- Process costing with zero beginning work-in-process inventory but some ending work-in-process inventory of DG-19 that is, some units of DG-19 started during the accounting period are incomplete at the end of the period. *This case builds on the basics and introduces the concept of equivalent units.*

The accuracy of the completion percentages depends on the care and skill of the estimator and the nature of the process. Estimating the degree of completion is usually easier for direct materials than it is for conversion costs since the quantity of direct materials needed for a completed unit and the quantity of direct materials for a partially completed unit can be measured more easily. In contrast, the conversion sequence usually consists of a number of basic operations for a specified number of hours, days, or weeks, for various steps in assembly, testing, and so forth. Thus, the degree of completion for conversion costs depends on what proportion of the total effort needed to complete one unit or one batch of production has been devoted to units still in process. This estimate is more difficult to make accurately. Because of the difficulties in estimating conversion cost completion percentages, department supervisors and line managers – individuals most familiar with the process – often make these estimates. Still, in some industries no exact estimate is possible or, as in the textile industry, vast quantities in process prohibit the making of costly physical estimates. In these cases, all work in process in every department is assumed to be complete to some reasonable degree. *The key point to note in Case 2 is that a* *partially assembled unit is not the same as a fully assembled unit.* There are the five steps in Case 2 of process costing:

Step 1. Summarize the flow of physical units of output.

Step 2. Compute output in terms of equivalent units.

Step 3. Compute equivalent unit costs.

Step 4. Summarize total costs to account for.

Step 5. Assign total costs to units completed and to units in ending work in process.

2.3.1.1 Physical Units and Equivalent Units (Step 1 and 2)

Step 1 tracks the physical units of output. Where did the units come from? Where did the units go? The physical units' column of Table 2.1 tracks where the physical units came from – 400 units started, and where they went – 175 units completed and transferred out, and 225 units in ending inventory.

Step 2 focuses on how the output for February should be measured. The output is 175 fully assembled units plus 225 partially assembled units. Since all 400 physical units are not uniformly completed, output in step 2 is computed in *equivalent units*, not in physical units.

Equivalent units is a derived amount of output units that takes the quantity of each input (factor of production) in units completed or in work in process, and converts it into the amount of completed output units that could be made with that quantity of input. For example if 50 physical units of a production in ending work-in- process inventory are 70% complete with respect to conversion costs, there are 35 (70%*50) equivalent units of output for conversion costs. That is, if all the conversion cost input in the 50 units in inventory were used to make completed output units, the company would be able to make 35 completed units of output. Equivalent units are calculated separately for each input (cost category). Examples of equivalent-unit concepts are also found in nonmanufacturing settings.

Table 2.1 Steps 1 and 2 summarize output in-physical units and compute equivalent units assembly department of Global Defence

Flow of Production	(Step 1) Physical Units	(Step 2) Equivalent Units Direct Materials	Conversion Costs
Work in process, beginning	0		
Started during current period	400		
To account for	400		
Completed and transferred out during current period	175	175	175
Work in process, ending	225		
225*100%; 225*60%	-	225	135
Accounted for	400		
Work done in current period only		400	310

*Degree of completion in this department: direct materials, 100%; conversion costs, 60%.

While calculating equivalent units in step 2, focus on quantities. Disregard dollar amounts until after equivalent units are computed. In the Global Defence example, all 400 physical units – 175 fully assembled ones and the 225 partially assembled ones – are complete in terms of equivalent units of direct materials since all direct materials are added in the Assembly Department at the initial stage of the process. Table 2.1 shows output as 400 equivalent units for direct materials because all 400 units are fully complete with respect to direct materials.

The 175 fully assembled units are completely processed with respect to conversion costs. The partially assembled units in ending work in process are 60% complete (on average). Therefore, the conversion costs in the 225 partially assembled units are equivalent to conversion costs in 135 (60% of 225) fully assembled units. Hence, Table 2.1 shows output as 310 equivalent units with respect to conversion costs – 175 equivalent units assembled and transferred out and 135 equivalent units in ending work-in-process (WIP) inventory.

2.3.1.2 Calculation of Product Costs (Steps 3, 4, and 5)

Table 2.2 shows steps 3, 4, and 5. Together, they are called the *production cost worksheet*. Step 3 calculates equivalent-unit costs by dividing direct materials and conversion costs added during February by the related quantity of equivalent units of work done in February.

We can see the importance of using equivalent units in unit-cost calculations by comparing conversion costs for the months of January and February 2001. Observe that the total conversion costs of $18,600 for the 400 units worked on during February are less than the conversion costs of $24,000 for the 400 units worked on in January. However, the conversion costs to fully assemble a unit are $60 in both January and February. Total conversion costs are lower in February because fewer equivalent units of conversion costs work were completed in February (310) than were in January (400). If, however, we had used physical units instead of equivalent units in the per unit calculation, we would have erroneously concluded that conversion costs per unit declined from $60 in January to $46.50 (18,600 ÷400) in February. This incorrect costing might have prompted Global Defence, for example, to lower the price of DG-19 inappropriately.

Table 2.2 Steps 3, 4, and 5: Compute equivalent-unit costs, summarize total costs to account for, and assign costs to units completed and to units in ending work in process assembly department of Global Defence, Inc., for February 2001

		Total Production Costs	Direct Materials	Conversion costs
(Step 3)	Costs added during February Divide by equivalent units of work done in current period (Table 2.1)	$50.600	$32.000 : 400	$18.600 : 310
	Cost per equivalent unit		$80	$60
(Step 4)	Total costs to account for	$50.600		
(Step 5)	Assignment of costs:			
	Completed and transferred out (175 units)	$24.500	(175a*$80)+(175a*$60)	
	Work in process, ending (225 units):			
	Direct materials	18.000	225b*$80	
	Conversion costs	8.100		135b*$60
	Total work in process	26.100		
	Total costs accounted for	$50.600		

aEquivalent units completed and transferred out from Table 2.3, step 2
bEquivalent units in ending work in process from Table 2.3, step 2.

Step 4 in Table 2.2 summarizes total costs to account for. Because the beginning balance of the work-in-process inventory is zero, total costs to account for consist of the costs added in February – direct materials of $32,000, and conversion costs of the $18,600, for a total of $50,600.

Step 5 in Table 2.2 assigns these costs to units completed and transferred out and to units still in process at the end of February 2001. The key idea is to attach dollar amounts to the equivalent output units for direct materials and conversion costs in (a) units completed, and (b) ending work in process calculated in Table 2.1, step 2. To do so, the equivalent output units for each input are multiplied by the cost per equivalent unit calculated in step 3 of Table 2.1. For example, the 225 physical units in ending work in process are completely processed with respect to direct materials. Therefore, direct material costs are 225 equivalent units (Table 2.1, step 2) * $80 (cost per equivalent of direct materials calculated in step 3), which equals $18,000. In contrast, the 225 physical units are 60% complete with respect to conversion costs. Therefore, the conversion costs are 135 equivalent units (60% of 225 physical units, Table 2.1, step 2) * $60 (cost per equivalent unit of conversion costs calculated in step 3), which equals $8,100. The total cost of ending work-in process equals $26,100 ($18,000 + $8,100).

Case 3- Process costing with both some beginning and some ending work-in-process inventory of DG-19. This case adds more detail and describes the effect of weighted-average and first in, first out (FIFO) cost flow assumptions on cost of units completed and cost of work-in-process inventory.

At the beginning of March 2001, Global Defence had 225 partially assembled DG-19 units in the Assembly Department. During March 2001, Global Defence placed another 275 units into production. Data for the Assembly Department for March 2001 are:

Physical Units for March 2001

Work in process, beginning inventory (March 1)	225 units
Direct materials (100% complete)	
Conversion costs (60% complete)	
Started during March	275 units
Completed and transferred out during March	400 units
Work in process, ending inventory (March 31)	100 units
Direct materials (100% complete)	
Conversion costs (50% complete)	

Total Costs for March 2001

Work in process, beginning inventory (March 1)		
Direct materials (225 equivalent units * $80 per unit)	$18,000	
Conversion costs (135 equivalent units * $60 per unit)	$8,100	$26,100
Direct materials costs added during March		$19,800
Conversion costs added during March		$16,380
Total costs to account for		$62,280

We now have incomplete units both beginning and ending work-in-process inventory to account for. Our goal is to use the five steps we described earlier to calculate (1) the cost of units completed and transferred out, and (2) the cost of ending work in process. To assign costs to each of these categories, however, we need to choose an inventory cost-flow. We next describe the five-step approach to process costing using two alternative inventory cost-flow methods the weighted average method and first-in, first-out method. The different assumptions will produce different numbers for cost of units completed and for ending work in process.

2.3.1.3 Weighted Average Method

The weighted-average process-costing method calculates the equivalent-unit cost of the *work done to date* and assigns this cost to equivalent units completed and transferred out of the process and to equivalent units in ending work-in-process inventory. The weighted-average cost is the total of all costs entering the Work in Process account divided by total equivalent of work done to date. We now describe the five-step procedure introduced Case 2 using the weighted-average method.

Step 1: Summarize the Flow of Physical Units. The physical units column of Table 2.3 shows where the units came from – 225 units from beginning inventory and 275 units started during the current period – and where they went – 400 units completed and transferred out and 100 units in ending inventory.

Step 2: Compute Output in Terms of Equivalent Units. As we saw in Case 2, even partially assembled units are complete in terms of direct materials because direct materials are introduced at the beginning of the process. For conversion costs, the fully assembled physical units transferred out are, of course, fully completed. The Assembly Department supervisor estimates the partially assembled physical units in March 31 work in process to be 50% complete (on average).

The equivalent-units columns in Table 2.3 show the equivalent units of work done to date – equivalent units completed and transferred out and equivalent units in ending work in process (500 equivalent units of direct materials and 450 equivalent units of conversion costs). Notice that the equivalent units of work done to date also equal the sum of the equivalent in beginning inventory (work done in the previous period) and the equivalent units of work done in the current period, because:

$$\begin{pmatrix} Equivalent\ units \\ in\ beginning \\ work\ in\ process \end{pmatrix} + \begin{pmatrix} Equivalent\ units \\ of\ work\ done\ in \\ current\ period \end{pmatrix} = \begin{pmatrix} Equivalent\ units \\ completed\ and \\ transferred\ out \\ in\ current\ period \end{pmatrix} + \begin{pmatrix} Equivalent\ units \\ in\ ending \\ work\ in\ process \end{pmatrix}$$

The equivalent-unit calculation in the weighted-average method is only concerned with total equivalent units of work done to date regardless of (1) whether the work was done during the previous period and is part of beginning work in process, or (2) whether it was done during the current period. That is, the weighted-average method merges equivalent units in beginning inventory (work done before March) with equivalent units of work done in the current period. Thus, the stage of completion of the current-period beginning work in process per se is irrelevant and not used in the computation.

Table 2.3 Steps 1 and 2: Summarize output in physical units and compute equivalent units weighted-average method of process costing
Assembly Department of Global Defence, Inc, for March 2001.

Flow of Production	(Step 1) Physical Units	(Step 2) Equivalent Units Direct Materials	Conversion Costs
Work in process, beginning	225		
Started during current period	275		
To account for	500		
Completed and transferred out			
during current period	400	400	400
Work in process, ending(a)	100		
100*100%; 100*50%		100	50
Accounted for	500		
Work done to date		500	450

a Degree of completion in this department: direct materials, 100%; conversion costs, 50%.

Step 3: Compute Equivalent-Unit Costs. Table 2.4, step 3, shows the computation of equivalent-unit costs separately for direct materials and conversion costs. The weighted-average cost per equivalent unit is obtained by dividing the sum of costs for beginning work in process and costs for work done in the current period by total equivalent units of work done to date. When calculating the weighted-average conversion cost per equivalent unit in Table 2.4, for example, we divide total conversion costs, $24,480 (beginning work in process, $8,100, plus work done in current period, $16,380) by total equivalent units, 450 (equivalent units of conversion costs in beginning work n process and in work done in current period), to get a weighted-average cost per equivalent unit of $54.40.

Step 4: Summarize Total Costs to Account For. The total costs to account for in March 2001 are described in the example data on page 615 – beginning work in process, $26,100 (direct materials, $18,000 and conversion costs, $8,100) plus $36,180 (direct materials costs added during March, $19,800 and conversion costs, $16,380). The total of these costs is $62,280.

Step 5: Assign Costs to Units Completed and to Units in Ending Work in Process. The key point in this step is to cost all work done to date: (1) the cost of units completed and transferred out of the process, and (2) the cost of ending work in process. Step 5 in Table 2.4 takes the equivalent units completed and transferred out and equivalent units in ending work in process calculated in Table 2.3, step 2, and attaches dollar amounts to them. These dollar amounts are the weighted-average costs per equivalent unit for direct materials and conversion costs calculated in step 3. For example, note that the total cost of the 100 physical units in ending work in process consists of:

Direct materials:	
100 equivalent units*weighted-average cost per equivalent unit of $75.60	$7,560
Conversion costs:	
50 equivalent units *weighted-average cost per equivalent unit of $54.40	$2,720
Total costs of ending work in process	$10,280

The following table summarizes the total costs to account for and the $62,280 accounted for in Table 2.4. The arrows indicate that costs of units completed and transferred out and in ending work in process are calculated using average total costs obtained after merging costs of beginning work in process and costs added in the current period.

Table 2.4 Step 3, 4, and 5: Compute equivalent-unit costs, summarize total costs to account for, and assign costs to units completed and to units in ending work in process weighted-average method of process costing assembly department of Global Defence, Inc, for March 2001

		Total Production Costs	Direct Materials	Conversion costs
(Step 3)	Work in process, beginning	$26.100	$18,000	$8,100
	Costs added in current period	$36,180	$19,800	$16,380
	Costs incurred to date		$37,800	$24,480
	Divide by equivalent units of work done to date (Table 2.3)		/500	/450
			$75.60	$54.40
(Step 4)	Total costs to account for	$62,280		
(Step 5)	Assignment of costs:			
	Completed and transferred out (400 units)	$52,000	(400a*$75.60)+(400a*$54.40)	
	Work in process, ending (100 units):			
	Direct materials	$7,560	100b*$75.60	
	Conversion costs	$2,720		50b*$54.40
	Total work in process	$10,280		
	Total costs accounted for	$62,280		

aEquivalent units completed and transferred out from Table 2.3, step 2
bEquivalent units in ending work in process from Table 2.3, step 2.

2.3.1.4 First-in First-out Method

In contrast to the weighted-average method, the first-in, first-out (FIFO) process-costing method assigns the cost of previous period's equivalent units in beginning work-in-process inventory to the first units completed and transferred out of the process and assigns the cost of equivalent units worked on during the current period first to complete beginning inventory, then to start and complete new units, and finally to units in ending work-in-process inventory. This method assumes that the earliest equivalent units in the Work in Process – Assembly account are completed first.

A distinctive feature of the FIFO process-costing method is that work done on beginning inventory before the current period is kept separate from work done in the current period. Costs incurred in the current period and units produced in the current period are used to calculate costs per equivalent unit of work done in the current period. In contrast, equivalent-unit and cost-per-equivalent-unit calculations in the weighted-average method merge the units and costs in beginning inventory with units and costs of work done in the current period.

We now describe the five-step procedure introduced in Case 2 using FIFO method.

Table 2.5 Steps 1 and 2: Summarize output in physical units and compute equivalent units FIFO method of process costing assembly department of Global Defence, Inc., for March 2001

Flow of Production	(Step 1) Physical Units	(Step 2) Equivalent Units Direct Materials	Conversion Costs
		(work done before current period)	
Work in process, beginning	225		
Started during current period	275		
To account for	500		
Completed and transferred out during current period:			
From beginning work in process[a]	225		
225*(100% - 100%); 225*(100% - 60%)		0	90
Started and completed	175[b]		
175*100%, 175*100%		175	175
Work in process, ending	100		
100*100%; 100*50%	-	100	50
Accounted for	500		
Work done in current period only		275	315

[a]Degree of completion in this department: direct materials, 100%; conversion costs, 60%.
[b]400 physical units completed and transferred out minus 225 physical units completed and transferred out from beginning work-in-process inventory
[c]Degree of completion in this department: direct materials, 100%; conversion costs, 50%

Step 1: Summarize the Flow of Physical Units. Table 2.5, step 1, traces the flow of physical units of production. The following observations help explain the physical units calculations.

- The first physical units assumed to be completed and transferred out during the period are the 225 units from the beginning work-in-process inventory.
- Of the 75 physical units started, 175 are assumed to be completed. Recall from the March data in Case 3 that 400 physical units were completed during March. The FIFO method assumes that the first 225 of these units were from beginning inventory; thus 175 (400 - 225) physical units must have been started and completed during March.
- Ending work-in-process inventory consists of 100 physical units – the 275 physical units started minus the 175 of these physical units completed.
- Note that the physical units "to account for" equal the physical units "accounted for" (500 units).

Step 2: Compute Output in Terms of Equivalent Units. Table 2.5 also presents the computations for step 2 under the FIFO method. The equivalent-unit calculations for each cost category focus on the equivalent units of work done in the current period (March) only.

Table 2.6 Steps 3, 4, and 5: Compute equivalent-unit costs, summarize total costs to account for, and assign costs to units completed and to units in ending work in process FIFO method of process costing assembly department of Global Defence, Inc., for March 2001

		Total Production Costs	Direct Materials	Conversion costs
	Work in process, beginning	$26,100	(costs of work done before current period)	
(Step 3)	Costs added in current period	$36.180	$19,800	$16,380
	Divide by equivalent units of work done in current period (Table 2.3) Cost per equivalent unit of work done in current		/275 $72	/315 $52
(Step 4)	Total costs to account for	$62,280		
(Step 5)	Assignment of costs:			
	Completed and transferred out (400 units)			
	Work in process, beginning (225 units):	$26,100		
	Direct materials added in current period	0	0a * $72	
	Conversion costs added in current period	$4,680		90a *$52
	Total from beginning inventory	$30,780		
	Started and completed (175 units)	$21,700	(175b*$72)+(175b*$52)	
	Total costs of units completed & transferred out	$52,480		
	Work in process, ending (100 units):			
	Direct materials	$7,200	100c*$72	
	Conversion costs	$2,600		50c*$52
	Total work in process, ending	$9,800		
	Total costs accounted for	$62,280		

aEquivalent units used to complete beginning work in process from Table 2.5, step 2.
bEquivalent units started and completed from Table 2.5, step 2
cEquivalent units in ending work in process from Table 2.5, step 2.

Under the FIFO method, the work done in the current period is assumed to first complete the 225 units in beginning work in process. The equivalent units of work done in March on the beginning work-in-process inventory are computed by multiplying the 225 physical units by the percentage of work remaining to be done to complete these units: 0% for direct materials, because the beginning work in process is 100% complete with respect to direct materials, and 40% for conversion costs, because the beginning work in process is 60% complete with respect to conversion costs. The results are 0 (0%*225) equivalent units of work for direct materials and 90 (40%*225) equivalent units of work for conversion costs.

Next, the work done in the current period is assumed to start and complete the next 175 units. The equivalent units of work done on the 175 physical units started and completed are computed by multiplying 175 units by 100% for both direct materials and conversion costs, because all work on these units is done in the current period.

Finally, the work done in the current period is assumed to start but leave incomplete the final 100 units as ending work in process. The equivalent units of work done on the 100 units of ending work in process are calculated by multiplying 100 physical units by 100% for direct materials (because all direct materials have been added for these units in the current period) and 50% for conversion costs (because 50% of conversion costs work has been done on these units in the current period).

Step 3: Compute Equivalent-Unit Costs. Table 2.6 shows the step 3 computation of equivalent-unit costs for work done in the current period only for direct materials and conversion costs. For example, we divide current-period conversion costs of $16,380 by current-period equivalent units for conversion costs of 315 to obtain cost per equivalent unit of $52.

Step 4: Summarize Total Costs to Account For. The total production costs column in Table 2.6 presents step 4 and summarizes the total costs to account for in March 2001 (beginning work in process and costs added in the current period) of $62,280, as described in the example data.

Step 5: Assign Costs to Units Completed and to Units in Ending Work in Process. Finally, Table 2.6 shows the step 5 assignment of costs under the FIFO method. The costs of work done in the current period are first assigned to the additional work done to complete the beginning work in process, then to the work done on units started and completed during the current period, and finally to the ending work in process. The easiest way to follow step 5 is to take each of the equivalent units calculated in Table 2.5, step 3, and attach dollar amounts to them. The goal is to determine the total cost of all units completed from beginning inventory and from work started and completed in the current period, and the costs of ending work in process done in the current period.

Only rarely is an application of pure FIFO ever encountered in process costing. As a result, it should really be called a modified or departmental FIFO method, because FIFO is applied within a department to compile the cost of units transferred out, but the units transferred in during a given period usually are carried at a single average unit cost as a matter of convenience. For example, the average cost of units transferred out of the Assembly Department is $52,480/400 units = $131.20 per DG-

19 unit. The Assembly Department uses FIFO to distinguish between monthly batches of production. The succeeding department, testing, however, costs these units at one average unit cost ($131.20 in this illustration). If this averaging were not done, the attempt to track costs on a pure FIFO basis throughout a series of processes would be unduly cumbersome.

2.3.1.5 Comparison of Weighted-Average and FIFO Methods

The following table summarizes the costs assigned to units completed and to units still in process under the weighted-average and FIFO process-costing methods for our example:

	Weighted Average (from Table 2.4)	**FIFO (from Table 2.6)**	**Difference**
Cost of units completed and transferred out	$52,000	$52,480	(+)$480
Work in process, ending	$10,280	$9,800	(-)$480
Total cost accounted for	$62,280	$62,280	

The weighted-average ending inventory is higher than the FIFO ending inventory by $480, or 4.9% ($480 / $9,800). This is a significant difference when aggregated over the many thousands of products that Global Defence makes. The weighted-average method in our example also results in lower cost of goods sold and hence higher operation income and higher income taxes than does the FIFO method. There are differences in equivalent-unit costs of beginning inventory and work done during the current period account for the differences in weighted-average and FIFO costs. Recall from the data that direct materials costs per equivalent unit in beginning work-in process inventory is $80, and conversion costs per equivalent unit in beginning work-in-process inventory is $60. These costs are greater than the $72 direct materials and $52 conversion costs per equivalent unit of work done during the current period. This reduction could be due to a decline in the prices of direct materials and conversion cost inputs or could be a result of Global Defence becoming more efficient.

For the Assembly Department, FIFO assumes that all the higher-cost units from the previous period in beginning work in process are the first to be completed and transferred out of the process, and ending work in process consists of only the lower-cost current-period units. The weighted-average method however, smoothes out cost per equivalent unit by assuming that more of the lower-cost units are completed and transferred out, and some of the higher-cost units are placed in ending work in process. Hence, in this example, the weighted-average method results in a lower cost of units completed and transferred out and a higher ending work-in-process inventory relative to FIFO.

Cost of units completed and hence operating income can differ materially between the weighted-average and FIFO methods when the direct materials or conversion costs per unit vary significantly from period to period, and the physical inventory levels of work in process are large in relation to the total number of units transferred out of the process. Thus, as companies move toward long-term procurement contracts that reduce differences in unit costs from period to period, and reduce inventory levels, the difference in cost of units completed under the weighted-average and FIFO methods will decrease.

Managers need information from process-costing systems to aid them in pricing and product-mix decisions and to provide them with feedback about their performance. The major advantage of FIFO is that it provides managers with information about changes in the costs per unit from one period to the next. Managers can use this information to evaluate their performance in the current period compared to a benchmark or compared to their performance in the previous period. By focusing on and the costs of work done during the current period, the FIFO method provides useful information for these planning and control purposes. The weighted-average method merges unit costs from different periods and so obscures period-to-period comparisons. The major advantages of the weighted-average method, however, are its computational simplicity and its reporting of a more representative average unit cost when input prices fluctuate markedly from month to month.

Note that unlike in job-costing systems, activity-based costing has less applicability in process-costing environments, because products are homogeneous and hence use resources in a similar way. Furthermore, each process; assembly, testing, and so on corresponds to the different activities. Managers reduce the costs of activities by controlling the costs of individual processes.

2.3.1.6 Standard-Costing Method of Process Costing

As we have mentioned, companies that use process-costing systems produce masses of identical or similar units of output. Setting standards for quantities of inputs needed to produce output is often relatively straightforward in such companies. Standard costs per input unit may then be assigned to these physical standards to develop standard costs per output unit.

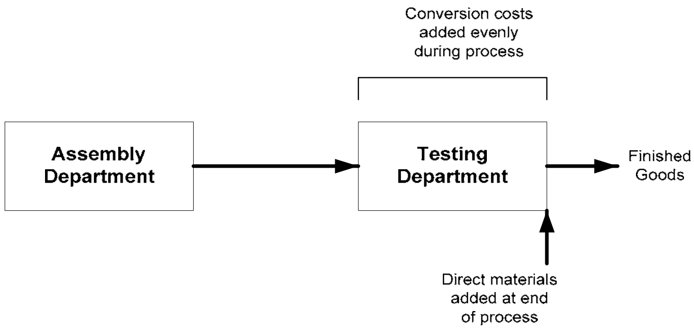
The weighted-average and FIFO methods become very complicated when used in process industries that produce a wide variety of similar products. For example, a steel-rolling mill uses various steel alloys produces sheets of various sizes and of various finishes. Both the items of direct materials and the operations performed are relatively few. But used in various combinations, they yield such a wide variety of products that inaccurate costs for each product result if the broad averaging procedure of actual process costing is used. Similarly, complex conditions are frequently found, for example, in plants that manufacture rubber products, textiles, ceramics, paints, and packaged food products. The standard-costing method of process costing is especially useful in these situations.

Under the standard-costing method, teams of design and process engineers, operations personnel, and management accountants determine separate standard or equivalent-unit costs on the basis of the different technical processing specifications for each product. Identifying standard costs for each product overcomes the disadvantage of costing all products at a single average amount, as under actual costing.

2.3.1.7 Transferred-In Costs in Process Costing

Many process-costing systems have two or more departments or processes in the production cycle. As units move from department to department, the related costs are also transferred by monthly journal entries. If standard costs are used, the accounting for such transfers is relatively simple. However, if the weighted-average or FIFO method is used, the accounting can become more complex. We now extend our Global Defence, Inc., example to the Testing Department. As the assembly process is completed, the Assembly Department of Global Defence immediately transfers DG-19 units to its Testing Department. Here the units receive additional direct materials, such as crating and other packing materials to prepare the units for shipment, at the end of the process. Conversion costs are added evenly during the Testing Department's process. As units are completed in Testing, they are immediately transferred to Finished Goods.

The following graphic summarizes these facts:



Transferred-in costs (also called *previous department costs*) are the costs incurred in a previous department that are carried forward as the product's cost when it moves to a subsequent process in the production cycle. That is, as the units move from one department to the next, their costs are transferred with them. Thus, computations of Testing Department costs consist of transferred-in costs as well as the direct materials and conversion costs added in Testing.

Transferred-in costs are treated as if they are a separate type of direct material added at the beginning of the process. In other words, when successive departments are involved, transferred units from one department become all or a part of the direct materials of the next department; however, they are called transferred-in costs, not direct materials costs.

2.3.1.8 Transferred-In Costs and the Weighted-Average Method

To examine the weighted-average process-costing method with transferred-in costs, we use the five step procedure described earlier to assign costs of the Testing Department to units completed and transferred out and to units in ending work in process. Table 2.7 shows steps 1 and 2. The computations are basically the same as the calculations of equivalent units under the weighted-average method for the Assembly Department in Table 2.3, except for the addition of transferred-in costs. The units are fully completed as to transferred-in costs because these costs are simply carried forward from the previous process. Note, however, that direct materials costs have a zero degree of completion in both the beginning and ending work-in-process inventories because, in Testing, direct materials are introduced at the end of the process.

Table 2.7 Steps 1 and 2: Summarize output in physical units and compute equivalent units weighted - average method of process costing testing department of Global Defence, Inc., for March 2001

Flow of Production	(Step 1) Physical Units	(Step 2) Equivalent Units: Transferred-In Costs	Direct Materials	Conversion Costs
		(work done before current period)		
Work in process, beginning	240			
Transferred-in during current period	400			
To account for	640			
Completed and transferred out during current period:				
From beginning work in process[a]	240			
240*(100% - 100%); 240*(100% - 0%)				
240*(100% - 62.5%)		0	240	90
Started and completed	200[b]			
200*100%; 200*100%; 200*100%		200	200	200
Work in process, ending[c]	200			
200*100%; 200*0%; 200*80%		200	0	160
Accounted for	640			
Work done in current period only		400	440	450

[a]Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 62.5%.
[b]440 physical units completed and transferred out minus 240 physical units completed and transferred out from beginning work-in-process inventory
[c]Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%

Table 2.8 describes steps 3, 4, and 5 for the weighted-average method. Note that beginning work in process and work done in the current period are combined for purposes of computing equivalent-unit costs for transferred-in costs, direct materials, and conversion costs.

Table 2.8 Steps 3, 4 and 5: Compute equivalent-unit costs, summarize total costs to account for, and assign costs to units completed and to units in ending work in process weighted-average method of process costing testing department of Global Defence, Inc, for March 2001

			Total Production Costs	Transferred-In Costs	Direct Materials	Conversion costs
(Step 3)	Work in process, beginning		$51,600	$33,600	$0	$18,000
	Costs added in current period	Costs	$113,800	$52,000	$13,200	$48,600
	incurred to date	Divide by		$85,600	$13,200	$66,600
	equivalent units of work done	to date		/640	/440	/600
	(Table 2.7)			$133.75	$30	$111
(Step 4)	Total costs to account for		$165,400			
(Step 5)	Assignment of costs:					
	Completed and transferred out (440 units)		$120,890	(440[a]*$133.75) + (440[a]*$30) + (440[a]*$111)		
	Work in process, ending (200 units):					
	Transferred-in costs		$26,750	200[b]*$133.75		
	Direct materials		0		0[b]*$30	
	Conversion costs		$17,760			160[b]*$111
	Total work in process, ending		$44,510			
	Total costs accounted for		$165,400			

[a]Equivalent units used to complete beginning work in process from Table 2.7, step 2.
[b]Equivalent units started and completed from Table 2.7, step 2

2.3.1.9 Transferred-In Costs and FIFO Method

To examine the FIFO process-costing method with transferred-in costs, we again use the five-step procedure. Table 2.9 shows steps 1 and 2. Other than considering transferred-in costs, the computations of equivalent units are basically the same as those under the FIFO method for the Assembly Department shown in Table 2.5.

Table 2.10 describes steps 3, 4, and 5. Note that the costs per equivalent unit for the current period in step 3 are only calculated on the basis of costs transferred in and work done in the current period. In steps 4 and 5, the total costs to account for and accounted for of $165,880 under the FIFO method differ from the corresponding amounts under the weighted-average method of $165,400 because of the different costs of completed units transferred-in from the Assembly Department under the two methods ($52,480 under FIFO and $52,000 under weighted average).

Table 2.9 Steps 1 and 2: Summarize output in physical units and compute equivalent units FIFO method of process costing, testing department of Global Defence, Inc., for March 2001

Flow of Production	(Step 1) Physical Units	(Step 2) Equivalent Units: Transferred-In Costs	Direct Materials	Conversion Costs
		(work done before current period)		
Work in process, beginning	240			
Transferred-in during current period	400			
To account for	640			
Completed and transferred out during current period:				
From beginning work in process[a]	240			
240*(100% - 100%); 240*(100% - 0%)				
240*(100% - 62.5%)		0	240	90
Started and completed	200[b]			
200*100%; 200*100%; 200*100%		200	200	200
Work in process, ending[c]	200			
200*100%; 200*0%; 200*80%		200	0	160
Accounted for	640			
Work done in current period only		400	440	450

[a]Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 62.5%.
[b]440 physical units completed and transferred out minus 240 physical units completed and transferred out from beginning work-in-process inventory
[c]Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%

Table 2.10 Steps 3, 4, and 5: Compute equivalent-unit costs, summarize total costs to account for, and assign costs to units completed and to units in ending work in process FIFO method of process costing, testing department of Global Defence, Inc., for March 2001.

		Total Production Costs	Transferred-In Costs	Direct Materials	Conversion costs
			(costs of work done before current period)		
	Work in process, beginning	$51,600			
(Step 3)	Costs added in current period	$114,280	$52,480	$13,200	$48,600
	Divide by equivalent units of work done in current period (Table 2.3)		/400	/440	/450
	Cost per equivalent unit of work done in current		$131.20	$30	$108
(Step 4)	Total costs to account for	$165,880			
(Step 5)	Assignment of costs:				
	Completed and transferred out (440 units)				
	Work in process, beginning (240 units):	$51,600			
	Transferred-in costs added in current period	0	0[a]*$131.20		
	Direct materials added in current period	$7,200		240[a]*$30	
	Conversion costs added in current period	$9,720			90[a]*$108
	Total from beginning inventory	$68,520			
	Started and completed (200 units)	$53,840	(200[b]*$131.20) + (200[b]*$30) + (200[b]*$108)		
	Total costs of units completed and	$122,360			
	Work in process, ending (200 units):				
	Transferred-in costs	$26,240	200[c]*$131.20		
	Direct materials	0		0[c]*$30	
	Conversion costs	$17,280			160[c]*$108
	Total work in process, ending	$43,520			
	Total costs accounted for	$165,880			

[a]Equivalent units used to complete beginning work in process from Table 2.9, step 2.
[b]Equivalent units started and completed from Table 2.9, step 2
[c]Equivalent units in ending work in process from Table 2.9, step 2.

Remember that in a series of interdepartmental transfers, each department is regarded as being separate and distinct for accounting purposes. All costs transferred in during a given accounting period are carried at one unit-cost figure, as described when discussing modified FIFO, regardless of whether previous departments used the weighted-average method or the FIFO method.

2.3.1.10 Common Mistakes with Transferred-In Costs

Here are some common pitfalls to avoid when accounting for transferred-in costs:

1. Remember to include transferred-in costs from previous departments in your calculations.
2. In calculating costs to be transferred on a FIFO basis, do not overlook the costs assigned at the beginning of the period to units that were in process but are now included in the units transferred. For example, do not overlook the $51,600 in Table 2.10.
3. Unit costs may fluctuate between periods. Therefore, transferred units may contain batches accumulated at different unit costs. For example, the 400 units transferred in at $52.480 in Table 2.10 using the FIFO method consists of when these units were worked on in the Assembly Department. Remember, however, that when these units are transferred to the Testing Department, they are cost at one average unit cost of $131.20 ($52,480/400) as in Table 2.10.
4. Units may be measured in different terms in different departments. Consider each department separately. For example, unit costs could be based on kilograms in the first department and litres in the second department. Accordingly, as units are received in the second department, their measurements must be converted to litres.

2.3.2 Job Costing

In this system, the cost object is an individual unit, batch, or lot of a distinct product or service called a job. The product or service is often custom-made, such as specialized machinery made at Hitachi, construction projects managed by Bechtel. Corporation, repairs jobs done at Sears Automotive Stores, and advertisements produced by Saatchi and Saatchi. Each special machine made by Hitachi is unique and distinct. Similarly an advertising campaign for one client at Saatchi and Saatchi differs greatly from advertising campaigns for other clients. Because the products and services are distinct, job costing systems can accumulate costs by each individual product, service, or job.

Job order costing is fundamental to managerial accounting. It differs from Process costing in that the flow of costs is traced by job instead of by process. For instance, think of an assembly line making cookies. Job order costing would track how much material is placed in each cookie. Process costing tracks the amount of dough used the baking time, and other aspects of the process of making cookies. Job costing is typically used for special orders or when the product made is unique. Process costing is used when the products are more homogeneous in nature.

In a job costing system, costs are accumulated by job. For a typical job, direct material and direct labour are tracked at their actual values. These are recorded and tracked until the job is completed. Overhead is applied either by using a rate based on direct labour hours, direct labour costs, direct material costs or by using an Activity Based Costing (ABC) cost driver. In either case, once overhead is added, the total cost for the job can be determined. Upon completion, the costs are transferred out of Work in Process to Finished Goods (Cost of Goods Sold for service industries).

2.3.2.1 Job Costing in Manufacturing

We illustrate job costing using the example of Robinson Company, which operates at capacity to manufacture and install specialized machinery for the paper-making industry at its Green Bay, Wisconsin, plant. In its job-costing system, Robinson accumulates costs incurred on a job in all parts of the value chain-R&D, design, manufacturing, marketing, distribution, and customer service. To make a machine, Robinson procures some of the components from outside suppliers and makes others itself. A key part of each of Robinson's jobs is assembling and installing the machine at customer sites; integrating it with the customer's other machines and processes, and ensuring its effective functioning.

The specific job we will focus on is the manufacture and installation of a small pulp machine for Western Pulp and Paper Company in the year 2000, for a price of $15,000. A key issue for Robinson in determining this price is the cost of doing the job. Knowledge about its own costs helps Robinson price jobs to make a profit and to make informed estimates of the costs of future jobs.

Consider Robinson's *actual costing* system, a job-costing system that uses actual costs to determine the cost of individual jobs. Actual costing is a method of a job costing that traces direct costs to a cost object by using the actual direct-cost rate(s) times the actual quantity of the direct-cost input(s) and allocates indirect costs based on the actual indirect-cost rate(s) times the actual quantity of the cost-allocation base(s).

2.3.2.2 General Approach to Job Costing

We present a seven-step procedure to assign actual costs to individual jobs. This procedure applies equally to job costing in the manufacturing, merchandising, and service sectors.

Step1. Identify the Chosen Cost Object(s): The cost object in the Robinson Company example is Job Number WPP 298, manufacturing a pulp machine for the Western Pulp and Paper Company in the year 2000.

Step2. Identify the Direct Costs of the Job: Robinson identifies two direct manufacturing cost categories – direct materials and direct manufacturing labour. Direct materials costs for the Western Pulp and Paper Company job are $4,606, while direct manufacturing labour costs are $1,579.

Step3. Select the Cost-Allocation Base(s) to use for Allocating Indirect Costs to the Job: Indirect manufacturing costs are costs that cannot be traced to specific jobs. Yet completing various jobs would be impossible without incurring indirect costs such as supervision, manufacturing engineering, utilities and repairs. These costs must be allocated to jobs. Different jobs require different quantities of indirect resources. The objective of allocating indirect costs is to measure the underlying usage of indirect resources by individual jobs.

Robinson chooses direct manufacturing labour-hours as the only allocation base for linking all indirect manufacturing costs to jobs, since Robinson believes that direct manufacturing labour-hours measures how individual jobs use manufacturing overhead resources, such as salaries paid to supervisors, engineers, production support staff, and quality management staff. There is a strong cause-and-effect relationship between the indirect manufacturing resources demanded and the direct manufacturing labour-hours required by individual jobs. In the year 2000, Robinson records 27,000 actual direct manufacturing labour-hours.

Step4. Identify the Indirect Costs Associated with Each Cost-Allocation Base: Because Robinson believes that a single cost-allocation base, direct manufacturing labour-hours, can be used to allocate indirect manufacturing costs to products, it creates a single cost pool called *manufacturing overhead costs.* This pool represents the indirect costs of the Green Bay Manufacturing Department that are difficult to trace directly to individual jobs. In 2000, actual indirect manufacturing costs total $1,215,000.

Step5. Compute the Rate Per unit of Each Cost-Allocation Base Used to Allocate Indirect Costs to the Job: For each cost pool, the indirect-cost rate is calculated by dividing total overhead costs in the pool by the total quantity of the cost-allocation base. Robinson calculates the allocation rate for its single manufacturing overhead cost pool as follows:

$$Actual\ \ indirect-\cos t\ \ rate = \frac{Actual\ \ total\ \ \cos ts\ \ in\ \ indirect-\cos t\ \ pool}{Actual\ \ total\ \ quantity\ \ of\ \ \cos t-allocation\ \ base}$$

$$= \frac{\$1,215,000}{27,000\ \ direct\ \ manufacturing\ \ labour-hours}$$

$$= \$45\ \ per\ \ direct\ \ manufacturing\ \ labour-hour$$

Step6. Compute the Indirect Costs Allocated to the Job: The indirect costs of a job are computed by multiplying the actual quantities of the different allocation bases (one for each cost pool) used to complete a job by their respective indirect cost rates. To make the pulp machine, Robinson uses 88 direct manufacturing labour-hours, the cost-allocation base for its only indirect-cost pool. Indirect costs allocated to the pulp machine job equal $3,960 ($45 per direct manufacturing labour-hour*88 hours).

Step7. Compute the Total Cost of the Job by Adding All Direct and Indirect Costs Assigned to It: The cost of the pulp machine job for Western Pulp is $10,145.

Direct manufacturing costs		
Direct materials	$4,606	
Direct manufacturing labour	$1,579	$6,185
Indirect manufacturing costs ($45*88 direct manufacturing labour-hours)		$3,960
Total manufacturing costs of job		$10,145

Recall that Robinson was paid $15,000 for the job. Thus, the actual costing system shows a gross margin of $4,855 ($15,000-$10,145) and a gross margin percentage of 32.37% ($4,855 ÷ $15,000).

Robinson can use the gross margin and gross margin percentage calculations to compare profitability across various jobs and identify the most profitable types of jobs for its sales force to target. At the same time, Robinson can examine the reasons why some jobs show low profitability. Job cost analysis provides crucial information for judging performance and making future improvements.

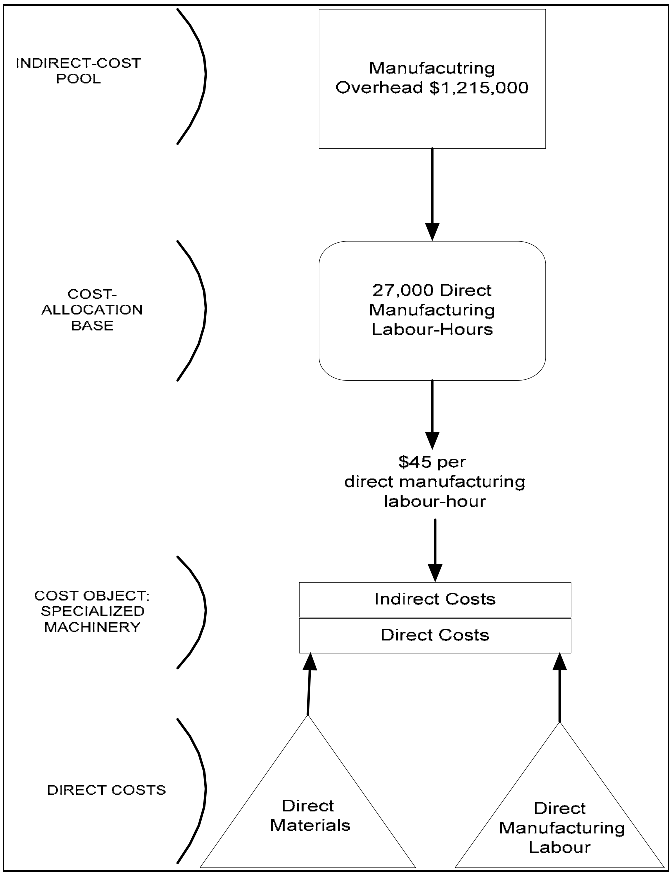


Figure 2.5 Job-costing overview for determining the manufacturing costs of jobs' at Robinson Co.

Figure 2.5 presents an overview of the Robinson Company job-costing system. This exhibit includes the five building block concepts-cost object, direct costs of a cost object, indirect costs of a cost object, cost pool, and cost-allocation base. Costing-system overviews like Figure 2.5 are important learning tools. We urge you to sketch one when you need to understand a costing system in manufacturing, service, or merchandising companies. Note the correspondence between the figure diagram and the cost of the pulp machine job described in step7. Figure 2.5 shows two direct-cost categories (direct materials and direct manufacturing labour) and one indirect-cost pool (manufacturing overhead) used to allocate indirect costs. The costs in step7 also have three dollar amounts that correspond to two direct and one indirect cost categories.

2.3.2.3 Two Major Cost Objects: Products and Departments

As determined, all costs are recorded to help individuals make decisions. Cost objects are chosen to aid decision making. The Figure 2.5 overview focuses on one major cost object of an accounting system: *products.* Managers also focus on a second major cost object: responsibility centres, which are parts, segments, or subunits of an organization whose managers are accountable for specified sets of activities. Examples are departments, groups of departments, divisions, or geographic territories. Manufacturing job-costing system assign costs first to responsibility centres and then to jobs.

The most commonly encountered responsibility centre is a department. Identifying department costs helps managers to control costs for which they are responsible. It also enables senior management to evaluate the performance of subordinates and the performance of subunits of the organization as economic investments. For example, Robinson identifies manufacturing as a critical activity and the Manufacturing Department as an important cost object. The costs of the Manufacturing Department include all costs of materials; manufacturing labour; and other manufacturing costs such as supervision, engineering, and production and quality control.

Note especially that costs such as supervision, engineering, and production and quality control that were considered indirect or overhead costs when costing individual jobs are direct costs of the Manufacturing Department since although these costs are difficult to trace to individual jobs within the Manufacturing Department in an economically feasible way, they are easily identified with and traced to the Manufacturing Department itself.

2.3.2.4 Time Period Used to Compute Indirect-Cost Rates

Robinson Company computes indirect-costs rates in step 5 on the basis of an annual period. If it used weekly or monthly rates, Robinson would be able to calculate actual costs of jobs much earlier and not have to wait until the end of the year. There are two important reasons for using longer time periods to calculate indirect-cost rates.

1. The *numerator reason* (indirect cost pool): The shorter the period, the greater the influence of seasonal patterns on the level of costs. For instance, if indirect-cost rates were calculated each month, costs of heating (including in the numerator) would be charged only to winter production. The use of an annual period incorporates the effect of all four seasons into a single indirect-cost rate.

Levels of total indirect costs are also affected by no seasonal erratic costs. Examples include costs incurred in a particular month that benefit operations during future months: repairs and maintenance of equipment, and vacation and holiday pay. If monthly indirect-cost rates were counted, jobs done in a month with high no seasonal erratic costs would be loaded with these costs.

2. The *denominator reason* (quantity of the allocation base): Another rationale for longer periods is the need to spread monthly fixed indirect costs over fluctuating levels of output. Some indirect costs may be variable with respect to the cost-allocation base, whereas other indirect costs are fixed.

Suppose a company schedules its production to correspond with a highly seasonal sales pattern. Assume the following mix of variable indirect costs (such as supplies, repairs and indirect manufacturing labour) and fixed indirect costs (plant depreciation and engineering support):

	Indirect Costs			Direct Manufacturing Labour-Hours	Allocation Rate Per Direct Manufacturing Labour-Hour
	Variable 1	Fixed 2	Total 3	(4)	(5)=(3):(4)
High-output month	$40.000	$60.000	$100.000	3.200	$31.25
Low-output month	10.000	60.000	70.000	800	$87.50

Note that the variable indirect costs change in proportion to changes in direct manufacturing labour-hours. Therefore, the variable indirect-cost rate is the same in both the high-output and low-output months $(\$40,000 \div 3200 = \$12.50;\ \ \$10,000 \div 800 = \$12.50)$.

Because of the fixed costs of 60,000, monthly total indirect-cost rates vary sizably-from \$31.25 per hour to \$87.50 per hour. Few managers believe that identical jobs done in different months should be allocated indirect-cost charges per hour that differ so significantly (\$87.50:\$31.25=280%). In our example, management has committed itself to a specific level of capacity far beyond a mere 30 days per month. An average, annualized rate based on the relationship of total annual indirect costs to the total annual level of output will smooth out the effect of monthly variations in output levels.

2.3.3 Normal Costing

The difficulty of calculating actual indirect-cost rates on a weekly or monthly basis means that managers cannot calculate the actual costs of jobs as they are completed. Managers often want a close approximation of the manufacturing costs of various jobs on a timely basis, not just at the end of the year. Managers want these costs for various ongoing uses, including choosing which job to emphasize or deemphasize, pricing jobs, managing costs, and preparing interim financial statements. Because management benefits form having immediate access to the costs of jobs, few companies wait until the *actual* manufacturing overhead is finally known before allocating overhead costs in computing the costs of jobs. Instead, a *predetermined* or *budgeted* indirect-cost rate is calculated for each cost pool at the beginning of a fiscal year, and overhead costs are allocated to jobs as work progresses. For the numerator and denominator reasons described in the preceding section, the budgeted indirect-cost rate is computed for each cost pool using the budgeted *annual* indirect cost and the budgeted *annual* quantity of the cost-allocation base. The use of budgeted indirect-cost rates gives rise to *normal costing*.

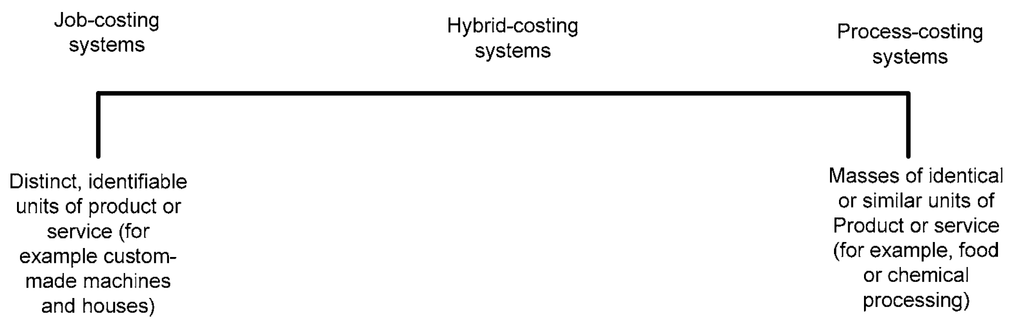
Normal costing is a costing method that traces direct costs to a cost object by using the actual direct-cost rate(s) times the actual quantity of the direct-cost input(s) and allocates indirect costs based on the budgeted indirect-cost rate(s) times the actual quantity of the cost-allocation base(s). Note that both actual costing and normal costing trace direct costs to jobs in the same way. The actual quantities and actual rates of direct materials and direct manufacturing labour used on a job are known from the source documents as the work is done. The only difference between actual costing and normal costing is that actual costing uses an *actual* indirect-cost rate(s),whereas normal costing uses a budgeted indirect cost-rate(s) to cost jobs. Figure 2.5 summarizes the differences between the actual costing and normal costing methods (Hongren et al, 2001).

Table 2.11 Actual costing and normal costing method

	Actual Costing	**Normal Costing**
Direct Costs	Actual direct-cost rate(s)* Actual quantity of direct-cost input(s)	Actual direct-cost rate(s)* Actual quantity of direct-cost input(s)
Indirect Costs	Actual indirect-cost rate(s)* Actual quantity of cost-allocation base(s)	Budgeted indirect-cost rate(s)* Actual quantity of cost-allocation base(s)

2.3.4 Hybrid Costing Systems

Product-costing systems do not always fall neatly into the categories of job costing or process costing. A hybrid-costing system blends characteristics from both job-costing systems and process-costing systems. Job-costing and process-costing systems are best viewed as the ends of a continuum:



Product-costing systems must often be designed to fit the particular characteristics of different production systems. Many production systems are a hybrid – they have some features of custom-order manufacturing and other features of mass-production manufacturing. Manufacturers of a relatively wide variety of closely related standardized products tend to use a hybrid-costing system. Consider Ford Motor Company. Automobiles may be manufactured in a continuous flow, but individual units may be customized with a special combination of engine size, transmission, music system, and so on. Companies develop hybrid-costing systems in such situations. The concepts in Action feature describe the evolution of a hybrid-costing system.

CHAPTER THREE

ACTIVITY-BASED COSTING ANALYSIS

Gradually, managerial accountants have become aware of the vanishing relevance of the numbers they produce for end-users and decision makers. In 1994, Professor John K. Shank of Dartmouth College said at the Institute of Management Accountants' 75th Anniversary Conference in New York City: "Traditional accounting is at best useless, and at worst dysfunctional and misleading". Those are pretty strong words. The audience was silent. But Shank continued to describe the imminent "sea change" that will occur in managerial accounting. He described how cost management will be to the 1990s what total quality management was to the 1980s (Cokins, 1996).

Activity-based costing (ABC) is part of that sea change. ABC is not a replacement for the traditional general ledger accounting. Rather, it is a translator or overlay, as Figure 3.1, that lies between the cost accumulators or the expenditure account balances in the general ledger and the end-users who apply cost data in decision making. ABC converts inert cost data into relevant information so that the users can take action (Cokins, 1996).

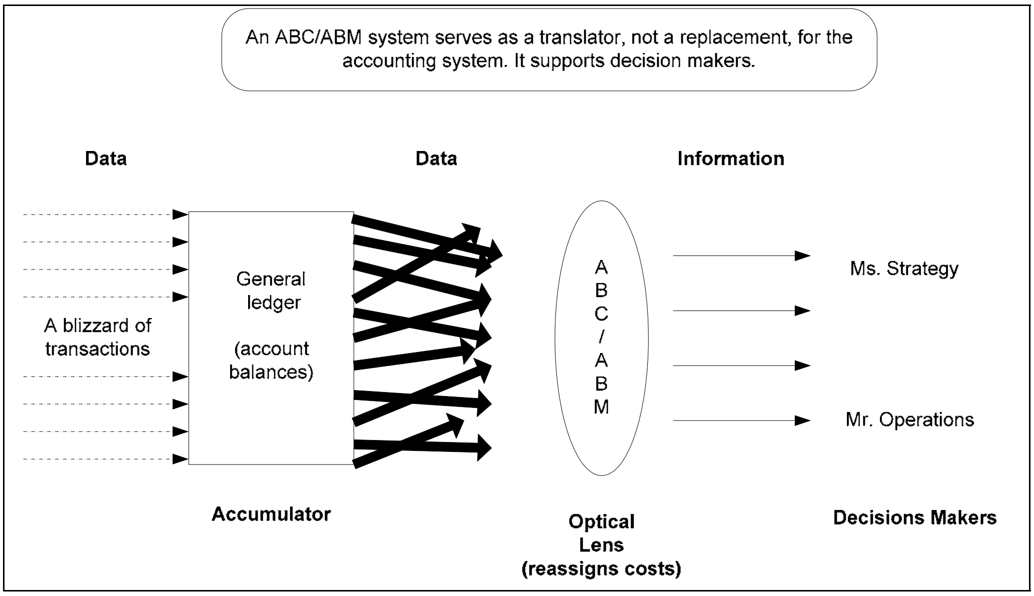


Figure 3.1 ABC/ABM reassign costs

ABC initially captured managements' attention in the early 1980s as a superior product and service costing technique. ABC removed the grotesquely distorting effect of broad-brushed overhead allocators, like labour hours or sales dollars. It replaced cost allocations with substantially more realistic cost assignments and consequently much greater accuracy. Then, in the 1990s, managers discovered that the same data they generated to recompute their ABC product or service costs could also be used to gain better insights and manage their product design and process design costs. It could also be used for performance measurements that align with business processes.

ABC is becoming increasingly more important for both identifying improvement opportunities and measuring the realized benefits of performance initiatives on an after-the-fact basis. Today's traditional costing practices show very little about the costs of cross-functional business processes and even less about where the non-value-added costs are. Further, when asked to detail their actual cost savings or cost avoidance realized from a project, managers cannot adequately do so.

Beyond thinking of ABC as a much better costing tool is recognizing it as truly an organizational methodology. Senior managers have been frustrated by the difficulties in bringing about change within their organization, and ABC data is paying an important role with it.

This chapter will present the philosophy, implementation steps, calculation methodology and some success/failure factors of implementing ABC.

3.1 History of Activity Based Costing

Traditionally cost accountants had arbitrarily added a broad percentage of expenses onto the direct costs to allow for the indirect costs.

However as the percentages of indirect or overhead costs had risen, this technique became increasingly inaccurate because the indirect costs were not caused equally by all the products. For example, one product might take more time in one expensive machine than another product, but since the amount of direct labour and materials might be the same, the additional cost for the use of the machine would not be recognized when the same broad 'on-cost' percentage is added to all products. Consequently, when multiple products share common costs, there is a danger of one product subsidizing another.

The concepts of ABC were developed in the manufacturing sector of the United States during the 1970s and 1980s. During this time, the Consortium for Advanced Management-International, now known simply as CAM-I, provided a formative role for studying and formalizing the principles that have become more formally known as Activity-Based Costing.

Robin Cooper and Robert S. Kaplan, proponent of the Balanced Scorecard, brought notice to these concepts in a number of articles published in Harvard Business Review beginning in 1988. Cooper and Kaplan described ABC as an approach to solve the problems of traditional cost management systems. These traditional costing systems are often unable to determine accurately the actual costs of production and of the costs of related services. Consequently managers were making decisions based on inaccurate data especially where there are multiple products.

Instead of using broad arbitrary percentages to allocate costs, ABC seeks to identify cause and affect relationships to objectively assign costs. Once costs of the activities have been identified, the cost of each activity is attributed to each product to the extent that the product uses the activity. In this way ABC often identifies areas of high overhead costs per unit and so directs attention to finding ways to reduce the costs or to charge more for costly products.

Activity-based costing was first clearly defined in 1987 by Robert S. Kaplan and W. Bruns as a chapter in their book Accounting and Management: A Field Study Perspective. They initially focused on manufacturing industry where increasing technology and productivity improvements have reduced the relative proportion of the direct costs of labour and materials, but have increased relative proportion of indirect costs. For example, increased automation has reduced labour, which is a direct cost, but has increased depreciation, which is an indirect cost.

Like manufacturing industries, financial institutions also have diverse products and customers which can cause cross-product cross-customer subsidies. Since personnel expenses represent the largest single component of non-interest expense in financial institutions, these costs must also be attributed more accurately to products and customers. Activity based costing, even though originally developed for manufacturing, may even be a more useful tool for doing this.

3.2 Definition of Activity Based Costing

The overarching issue with ABC/ABM involves its perception as just another way to spin financial data rather than its use as mission-critical managerial information. The Information Age we are entering can be mind-boggling. In our future, as technology advances, so will the demand to access massive amounts of relevant information. The companies and organizations that survive will be those that can answer these questions (Cokins, 1996):

> "How do we access all this data?"
>
> "What do we do with it?"
>
> "How do we shape the data and put into a form with which we can work?"
>
> "What will happen when we apply technologies developed during the Information Age?"

Clearly, as information technology evolves, organizations will increase their effectiveness. Further, as markets change, companies and organizations will run into global competitors that increasingly look to information and information technology for competitive advantage. ABC/ABM is involved in this broad arena of "outsmartsmanship."

What are today's burning issues with implementing ABC/ABM? The answers depend on the starting point of an organization. There appear to be three sequenced starting points: (1) one for beginners, (2) one for pilots, and (3) one for advanced, mature users. Each starting point is unique and discussed below.

1. Since the late 1980s, the concepts of ABC/ABM have been sufficiently explained in seminars and published articles; by now most financial managers and many operations personnel adequately understand what ABC/ABM is. That is not the problem anymore for organizations waiting to begin implementation of ABC/ABM. The beginners' key issue today is how to get started. Their employees intuitively feel that their financial reporting both blocks the view of true costs across business processes as well as distorts product and service costs. In sum, employees have few reliable facts, severely inaccurate product and service costs, and little true cost visibility. Beginner organizations can't get started on ABC/ABM for a variety of reasons, including some users' fear of accountability as well as misconceptions that ABC/ABM involves a mud slide of data with horrendous updating and reporting problems.

2. The issue with the ABC/ABM pilot starting point involve avoiding implementation failure. Over these past few years, the jungle drums have been beating between other companies describing the lack of success with ABC/ABM, and consequently, newly formed project teams are cautious. Companies that have ventured into an ABC/ABM pilot are motivated to move away from their traditional cost system and the bad decisions it is causing; but they also appreciate that when they do change, there are preventions they can take to assure a successful implementation.

3. The third starting point is that of the advanced, mature users. These companies usually have two or more pilots that have been in progress for well over a year. They are moving toward wide employee acceptance of his new form of financial data and increasing user for more frequent reporting, for selective greater detail, or for integration with other application software systems, like their customer order quotation systems, which are still harnessed to the old, flawed traditional cost data. The advanced users' key issue is how to migrate from their PC-based models that take periodic cost snapshots to a permanent, fully-integrated production ABC/ABM system.

This is no small task because the pilots were championed by strong "pioneer-types" of individuals who raced the clock to maintain momentum and left little documentation behind when implementing their pilot. A permanent ABC/ABM production system must be repeatable and reliable, and this involves technical information systems personnel and their end-users, who we can refer to as the "settlers". Settlers like predictability and consistency. Settlers often feel like they are left behind to clean up the mess the pioneers created before they moved on to system integration of ABC/ABM.

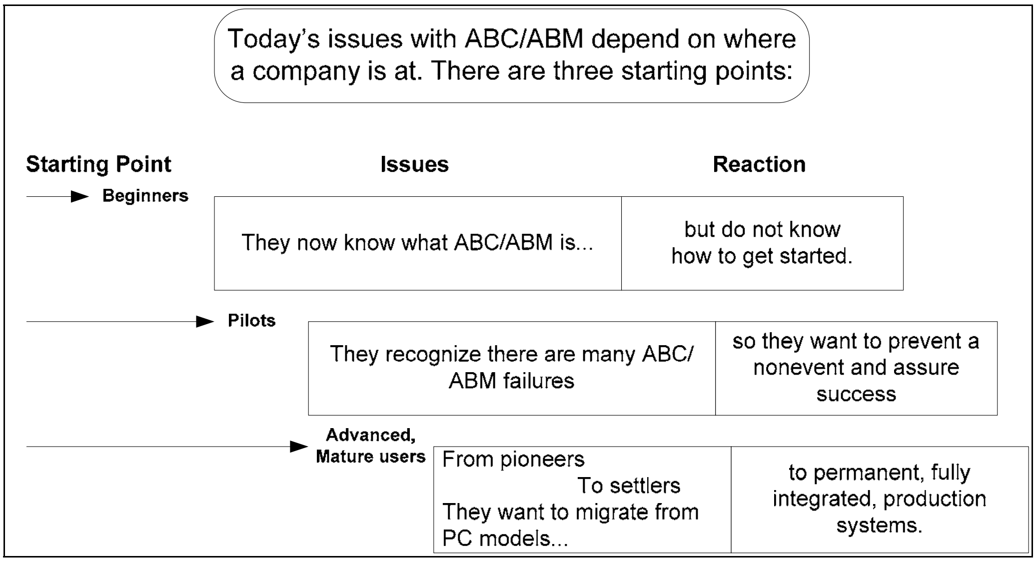


Figure 3.2 Three starting points for ABC/ABM

Regardless of a company's starting point with ABC/ABM, much more attention must be placed on stimulating the no accountants and end-users to buy into ABC/ABM concepts and data.

Jonathan B. Schiff, former editor of the Cost Management Group of the Institute of Management Accountants (IMA) monthly *Cost Management Update,* summarized ABC's take-off problem in the November 1993 issue. He described the acceptance of ABC/ABM as an imbalance between the supply and demand sides of an equation. The substantial increase in ABC/ABM training and development programs, mainly directed to finance and accounting managers, represents a hefty supply side of equation.

The demand side is the active stimulation of internal end-users to apply ABC/ABM information in their decisions and analyses. This has been weak. Without end-user interest on the demand side, the upgraded supplier will have difficulty integrating the new information into the end users' decision-making habits. If there is not a healthy relationship between the accountants and their internal customers, then merely upgrading the supply side could have a negligible effect on improving he organization's decision-making capabilities.

End users will assume no change, resulting in the same outputs as in the past – information that is late, difficult to understand, inaccurate, confusing, and overly complex.

The shame is it is only through the application of ABC/ABM technology, not the technology itself, that we get the full impact of any investment in better cost management techniques and information. One can only create value for customers by applying ABC/ABM.

Simply put, ABC/ABM has two groups operating too much in isolation from the other: The inventors and the end-users of the ABC/ABM technology. The end-users do not believe that the inventors understand their problem. And the inventors believe they are solving the end-users' problem. One possesses the need, while the other possesses the technology and know-how. This gap in communications, knowledge, and understanding must and will be closed through better collaboration.

In summary, there is no lack of issues for the ABC/ABM movement. The ABC/ABM method is certainly more correct than the traditional accounting system's: but there is so much more involved in creating wide acceptance and deploying its information.

3.2.1 Popular Business Improvements Approaches

Today organizations want business improvement programs that create value and ultimately bring profits to the bottom line. They want to convert carbon-based coal into diamonds. Companies appear less interested in improvement programs that are only value-enabling, and that only locate carbon. They want to value-creating programs.

Figure 3.3 lists five of the most popular business improvement approaches that many companies today are consciously or subconsciously applying. The diagram simply shows a corrective performance feedback loop that starts and ends with customers. It reveals that organizations try to focus their "4M" resources (manpower, machines, money and materials) to produce desired results while constantly overcoming obstacles and organizational residence.

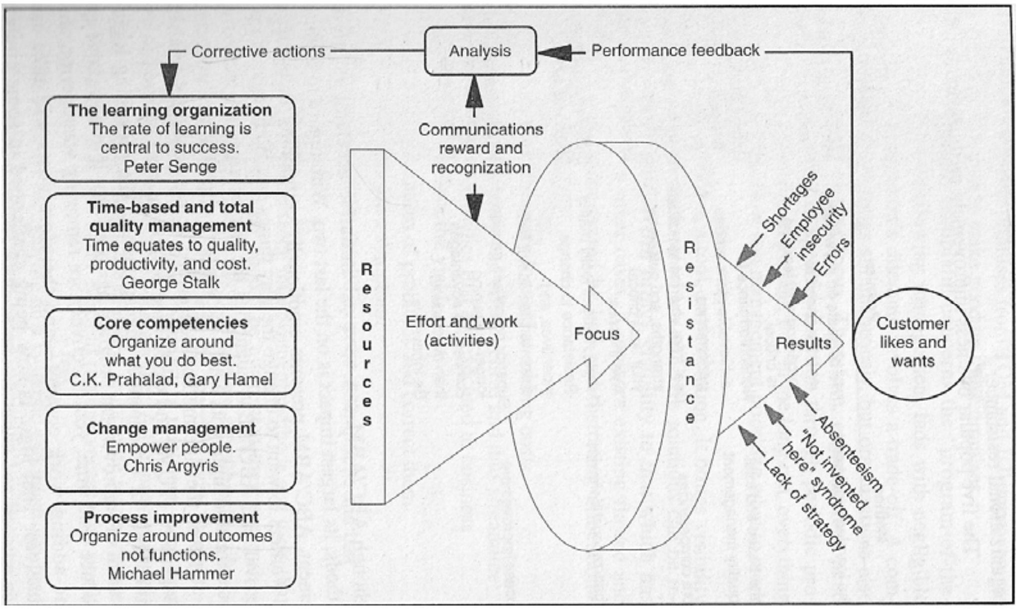


Figure 3.3 Five popular approaches to Business Improvement (Cokins, 1996)

The five popular business improvement methods are as follows:

Method	Premise	Thought Leader/Organization
The learning organization	We compete on knowledge and speed of organizational learning is critical	Peter Senge, Massachusetts Instute of Technology
Time-based and total quality management	Noncomformance to achievable plans erodes performance	Gearge Stalk, Boston Consulting Group, and Dr. W. Edwards Deming
Core competencies	Deal from your market-critical strengths, and outsource your less critical weakness	C.K. Prahalad, University of Michigan, and Gary Hamel, London Business
Organizational Behaviour	People matter. Really matter. Resistance of change, incentives, and empowerment is not fluff	Chris Argris, Harvard Business School
Process Improvement	Superior processes provide longer-sustaining competitive advantages than do products. Be innnovative.	Michael Hammer, formerly Massachusetts Institute of Technology

Although ABC/ABM can serve as “initiative accelerators” to all five methods, its largest impact is on the last two. With regard to change management, ABC/ABM presents emotionally compelling facts that stimulate workers to want to change the way things are with regard to process improvement, ABC/ABM quantifies the business process across the organizations and highlights where the waste or opportunities are located.

One of the five methods described above combines total quality management (TQM) and cycle-time reduction. The prevailing logic with this form of improvement program has been that if you improve quality or reduce lead time, you effectively are removing waste, error, and low value-adding work content – and therefore costs will take care of themselves. That logic is now being challenged in some circles, but debuting managerial philosophies can be like religious wars. ABC/ABM can help make good on some of the failed promises about TQM and JIT improvement programs.

A common employee complaint concerns the “program-of-the-month” approach that is, following management fads with negligible long-term impact. Management’s dilemma involves a trade-off: A company must be do lots of good things simultaneously, but organizations also have a natural tendency to lose focus. Therefore, organizations need guidance and reinforcements of specific direction through periodic programs to emphasize something important; but, in the long run, everything is connected to everything. Management can prioritize what to work on that ABC/ABM can help.

Simply put, ABC/ABM is a tool, not a solution. It brings visibility of the symptoms of problems from which effective solutions can be inferred. In some cases, ABC/ABM brings visibility to that which has never been seen before; in other cases, it replaces existing flawed and highly misleading cost data caused by bad and distorting allocations. ABC/ABM has four objectives:

a) To eliminate or minimize low value adding cost.
b) To introduce efficiency and effectiveness and thus streamline the value-adding activities that is executed in business processes to improve the yield.
c) To find the root causes of problems and correct them. Remember, costs are a symptom.
d) To remove distortions caused by poor assumptions and bad cost allocations.

Regardless of the performance improvement methods and tools that companies choose to apply, they should be aware of that their enterprises are subject to certain natural properties, just like we are subject to physical laws of the universe such as gravity and the speed of light. One commonly overlooked natural property of business is that time, cost, and quality are linked, not independent of one another. All improvement efforts, continuous or breakthrough, are intended to increase value for one or more stakeholders. The goal is more efficient responsiveness with profit.

Today's managers are recognizing how systematic and interconnected their work is. That is one reason team-based managing has become so popular. There are no more "island solutions". Businesses today must simultaneously behave better, faster, and cheaper – quality, time, and cost. No more can companies pick two and let third one slide. They have to consider the three elements all together. There must be integration.

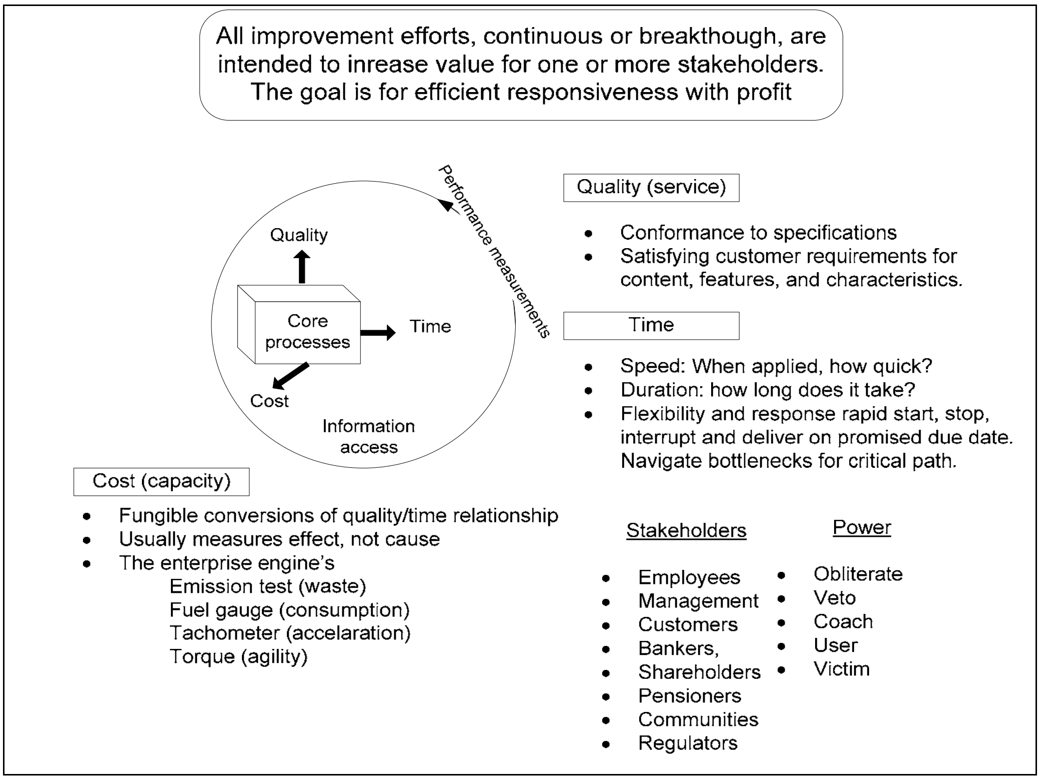


Figure 3.4 Interconnectivity of time, cost, and quality (Cokins, 1996)

What is the role of cost data in this systematic model (integrated quality, cost and time)? When you cut to the chase, costs are simply the residual of people or equipment doing activities. Costs are a derivative. They are a dependent variable – the result of work being done and things being purchased. They reflect an impact Costs are the shadow of a body or the echo of a sound. Costs are sometimes viewed as symptoms, representing deeper-rooted causes.

An analogy for an ABM cost model is an emission testing and diagnostic instrument for automobiles – it captures the auto's exhaust for a short interval and then checks its fuel consumption rates (costs) and purity content (value). The car engine's pistons, rods, carburettors, and injection mechanisms are combusting (the activities) gasoline (the resources), while the emission tester (the ABM model) gives feedback on rates and purity.

3.2.2 The Emerging Consensus on ABC/ABM

ABC/ABM data are currently not being used as a managerial command-and-control tool. In fact, this is quite the opposite. The most popular uses of the new financial data involve *forward planning* and *predictive modelling* of the cost impact of decisions that will affect the future. Rarely is ABC/ABM data used with an “accounting police” mentality in a similar way that standard cost and budget variance data and analyses are frequently used to curb department spending and punish irresponsible spenders. ABC/ABM enhances the new image of financial accountants as partners, not enforces and gatekeepers, with sales and operations personnel in navigating and coordinating the various business improvement program options and initiatives.

3.2.2.1 Cost of Processes (ABM)

The bulleted items below will read like sound bites. They are written more for quick overview than for depth.

- As organizations flatten in structure and companies strengthen their commitment to customer satisfaction and customer retention, business processes are becoming more visible. Business processes run across artificial organizational boundaries, and they are emerging in full view of all managers’ eyes as the vehicles that bring and achieve value for customers. Some business processes are part of the supplier value chain. The supply chain is what needs to be better managed. Activity accounting quantifies this new view with cost data.

- Customers are gaining in power. Brand loyalty is declining and giving way to everyday low prices and a keener sense for value. Customers are also seeking increased customization to meet their unique needs. There is no “average” customer. This creates greater product variety and diversity along with new services. Business is no longer some sort of anonymous distribution system through which to pump products.

- Organizations are discovering that the business process performance levels necessary to remain competitive exceed what is possible from conventional, highly vertical, functional organization forms. The traditional corporate model is becoming less valid as business processes transcend the old departmental boundaries. Future cost reductions and performance improvements can be achieved only through reconfiguring work activities into fewer, more integrated jobs. Optimizing a functional department is no optimal.

- The major, core cross-functional business processes of any organization are large in size and few in number. Examples of business processes are order fulfilment (from customer order to cash payment) or new product development (from concept idea to final prototype).

- Functional names, like an Order Entry Department, disguise the broader business processes. In contrast, groups of activities, like those occurring in search and development, are often not recognized as core business processes.

- Customers see increasing value in good business processes and will pay a premium for them. For example, Federal Express overnight delivery and McDonald's ready-to-serve meals revolutionized their industries.

- Traditional financial accounting supports old-fashioned functional thinking. When you tilt the organization sideways 90 degrees and begin thinking in terms of process and not function, then the financial accounting system becomes an obstacle. Here are the two major problems:

    - The chart-of-accountants (wages, fringe benefits, supplies, etc.) gives no visibility to work, to work's content, and to work's worth to customers. To overcome this deficiency, activity accounting forces the use of verb-noun grammar so that employees can finally see the work – and employees are actually more comfortable with this more natural language of activities.

    - Departmental or cost centre segmented financial reporting perpetuates the vertical hierarchy as the driving force in an organization, instead of the more deserving customer who is at the end of a business process crossing the organization horizontally.

- A significant challenge will surface as process-based cost reporting and associated performance measures take root. There will be tension between those who will continue to support functional organizational goals and those wishing to meet customer needs. In many organizations the neighbours don't true one another. In customer-focused companies, they behave like a unified community.

- Traditional accounting blocks managers from seeing, understanding, and reacting to the costs they should be managing. It blocks them from understanding the causes of their costs. In contrast, activity accounting brings visibility. It also brings quantification. ABC/ABM connects action words to management concepts and vice versa. It shows end-users where accountability and empowerment intersect. It is a mirror reflection of the organization's costs of business processes.

- Both processes owners and participants will need cost data that support this new end-to-end horizontal thinking. New organizational alignments to support customers will exhibit centralized control with decentralized execution. The former requires better cost planning; the latter, more relevant cost monitoring.

- Activity accounting provides a natural framework to assign value. Where are we adding value? Where are we not adding value? How well are we adding value? These questions can be answered by scoring or grading the value-content of individual activities within supply chain processes.

- Total quality management (TQM) teams and just-in-time (JIT) cycle-time compression teams are taught to think in terms of processes and to measure processes. With some outdated business processes, encrusted with a legacy of path-dependent, quick-fix corrections, TQM and JIT teams are now running into walls, namely themselves. Their efforts are not always turning into benefits or improving profits. Senior management is getting disturbed by the diminishment of benefits realized from TQM.

- Why examine activities? Examining activities helps employees understand activities. Also, the root causes that drive activity costs can be identified and included in employees” thinking. This is all very human and behavioural. Remember that activities ultimately always involve people serving other people. The idea is to positively influence behaviour. And that means not penalizing people for errors, but discouraging them from the repetition of errors.

Only activity-based accounting principles support process-based thinking and its associated business improvement actions and programs. Activities are such a central foundation. TQM is doing activities without errors. JIT is doing activities without waste. Reengineering is synchronizing activities across functional boundaries. With traditional accounting there is no process view; you can get there from here. With activity accounting you can follow the path of a business process. Also, you can check the alignment of costs with senior management’s defined strategies.

3.2.2.2 Product and Service Costs (ABC)

While allocations are out, direct costing is in:

- Complexity and product/service diversity are escalating. Unique customer needs are driving this explosion. Meeting customer needs is resulting in increasing overhead costs can be casually traced to whom (which customer) or to what (which product) the overhead activity work is benefiting. When redistributing costs, accountants call whom and what final cost objects.

- Ideally, all costs should be directly charged, but as technology increases, more costs are indirect. Activity-based costing acts as a surrogate for directly charging costs of activities that traditionally have not been traced to cost objects. ABC displaces the traditional and distorting practice of allocating expenses. Allocations should be a last resort.

- Traditional financial accounting practices inadequately capture how the diversity of products and services consume resources via the activities that serve them. Figure 3.5 pictures various types of diversities. Allocations are bad because:

    - Allocations assume convenient or arbitrary ways, and certainly uncorrelated ways, to assign costs.

    - Allocations apply averaging when in fact product or service cost consumption patterns are actually irregular and disproportionate. A broad-brush average hardly represents the unique population of consuming cost objects.

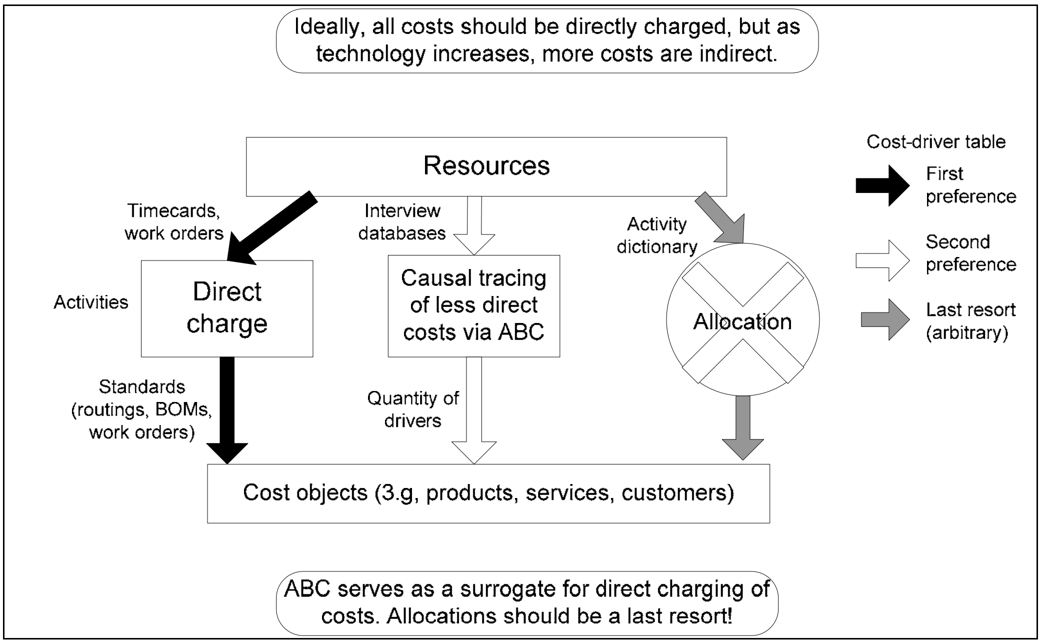


Figure 3.5 The flow of costs (Cokins, 1996)

The collective impact all forms of diversity are eventually captured in the final cost objects.

- As a consequence of unquestioned formula cost allocations, traditional financial accounting can grotesquely distort the true costs of products and services, which run can wildly distort their individual profit margins. Total costs are being redistributed in what is effectively a zero-sum and no-net-change game. Only ABC adequately removes the distortions from simplistic

> cost allocations. An allocation-free cost system is like a smoke-free environment – no pollution. In short, don't allocate – prorate. In sum, ABC serves as a direct-costing system for the total enterprise.

Once the product or service costs are accurately calculated, then the fun really begins. Since it is predictable that hidden losses exist as a result of historical misguided pricing, it follows that ABC will ultimately reveal with what specific products, services, and customers are profits or losses really occurring. Reassigning costs is a zero-sum game. But cost-plus pricing linked to the traditional costs creates a total net profit condition of big winners or big losers. With ABC profit margins now computed, a graph plotting the highest to lowest ABC margin dollars can be plotted like Figure 3.6.

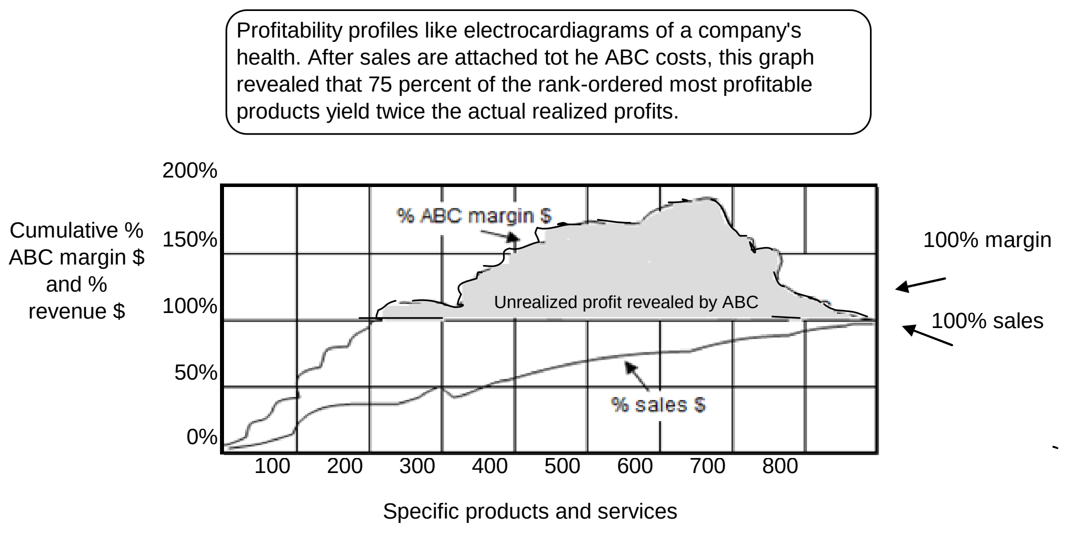


Figure 3.6 Example of a profitability profile (Cokins, 1996)

The shock comes from seeing that a much greater profit than ever considered was captured by perhaps two-thirds of the more profitable products – and then there were big loses.

In sum, profitability computations that combine customers with more accurately cost products and services are an advanced measure. It helps management locate profit-friendly customers and grow more of those kinds. It also helps managers to suggest how some of their unprofitable customers can alter their own behaviour to become profitable. In the extreme case it helps managers terminate some of their customers.

ABC is about segmenting the diversity of consumed resources and logically tracing them to the products, services, and customers. ABC/ABM data not provide panacea. Costs are symptom, not the root cause. Arguably ABC/ABM is not in the same category as other performance improvement programs. However, better cost data can serve as enablers and initiative accelerators to those programs. Cost information reinforces the thinking needed to make improvement programs really work. Cost measure effect, not cause. But with data on cost-driver rates also being an output of an ABC/ABM model, managers can visibly quantify and rationalize the causes of cost. And by understanding the relative magnitude of graded attributes that are attached to activity costs and the impact of individual activity costs for recent time periods, managers and employees can improve their focus on where the good improvement opportunities are.

3.2.2.3 Full Absorption Costing with Fixed versus Variable Thinking

- All costs are variable in the long run.
- When tracing costs to activities, products, or services, it can be dangerous to excessively include certain kinds of costs. When costs that are outside the control of managers and employees are recklessly included, without any indicator or caveat, it sends misleading signals to managers and employees.
- Few costs are actually fixed, that is, permanent. Costs are commonly referred to as fixed if they do not vary in proportion or if they do not parallel some level of sales or production volume. In reality most activity costs either vary with some type of non-sales, non-production activity cost driver or they can be partitioned to reflect how they serve a specific product family, customer segment, or class of purchased supplies or subcontractor's services. When these cost drivers or the beneficiaries of the activities go away, so do the work activities and eventually their costs (refer to Figure 3.7).

- Traditional costing "unitizes" costs, giving the illusion that all of the costs directly vary with units of end output. The focus should be on the total costs per time period, not cost per unit.

- Only ABC/ABM principles provide the capability to focus on total costs while specifically capturing which activity costs vary with a unique cost driver to benefit a family/class/segment of a product, service, or customer.

- Unused capacity costs should not flow through to costs objects. Such surplus resources that are deemed below expected demand levels should be isolated and traced to an "unused capacity activity".

- Only ABC/ABM principles allow declaring some costs like building rent as being fixed or as being discretionary. This facilitates separately reporting certain uncontrollable costs as a "company tax or surcharge", rather than traditional accounting's practice of baking those costs directly into process, product, or service costs.

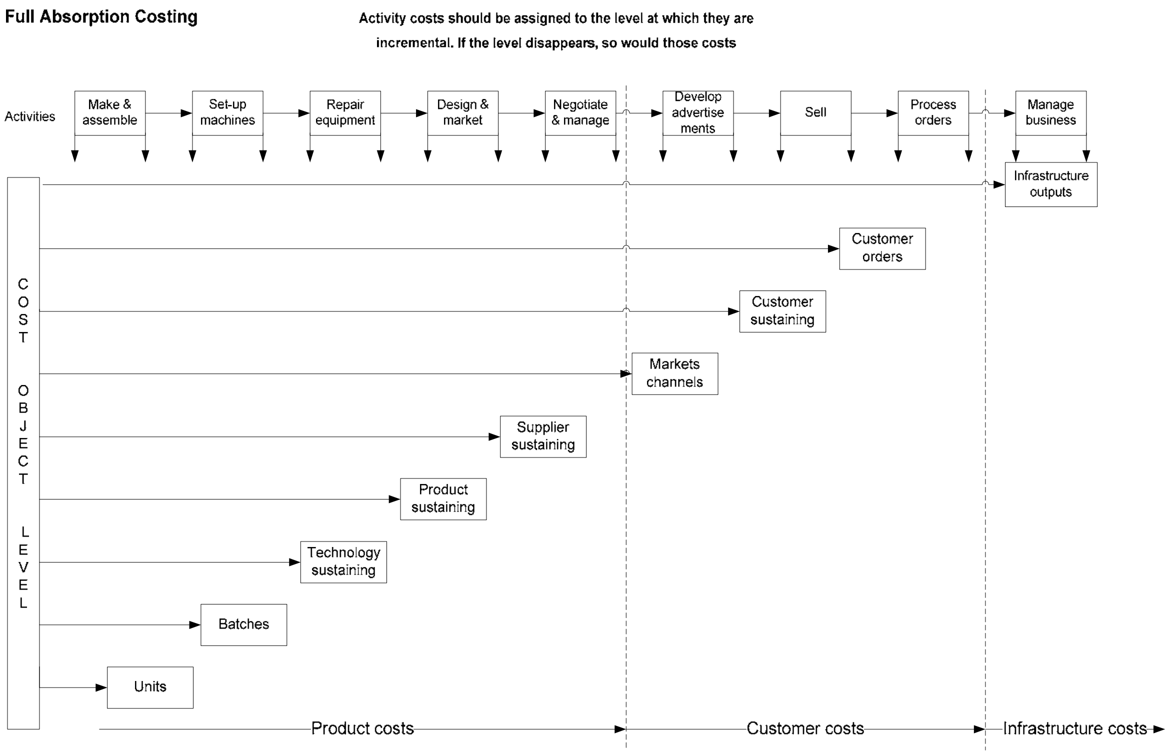


Figure 3.7 Full absorption costing

3.2.3 Clarifying What ABC, ABCM and ABM

There is significant confusing about the semantics and acronyms associated with activity-based information for which no standard definitions exist.

In a narrow sense, activity-based costing (ABC) can be considered the mathematics used to reassign costs accurately to cost objects, that is, outputs, products, services, customers. Its primary purpose is profitability analysis.

Activity-based cost management (ABCM) uses the ABC cost information to not only rationalize what products or services to sell but, more important, to identify opportunities to change the activities and processes to improve productivity.

Activity-based management (ABM) integrates ABC and ABCM with non-cost metrics such as cycle time, quality, agility, flexibility, and customer service. ABM goes beyond cost information.

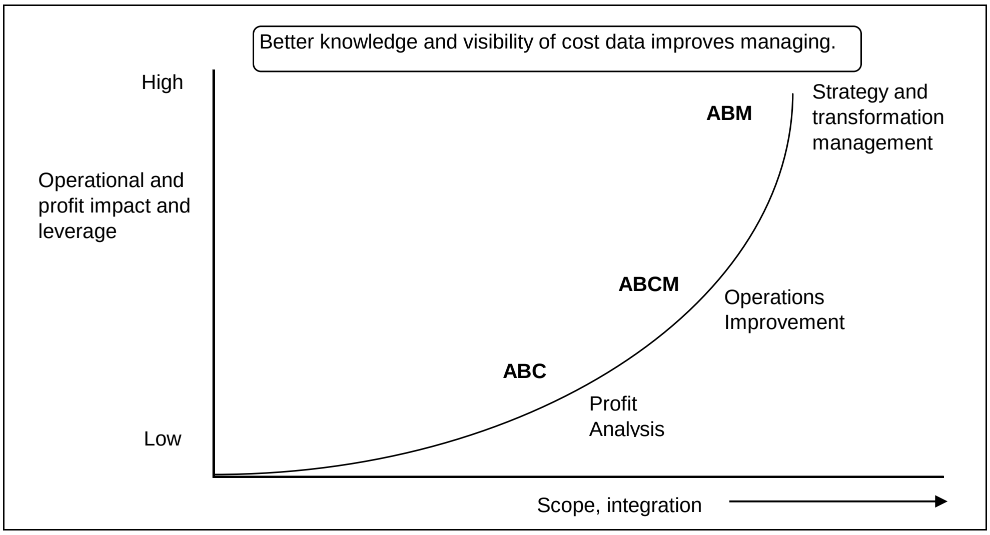


Figure 3.8 Activity based information acronyms (Cokins, 1996)

Companies need to see the content of work and predict the potential impact on work of new customer orders, decisions, and proposed improvement projects and initiatives. Companies need to better understand the creation of value. The traditional general ledger financial accounting system requires a translation into an activity-based language with new metrics Computing costs with ABC/ABM is relatively mechanical. Dealing with people, their lack of understanding of costs, and their resistance to new ways looking at the same world they operate in is the more difficult implementation challenge. Success will not come until the attitudes of individuals are changed. Only after that happens will shared group values emerge.

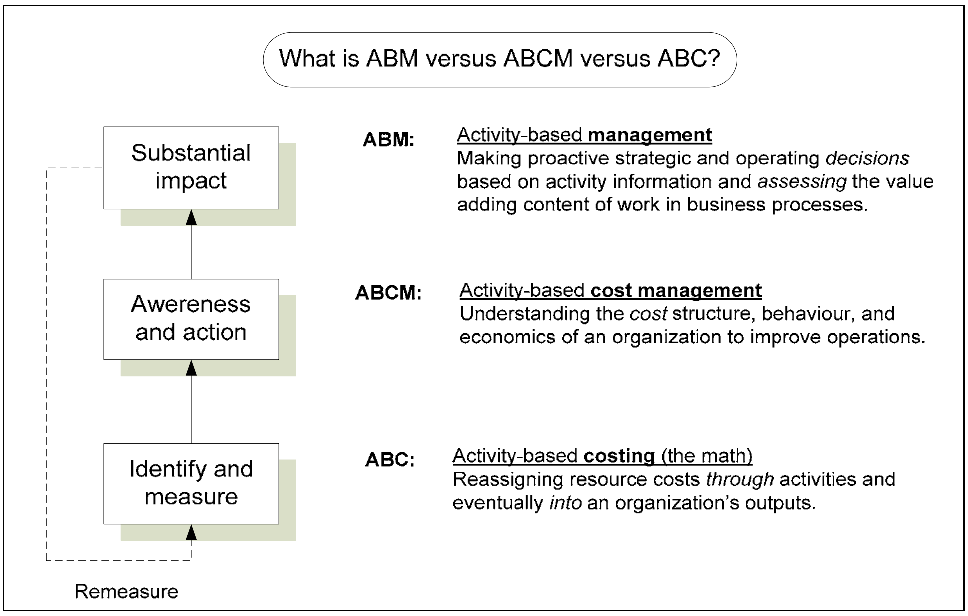


Figure 3.9 ABM versus ABCM versus ABC (Cokins, 1996)

To many organizations, simple rules for improvement may be satisfactory, particularly if they are far from performing well. But those organizations will eventually need ABC/ABM when they think they are getting closer to optimum performance.

3.2.4 Cost Hierarchies

A cost hierarchy categorizes costs into different cost pools on the basis of the different types of cost drivers or different degrees of difficulty in determining cause-and effect relationships (Horngren et al, 2001).

ABC systems commonly use a four-part cost hierarchy “output unit-level costs, batch-level costs, product sustaining costs, and facility sustaining costs” to identify cost-allocation bases that are preferably cost drivers of costs in activity cost pools.

Output unit-level costs are resources sacrificed on activities performed on each individual unit of a product or service. Manufacturing operations costs that are related to the activity of running the automated moulding machines are output unit-level costs. Because the cost of this activity increases with each additional unit of output produced (or machine-hour run).

Suppose that in Plastim example (Cost Accounting, Horngren, Foster, Dater, p.137) , each S3 lens requires 0,15 moulding machine-hours. Then S3 lenses require a total of 9.000 moulding machine hours (0,15 hour * 60.000 lenses). Similarly, suppose CL5 lenses require 0,25 moulding machine-hours. Then the CL5 lens requires 3.750 moulding machine-hours. The total moulding machine costs allocated to S3 and CL5 depend on the quantity of each type of lens produced regardless of the number of the batches in which the lenses are made.

Batch-level costs are resources sacrificed on activities that are related to a group of units of product(s) or service(s) rather than to each individual unit of product or service. In the example, setup costs are batch-level costs. Setup resources are used each time moulding machines are set up to produce a batch of lenses. The S3 lens requires 500 setup-hours (2 hours per setup * 250 batches). The CL5 lens requires 1500 setup-hours (5 hours per setup * 300 batches). The total setup costs allocated to S3 and CL5 depend on the total setup-hours required by each type of lens, not on the number of units of S3 and CL5 produced.

In companies that purchase many different types of direct materials, procurement costs can be significant. Procurement costs include the costs of placing purchase orders, receiving materials, and paying suppliers. These costs are batch-level costs because they are related to the number of purchase orders placed rather than to the quantity or value of materials purchased.

*Product-sustaining (*or *service-sustaining) costs* are resources sacrificed on activities undertaken to support individual products or services. In the example, design costs are product-sustaining costs. Design costs for each type of lens depend largely on the time spent by designers on designing and modifying the product, mould, and process. These costs are a function of the complexity of the mould, measured by the number of parts in the mould multiplied by the area (in square feet) over which the molten plastic must flow (12 parts * 2,5 square feet or 30 parts-square feet for the S3 lens, and 14 parts * 5 square feet or 70 parts-square feet for the CL5 lens). The total design costs allocated to S3 and CL5 depend on the complexity of the mould, regardless of the number of units or batches in which the units are produced. Design costs cannot be linked in any cause-and-effect way to individual units of products or to individual batches of products.

Facility-sustaining costs are resources sacrificed on activities that cannot be traced to individual products or services but support the organization as a whole. In the example, the general administration costs (including rent and building security) are facility-sustaining costs. It is usually difficult to find good cause-and-effect relationships between these costs and a cost allocation base. This lack of a cause-and-effect relationship causes some companies not to allocate these costs to products and instead to deduct them from operating income.

3.3 A Framework for Mapping Cost Flows

In the valley of the blind, even the one-eyed man is king! Professor Robert Kaplan of the Harvard Business School used those words at a cost management conference in Nashville, Tennessee, on May 18, 1994. He was implying that with limited visibility or manageable cost data problems, many companies can get by. But with a substantially more powerful costing approach like ABC/ABM, companies can make much smarter decisions and sharper assessments, and more frequently (Cokins, 1996).

3.3.1 The CAM-I Cross of ABC/ABM

In 1990, the noted author and lecturer Dr. Peter Turney and management consultant Norm Raffish created a diagram to represent an activity-based cost management framework to benefit member companies of the not-for-profit Consortium for Advanced Manufacturers-International (CAM-I). Within CAM-I, the Cost Management Systems (CMS) program has provided a forum for leading thinkers in industry, academia, and government to collectively challenge and improve cost management systems. As shown in Figure 3.10, the diagram commonly referred to as the CAM-I cross.

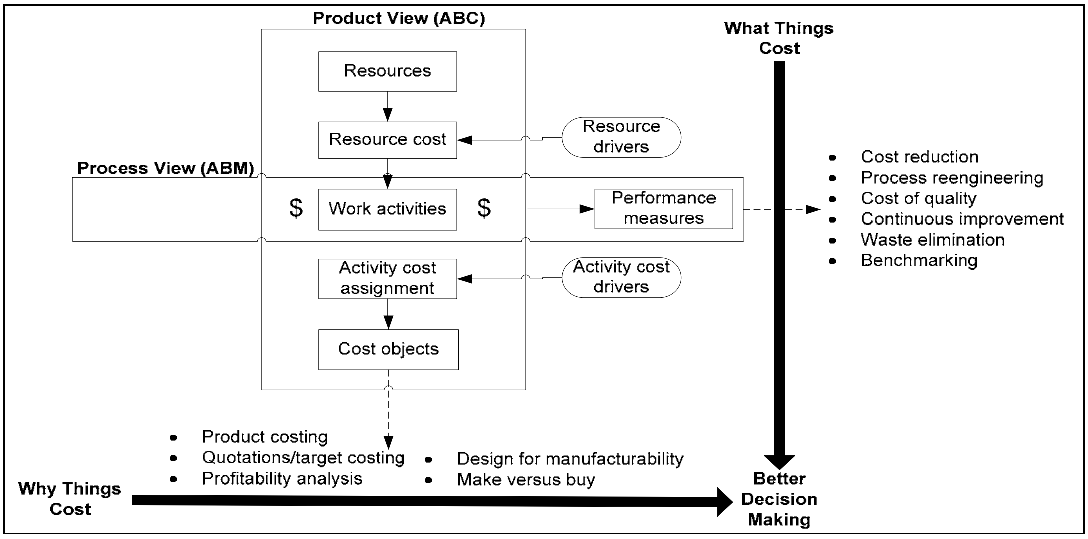


Figure 3.10 Multiple cost flows

The diagram reveals in a simple fashion that the work activities in the intersection of the cross are integral to reporting both the costs of processes and the costs of the work objects. The work objects are the persons or things that benefit from incurring activity costs. Examples of final cost objects are a component part of an assembled product or a specific customer. The vertical cost assignment (ABC) direction explains what things cost and is called the cost object view, whereas the horizontal process view (ABM) explains why things cost and what causes costs to exist.

The vertical ABC product view is very effective at capturing how the diversity of things, like different products or various customers, can be detected and their costs as reassigned by first measuring resources through their consuming activities and then into the form of final cost objects. In contrast the horizontal ABM process view is very effective at displaying the cost terms the end-to-end alignment of activities of a business process. Since a process is defined as a sequence or network of two or more activities with a common purpose, a process' costs are additive regardless of an activity's defined level of detail. In addition, the ABM process view can provide nonfinancial, operational information about activities, such as inputs, outputs, constraints, and enablers. The ABM process view is frequently called the supplier value chain, and its costs are interpreted using process value analysis (PVA).

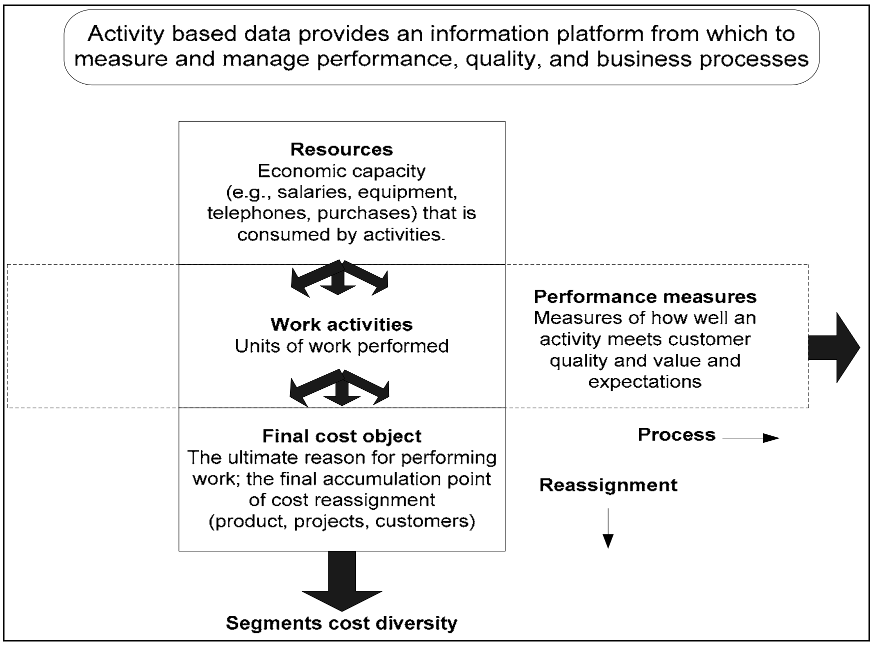


Figure 3.11 Activities are central to both views (Cokins, 1996)

In an ABC/ABM system, the total resource costs will always reconcile to the total process costs and the total object costs. It is a closed cost system with dual measures that pivot around work activities. This is a key point. Traditional cost systems start with which ledger account balances get charged with an expense. In contrast, ABC starts with work activities, not people or their wages, as the origin of thinking. This makes ABC a socio-technical tool, not just a reporting tool.

3.3.2 The Product and Service Line View (ABC)

Although today's acceptance and practice of activity accounting is being boosted by the managerial revolution toward process and systems-based thinking, it was actually ABC that initially fuelled the interest in the early 1980s. Regardless of activity accounting's true genesis, it is important to understand origins of ABC before learning how the data used for product costing also support process and performance improvement.

The major distinction between traditional cost accounting and ABC is that ABC uses non-single-unit production volume cost drivers to trace or reassign activity costs to products or services. In contrast, traditional systems allocate all indirect, variable overhead costs to final cost objects by assuming the overhead's consumption varies at exactly the same rate as a single unit of volume, like a labour hour, a machine hour an assembled unit of output, or a dollar of purchased material. Allocations assume overhead varies with these factors one-to-one. ABC knows that overhead is more complex, that it doesn't vary with output in that way.

With ABC, an activity cost driver stated in terms of a unit of output is used to compute a cost rate for each activity. Subsequently, the activity cost is traced or reassigned to a unique cost object on the basis of how many units of output each activity consumes during a defined period.

In summary, ABC can detect proportionate consumption of resources in an organization's interrelated activities; the organization can then reassign the flow of costs into a diverse mix of final cost objects comprised of products, customers, and product sales orders.

3.3.3 Expanding the CAM-I ABC/ABM Cross

Providing ABC/ABM data to end-users is like turning up the lights in a dark room. It's useful for seeing performance improvement opportunities. ABC/ABM illuminates the content of work in verb-adjective-noun grammar (e.g, "rework defective parts) and presents the costs of business processes across traditional department boundaries. But rearranging the furniture and cleaning house is what ABC/ABM is really all about. That is, ABC/ABM does more than just provide greater visibility and new insights; it enables organizations to make changes. Figure 3.12 expands the CAM-I cross to include the decision-making and diagnostic capabilities that are supported by cost data.

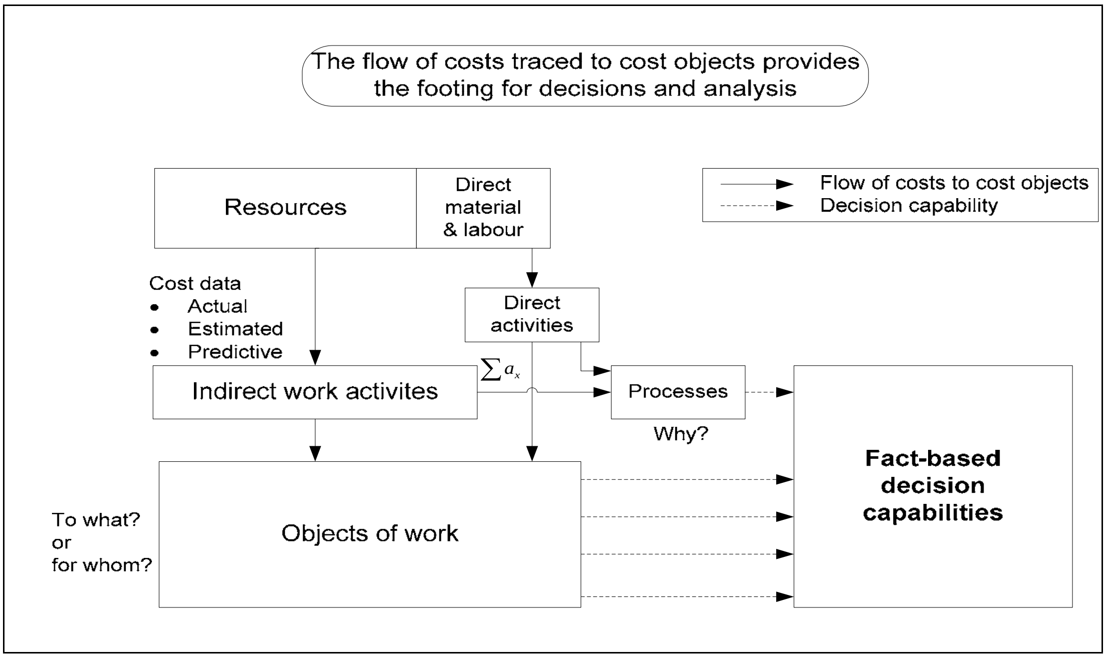


Figure 3.12 Integrated cost management (Cokins, 1996)

Experienced, successful users of ABC/ABM systems from different companies regularly communicate with each other by phone or at forums to share their applications of the data. Few of these companies are using the data as a tool to control spending. To date, there has been little evidence of after-the-fact spending and variance-to-standard analysis using ABC/ABM information strictly for control purposes. There probably never will be such uses. ABC/ABM is best applied as a forward-looking planning tool, not a historical reporting tool. The most popular uses of ABC/ABM data fall into three broad, overlapping sets of decision and diagnostic capabilities:

1. Activity-based costing simply reports what things truly cost without the grotesque distortions from flawed or unnecessary overhead cost practices. This new look at old data often brings surprising reversals of what the traditional and misleading accounting system reported as profitable and non-profitable product and service offerings. Organizations tend to use ABC data more for strategic decisions. ABC also computes the cost of a process output, for example, the total cost to process an invoice. ABC brings allocation-free, increased accuracy.

2. Activity analysis supports the managerial movement toward continuous improvement and concentrates more on diagnostics and tactical issues. It gives less attention to what things costs and more attention to what causes or drives costs (i.e., activities) – that is why things cost. Activity analysis (ABM) stems from the new visibility of costs that were hidden in the traditional accounting system. The scoring or grading of activities and processes for their value-content or near-term incapability is a popular extended use of baseline ABM data. Employees can reduce costs by identifying activities that add little or no value. ABM data help prioritize where to alternatively spend problem-solving time and energy for quicker payback.

3. Forward planning and predictive modelling is emerging as the most popular application of the ABC/ABM data. Once an ABC cost consumption model is completely built, it has been, in one sense, calibrated. It becomes the simulation cost model for the entire enterprise. The model's activity cost driver rates, for example, are reliable for reasonable time periods assuming a relevant range. These rates can be used in conjunction with forecasted quantities of drivers in various scenarios, thus enabling the enterprise to predict future costs. This makes the ABC/ABM data a natural for decisions involving cost-estimating such as order quotations, make-versus-buy analysis, and investment justifications. ABC/ABM is truly a resource consumption modelling tool.

3.3.4 Unveiling the Expanded CAM-I Cross

Prior to tracing activity costs to their final cost objects, an organization can analyze, evaluate, improve, or reengineer processes without knowing precisely what a specific product or service costs. The focus is on the process. This partly explains why cycle-time compression and TQM initiatives are so popular. Their premise is that by improving on time or quality, costs will eventually take care of themselves, somehow exiting the organization.

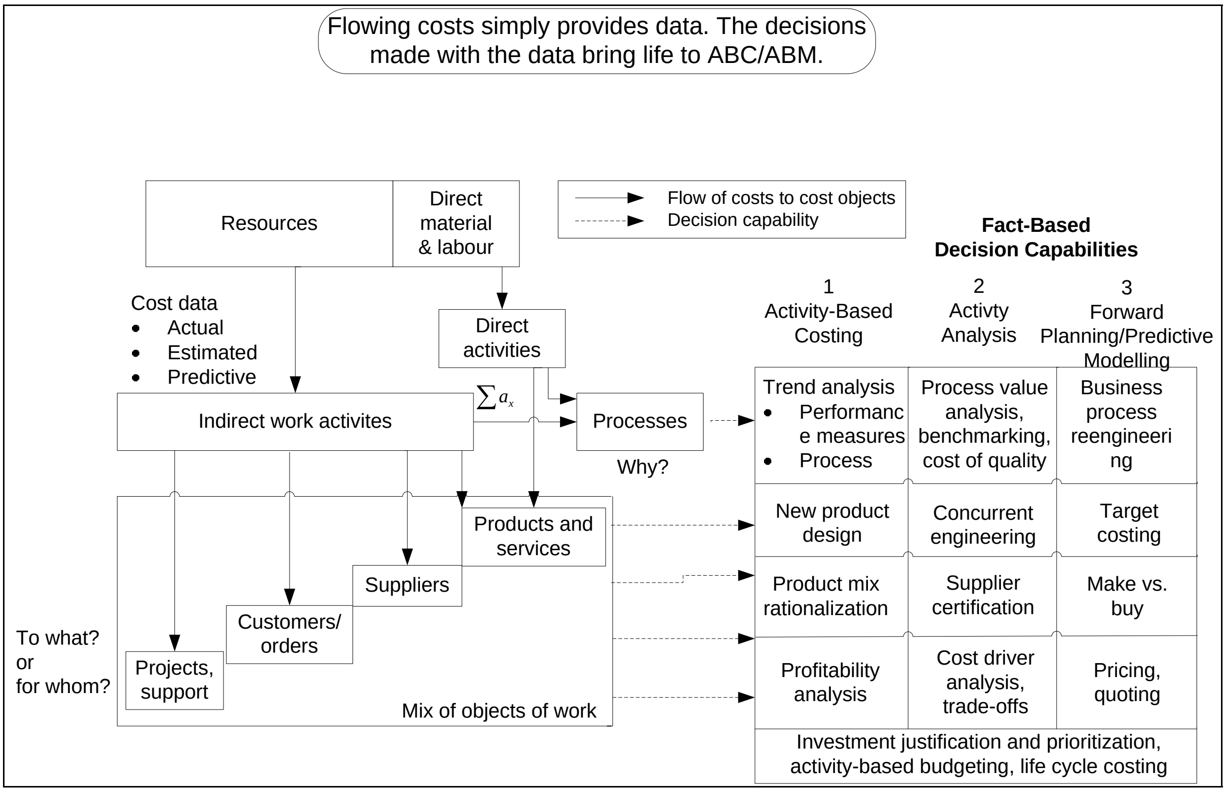


Figure 3.13 Fact-based decision making (Cokins, 1996)

The importance of assigning costs to processes prior to embarking on continuous process improvement and total quality management projects cannot be understood. Although these improvement endeavours may appear worthy, without relevant and true cost data, an organization cannot adequately predict the cost impact they may have. Arguably, it may not even easily identify the opportunities for improvement.

Here are some basic characteristics about a business process. They should be:

- The defined with inputs, outputs, constraints, enablers, and identification of ownership. A customer must exist for the outputs.
- Controlled and monitored to detect process variation outside acceptable limits.
- Effective in doing the right things.
- Efficient in doing those right things well
- Adaptable, with flexibility to respond quickly to unplanned changes.

Managers and employees are always trying to stabilize processes, but unplanned forces bring imbalances to the business system. Often, reactive expediting and fire fighting can introduce "disturbance activities" that propagate additional unanticipated costs along the business processes.

Tracing the costs that results from specific customer groups, or individual customers, make sense. After all, customer behaviour places demands on the work activities of employees apart from the costs of producing the products or building the services.

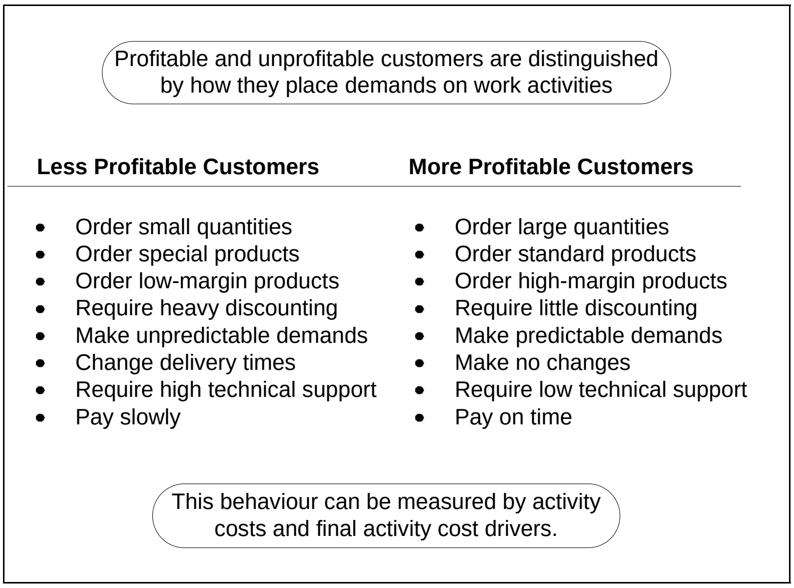


Figure 3.14 Segmenting customer diversity (Cokins, 1996)

At this point in tracing the flow of costs using ABC principles to segment diversity, we can conclude that the lowest diversity of activity cost consumption would come from a unique product-customer-order combination, where component parts, ingredients or services are supplier-specific. 21st Century cost systems may well flow costs with that much visibility – if it is worth it to decision makers. The amount of detail and accuracy of cost data should be weighed against the risk of not having the data. These trade-offs govern the design of an ABC/ABM system.

Consequently, continuing with the cost objects in Figure 3.13, onetime projects and support infrastructure are facility-sustaining activity costs. Facility sustaining costs (like contractor lawn maintenance and snow removal services) are defined as those necessary to even be in business, but these costs are not directly caused by customer behaviour or products. They have been historically referred to as fixed costs. Any attempts to allocate facility-sustaining costs to parts, products, suppliers, or customers are strictly arbitrary. Since these costs, are outside the direct control of the process-owners responsible for satisfying product-customer-order combination, they should be reported separately. The facility-sustaining costs should be isolated but visible, and termed a surcharge or an enterprise tax.

3.3.5 Industry-wide ABC/ABM: Efficient Consumer Response (ECR)

The retail and food industries are recognizing that their suppliers' and customers' behaviours generate a significant amount of their operating costs. These industries have coined the terms efficient consumer response (ECR) and quick response (QR), supply-chain language that links the total business process from the dirt and raw materials to the end consumer.

The key to successfully implementing ECR and QR is recognizing that the customer is truly very important and conflicts between the manufacturers and retailers that precede the customer in the supply chain must be resolved. In most manufacturer-retailer relationships, the two constantly wrestle with each other to gain the next increment of profit. The wrestling introduces extra costs transparent to the end-consumer.

ECR and QR programs dramatically deemphasize us-versus-them mentality by helping all the companies linked in the supply chain to view themselves a single, unified virtual company. As these industry wide participants realize their collaboration produces mutual benefits, they learn to share data and technology, create common standards, and understand each other's cost economics. This enables manufacturers, wholesalers, and retailers to maximize profit along the supply chain.

The primary enablers for ECR and QR are:

1. Electronic commerce, including electronic data interchange (EDI)
2. Continuous stock replenishment, which links:
   - Category management, which monitors point-of-sale data and item shelf-space allocation data.

- Flexible, lean, and agile manufacturing and distribution.

3. Activity-based costing and management.

Collaboration among trading partners requires increases in mutual trust, which is obviously lacking given decades of us-versus-them behaviour. The use of ABC/ABM data not only replaces intuitions and opinions with facts; it also allows multiple parties to more quickly agree on how they can change their behaviour to consequently reduce unnecessary demands for work, thus costs, on each other. Trading partners must tie themselves together.

3.3.6 Integrating Process Management to Financial Results

Figure 3.15 is an overarching diagram of the relationships between business process, decisions, and financial results. To the far right are the economic value added (EVA) financial results. EVA is emerging as the premier measure for monitoring period-to-period creation or destruction of shareholder wealth. It is becoming a popular executive compensation tool because it overcomes some of the flaws of earnings per share (EPS) and return-on-investment (ROI) measures. EVA is also used for allocating capital investments to the highest-yielding opportunities.

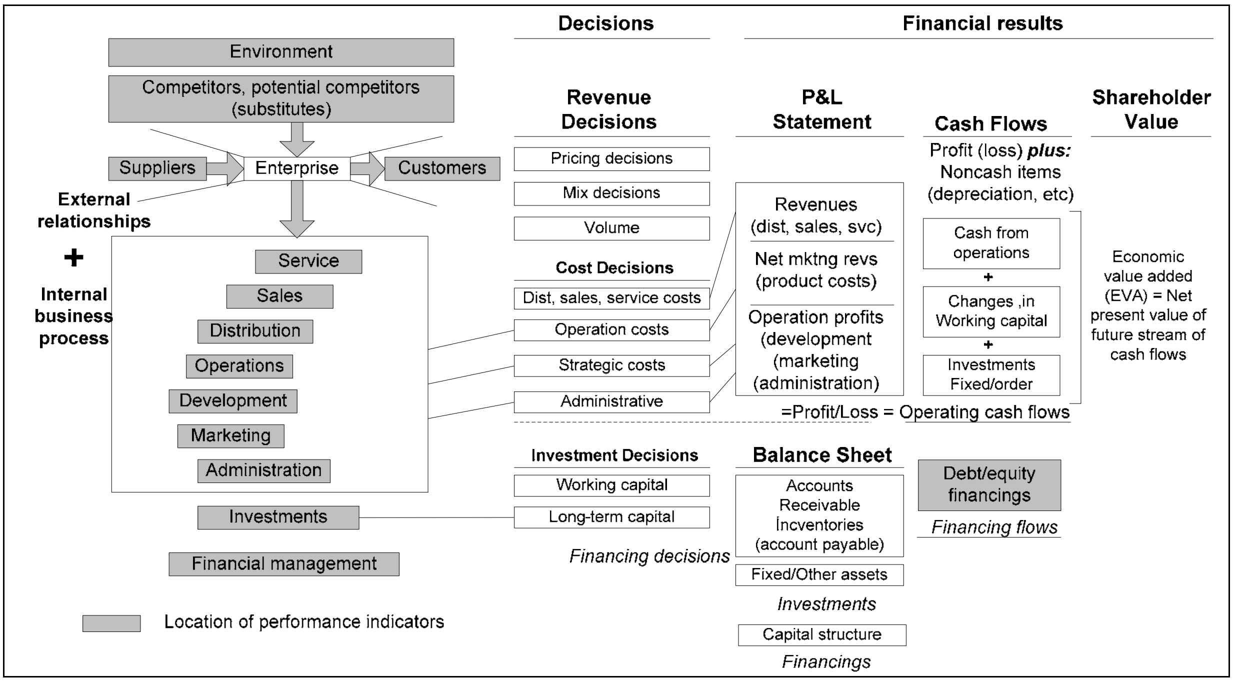


Figure 3.15 Decisions produce results (Cokins, 1996)

3.3.7 The Emergence of Lean and Agile Competition

The contemporary forces that are leading to more fierce competition have been discussed frequently in speeches and articles: global competition declining profit margins, customer demands, and so on. Figure 3.16 condenses the migration toward mass customization from an economy initially based on agricultural and natural resources. We are moving toward an Information Age in which large mass-production organizations either collide or collaborate with the niche specialists from the Industrial Age. Alliances of organizations, some for only short terms, are predicted to abound, creating virtual enterprises.

The implication for agile, lean, and virtual organizations with regard to ABC/ABM become evident as we move from Industrial Age structures to Information Age ones:

Industrial Age Organizaitons	Information Age Organizations
Nominal overhead costs relative to direct costs.	Sizable overhead support costs of technology dwarfing direct costs.
Labour or material volume was acceptable proxy for allocating overhead costs.	Traditional overhead allocators are poor and misleading cost drivers.
Mass production with standard products.	Flexible processes, customized products with information-added services.
Focus on efficiency.	Focus on value, quality, service, time, and cost
Focus on growth.	Focus on being the right size to match customer demand.

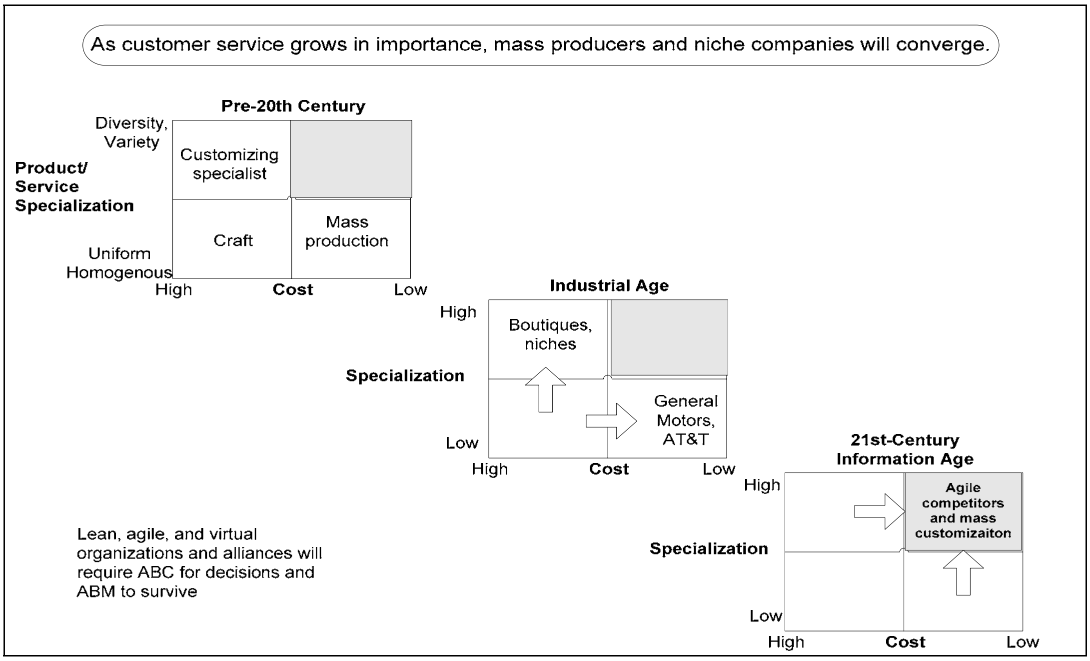


Figure 3.16 The emergence of agility (Cokins, 1996)

Traditional accounting, a consequence of 19th-century capitalism, satisfies stockholders, bankers, and regulators, not business managers. It is backyard-looking and reports data at too aggregated a level in scope and time for managers to use for predictive planning. It doesn't reflect the business process flow very well and is inadequate for tracing shared service costs into the end products and customer services that are ultimately sold to generate profit.

It is becoming apparent that 21st-century Information Age organizations will leverage collaboration, have flat hierarchies of people, rely on concurrent (not sequential) and parallel from-concept-to-cash processes, and use agile performance measures, often referred to as a balanced score card. It is inconceivable these organizations will be able to make trade-off decisions without ABC/ABM. In the Industrial Age, the customer and financial community were tolerant, lenient and mostly unknowledgeable of business errors. In the Information Age, the cost of taking risks without gauging the likely consequences will be large. ABC/ABM enhances the kinds of critical decision making that managers and employee teams will be regularly dealing with.

3.4 ABC Is about Flowing Costs

All costing techniques involve reassigning costs by flowing or tracing costs from general ledger account balances to someplace else. For example, traditional manufacturing product costing flows an aggregate of overhead cost balances into products using a single cost allocator or driver, usually labour or machine hours. When more accurate product costs were eventually needed, accountants began using multiple cost drivers to reflect the segmentation of diversity and capture proportionate cost consumption of resources by different products or customers. Now that organizations are placing greater attention on managing cross-functional business processes, organizations need to expand from two-stage cost flow calculations to ones with multiple-stage cost flows and multiple cost drivers. This better segments the diversity of how activity costs flow into other activities plus gives visibility to underlying processes (Cokins, 1996).

3.4.1 Tracing the Flow of Costs from Resources to Final Cost Objects

In the two stage ABC approach, subaccounts of the general ledger are distributed to the various activities in the appropriate proportions using, as they are called in ABC lingo, *first stage resource cost drivers.* The distributions are based on employee estimates of what activities consume their time and how much. The costs accumulated in these activities are then distributed and reassigned directly to final cost objects using second-stage activity cost drivers, such as the number of orders. For instance, costs like employee fringe benefits and electrical powers might initially be distributed to activities using employee head count and machine hours, respectively, as first-stage resource drivers. Costs accumulated in the various activities are then further traced and reassigned to products using second-stage activity cost drivers such as the number and mix of machine setups, sales orders, purchase orders, machine hours, labour hours and so forth.

Figure 3.17 shows how an early two stage ABC model computes activity cost driver rates. Those rates become the basis for reassigning the activity costs to each part, item or service according its unique consumption pattern. That is, the cost driver unit cost rate is equal to the total activity cost divided by the quantity of activity outputs.

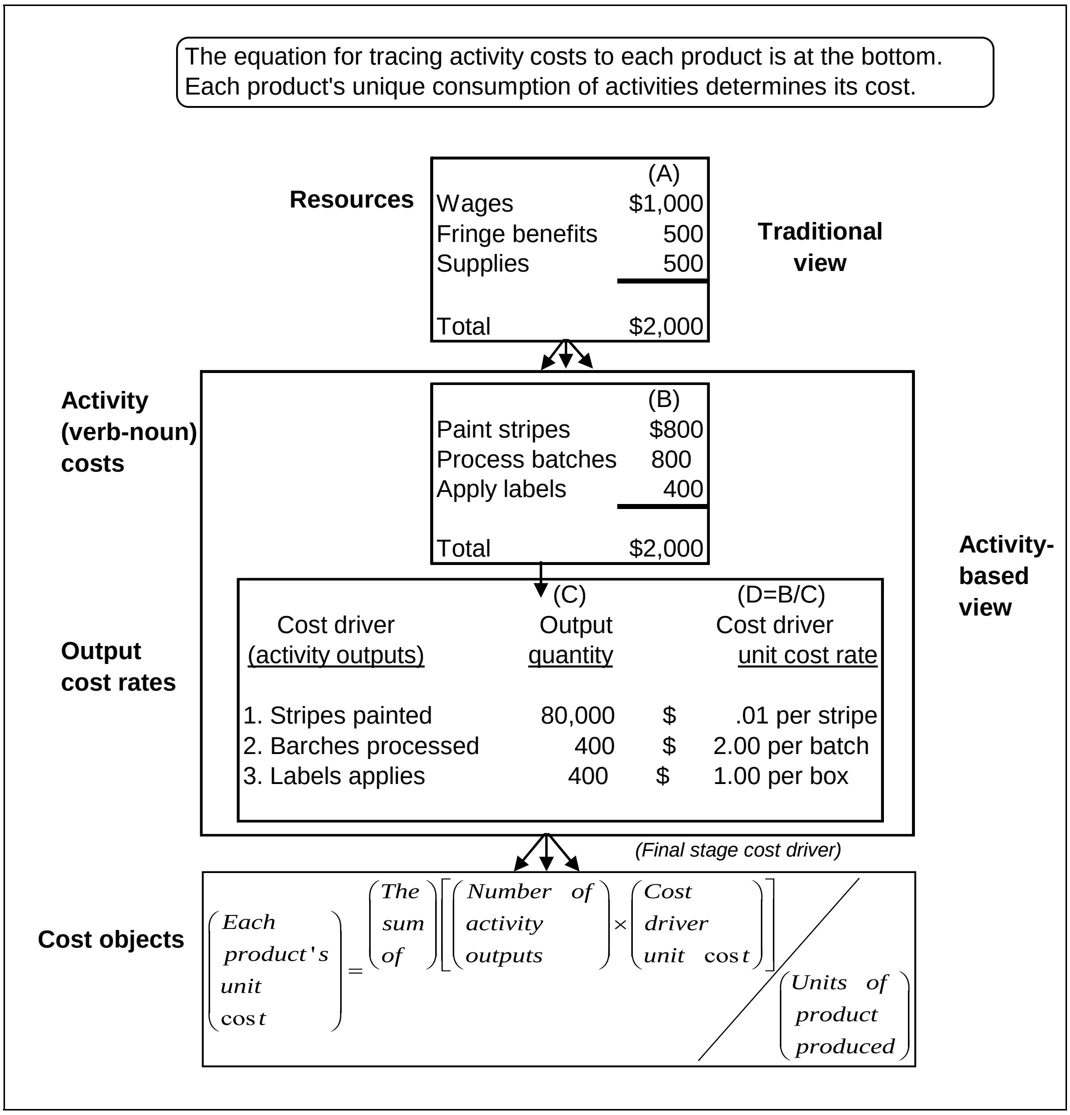


Figure 3.17 Activity cost driver rate calculation (Cokins, 1996)

An improvement to the two-stage ABC approach, the multiple-stage ABC approach more closely mirrors the more detailed flow of costs through an organization. Instead of oversimplifying the allocation by quickly trying to move costs from their point of incurrence to their final cost objects in just two stages, this approach emphasizes relationships between activities and other activities, as well as between activities and their final cost objects. The multi-stage approach recognizes that some activities are consumed by two or more other activities, which in turn are consumed by final products or services.

With multiple stages, and cost assignment drivers, the diversity of consumed resources can be better segmented to truly reflect the costs of product or service proliferation and operational complexity. Following this multiple-stage ABC approach, costs move from initial incurrence to intermediate cost objects in a series of financial tree-branching arterial decomposition steps, all based on cause-and-effect relationships using activity cost drivers.

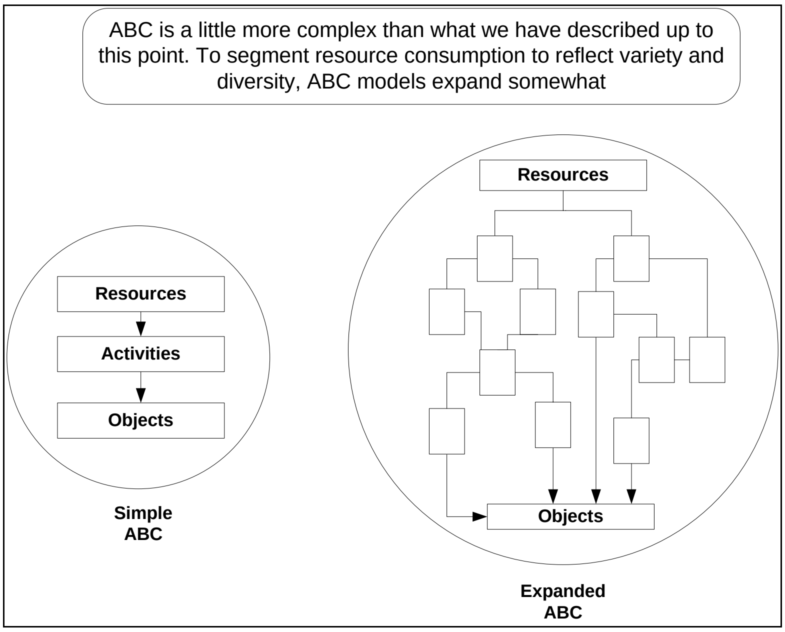


Figure 3.18 Multilevel cost flowing

Although the initial assignment of general ledger costs to activities is usually completed using time effort estimates, the subsequent reassignment of the progressively accumulating activity costs to other activities is accomplished using intermediate activity cost drivers. Ultimately, costs are flowed or reassigned to their final cost objects, such as end-products or customers, using final activity cost drivers.

Multiple-stage ABC decomposition is really a series of reassigning costs along flow lines called cost assignment paths. The cost data can be captured both on an incremental and on a cumulative basis on its way toward the total cost of the final cost objects. The initial assignment translates the general ledger account balances into activities. Total costs are reassigned.

3.4.2 The Evolution of Overhead Cost Systems

In an ideal world, all resource costs could be directly charged or assigned from a people or machine resource to a specific product or service customer. But in our practical world, there is so much complexity and technology that most resource costs are initially incurred in the form of indirect overhead.

The first two generations or approaches represent traditional cost accounting systems with whole departments' costs uniformly allocated, usually using arbitrary and inappropriate factors like square feet or head count. The last three generations are increasingly activity-based and grow in progressiveness from left to right.

The simple ABC approach uses activity cost drivers that are not tied to units of volume input/output, such as labour hours, sales dollars, or completed products or services. This approach subdivides whole departments of people by using action verb-adjective-noun descriptions of activities. But in the simple approach, the work described as activities is not related or sequenced end-to-end.

The flexible ABC approach begins adding more stages of cost redistributions to give more freedom to segment cost diversity. As a result, product, service, or customer related costs can be computed more accurately. The individual activities remain insensitive to their sequential relationship in an end-to-end process. This ABC model does not need to know, nor care, how activities relate to each other within a business process. It primarily aims to financially decompose activity costs with little regard to operational uses of data.

The advanced ABC approach incorporates process-based thinking. The activities are now linked end-to-end as a process chain network or web like artery system. This advanced approach usually has well over three stages of cost redistributions to segment diversity, variety, and uniqueness.

Advanced ABC better facilitates process-based management. This is the direction the cost management revolution is headed. Activity related information is used to manage the activities performed and understand their causes in order to reduce the costs consumed by those activities. Improved and more accurate product or customer costing is a natural by-product of process cost model.

3.4.3 Cost Push versus Demand Pull ABC System

ABC software vendors initially chose one of two methods to calculate and reassign costs: (1) activity-based cost decomposition or (2) customer consumption demand. Both methods trace and reassign 100 percent of an organization's costs. Their differences are in the direction they trace the costs.

The alternative ABC calculation method starts with the cost objects and, working in the opposite direction, asks which primary activities are consumed and how much. Customer demand is the driving force. Support or secondary activities are similarly consumed by the primary activities. The activities are viewed as consuming the resource costs of payroll and purchase items or services. This method results in ABC cost flow designs that more physically mirror the business process flow work steps as compared to the activity cost decomposition method. By declaring standard activity cost driver rates, this method allows isolating excess capacity costs for each activity.

It is easier to achieve accurate cost object costs through the activity cost decomposition approach because its cost flow network is unconstrained by requirements to chronologically link activities to other activities. In contrast, the process flow approach mirrors the physical reality of how work gets done, which appeals to those focusing on the costs of the process. However, the process flow demand pull approach can concurrently trace and keep track of the various diversities through the network. In the end, the total costs reassigned by each approach must be equal, and both approaches can be designed such that those totals are also equal for each final cost object.

3.4.4 Elements of Resource Costs

An important step in developing the ABC system's cost flow is to initially organize its elements of resource cost into two categories: material costs and activity costs.

Consider material costs to be all non-payroll costs representing purchases that are moderately related and conveniently traceable to a specific product or service. Most of these types of cost, like raw materials, are obvious and have traditionally been treated as direct costs.

Activity costs are the people and equipment-based conversion costs involved in performing or supporting the activities that take place within the organization. These costs would include all labour and fringe benefit costs, as well as other closely associated "super-fringe benefit" costs, like laptop computers or phone bills, normally treated as overhead in a traditional cost accounting system. For key equipment activities, the costs include amortized depreciation. Refer to Figure 3.19.

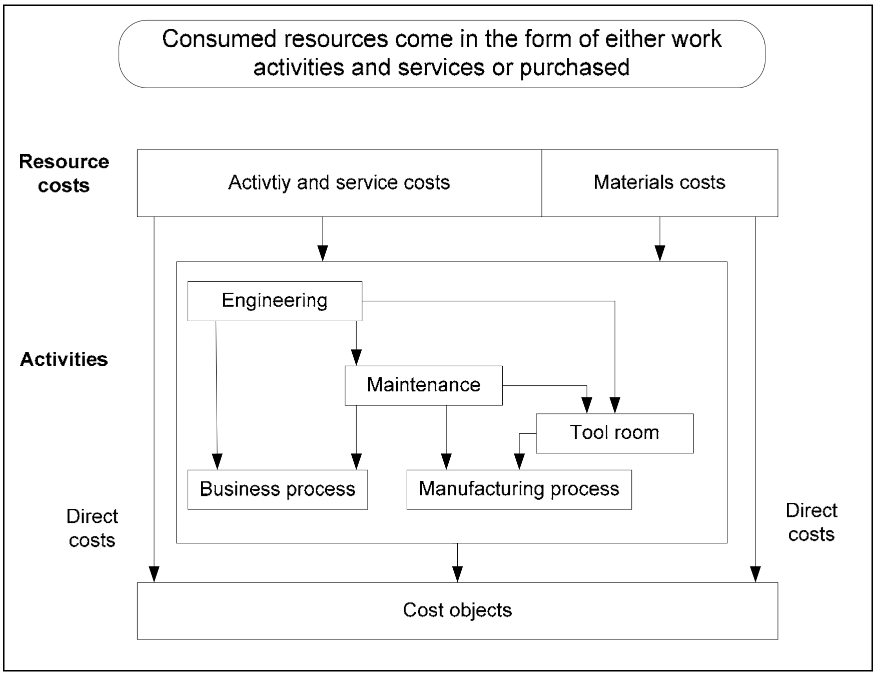


Figure 3.19 Two categories of resource costs (Cokins, 1996)

Material costs can be traced directly to the products or services whose throughput measures drive the costs. For instance, the raw materials, purchased components, and some outside contractor services that go into a manufactured product are all driven by the units of throughput of that particular part. An example would be a hospital's purchase costs for each x-ray that requires the same variety and size of film.

Activity costs, on the other hand, are people and machine-related and are traced to the activities whose drivers make the costs necessary. Indirect material and supplies as well as other contractor services can be traced to intra-activities where they eventually get traced to final cost objects. Once accumulated in the activities, the cost of each activity is traced to each product or service, or to another activity whose drivers make the activity necessary.

3.4.5 Usefulness of Indented Code Numbering Schemes

Indented code-numbering schemes allow displaying the subtotals of a total. Subtotals can be repeatedly nested below the total they make up.

Indented coding schemes simplify the following of costs by allowing a downward decomposition of activity costs and dividing wholes into their pieces. The same indented coding schemes also allow upward summarization and cost roll-ups to higher aggregates. Remember that the most detailed data will always be captured at the lowest level verb-adjective-noun code for an activity, and every cost reported above it must be a sum total created by formula or equation.

One's initial impression of subdividing activities with indented code-numbering is in the direction of levelness – activities are broken into tasks. But there is also a direction of diversity caused by the cost object driver. The same activity can be divided by what or whom it serves to improve granularity. The factors influencing the ABC model design will always swing between process view and product view.

Business processes were previously defined as a sequence or network of activities, regardless of the activities' level of detail. By decomposing functional areas into large numbers of activities for the purpose of segmenting diversity, the activities can be recombined to understand costs across the core business processes. For instance, a business can determine all of the costs involved in the process used to procure needed raw materials, purchased components, indirect materials, and outside processing services. First, the functional areas such as purchasing, material handling, shipping, receiving, inspection, accounts payable, and quality control are decomposed into verb-adjective-noun activities that describe employee efforts in the procurement process. Then, only those activities from each functional area that apply can be recombined into the process to arrive at the desired cost information.

3.4.6 Scoring Activities to Facilitate Managerial Analysis and Actions

Organizations interested in performance improvement can use grading methods to evaluate the activities that contribute to the output of goods or services according to whether or not the activities are necessary, support critical strategic success factors, or the performed efficiently. Various coding methods are used for this scoring of activities; these range from the very simple value-added/non-value-added approach to differentiating methods using very complex criteria. The idea is to eliminate non-value-adding activities and optimize value-adding activities, thus enabling employees to focus on the worth of work. Focus and visibility are enhanced because people can more easily see where costs are big or small and what costs can be impacted or managed in the near term.

The most popular differentiating categories are often called activity metrics or attributes and they are attached to the activity costs:

- Impactability or urgency.
- Value-added content.
- Effectiveness in performing the activity.
- Importance in supporting management's strategic plans.
- Quality content.
- Cost influencing content.

In addition to categories, there are multiple views from which to grade activities:

- From a customer's or process owner's view.
- From the product or service's view.

- From enterprise strategy’s view.
- From an efficiency view.

Employee teams usually customize their own approach by differentiating categories from multiple views and defining the scoring scale for multiple views and defining the scoring scale for each specific category using complex criteria. The underlying principle is that activities can be scored or graded at the lowest activity level, like a gene in a chromosome, which then allows the scored cost to uniquely accumulate into any cost roll-up or cost recombination involving two or more activities. Insights are gained as the marked activity dollars are combined, and then analysis can show both where and how intense problems or opportunities might be.

The employees who score or grade can be a different team than the employees or functional representatives who defined the activities and estimated costs.

- *Degree of impactability or urgency*. Each lowest-level activity can be graded for its near-term and long-term impactability as high, medium, low, or none. Alternatively, a percent of impactability can be estimated for each activity to test and quantify the aggregate cost savings opportunity that currently is based on a gut feeling or a non-quantitative, non-dollarized judging scheme. Employees usually score an activity’s impactability high if they believe it is non-value-adding. As an option, activities can also be graded by the necessity to change their consumption level in order to align activities with strategic goals or to remove waste.

- *Value*-added content. This scoring scheme has evolved over time. This evolution has moved from a focus on the dichotomy of either value-added or non-value-added, to the degree of value-added, to value-creating from a customer’s view value-enabling product from a product’s or process’ view, non-value adding from all three of those views, and the degree of value added.

- *Effectiveness level*. This scoring scheme assesses how well the performance meets the activity or process customer’s expectations.

- *Importance level*. This scoring scheme relates each activity to how well it supports management's strategic goals. A test question for each activity is, "If we stopped this completely, what would be consequences?"

- *Quality content.* This scoring scheme, shown in Table 3.1, classifies each activity and supports the popular TQM categories as follows; cost of conformance (prevention activities and appraisal and test activities), and cost of non-conformance (internal failure activities and external failure activities).

- *Cost influencing content.* This scoring scheme attaches and associates a specific upstream activity with a specific downstream activity that was caused upstream. There is an effect-based relationship between activities.

Table 3.1 Cost of quality using activities

Companies can assign activity attributes to cost of quality (COQ) categories.

	Conformance		Nonconformance	
finitions oup amples	I Prevention	II Appraisal	III Internal failure	IV External failure
tivity oup amples	Activities designed to prevent errors and mistakes during make and delivery	Activities to review, audit, evaluate, or measure to assure conformance	Activities correcting errors **prior** to customer receipt.	Activities correcting errors **after** customer receipt
	Training Advanced quality planning [illegible] Fool proofing	Incoming inspection Editors' review Line inspection [illegible] Finished goods inspection	Process scrap Rework [illegible] ntime	Handle complaints Warrant changes Process returns Expedited late order Lawsuits.

Take actions to shift costs to lower overall COQ

Consequently, the scoring of activities brings colours and shadings to the ABC/ABM model; without such scoring, all dollars are devoid of any nonmonetary value. By differentiating dollar cost with scoring and grading schemes, the managerial analysis is greatly improved and attention and focus of employees can be better directed.

3.5 ABC versus Theory of Constraints versus Throughput Accounting

In the early 1980s, a physicist specializing in fluid dynamics named Eliyahu M. Goldratt captivated operations managers' attention with his Theory of Constraints (TOC), an approach to material flow control based on bottleneck properties. He mesmerized people not only with the simplicity of the theory's approach but also by describing major flaws in traditional full-absorption accounting (Cokins, 1996).

Goldratt would described how the accountants' cost allocation practice of applying overhead costs to products on the basis of labour hours or machine hours is also used to measure a work centre's utilization and efficiency performance. Measuring the productivity of a work centre without regard to the total system inadvertently motivates behaviour that, while individually appearing good, collectively is contrary to just-in-time managerial thinking and adversely affects the total organization's efforts.

One of Goldratt's mantras is "The sum of the local optimums will never exceed the global optimum." So in conjunction with explaining what is bad about traditional cost accounting, Goldratt also provided a vision of what a better replacement cost system would look like. Having both a criticism and a solution is a basic formula for overcoming organizational resistance to change. His replacement costing approach is simple and very appealing to logic:

- You start with basic assumption that the goal of any profit-making business is to make money.
- The replacement cost accounting then falls neatly into place by focusing on the three possible dimensions of money:

  I. Throughout (T) – the rate at which the system (i.e., the business) generates money through sales.

  II. Inventory (I) – all the money the system invests in purchasing things it intends to sell (i.e. direct and associated indirect materials).

III. Operating expense (OE) – all the money the system spends in converting inventory into throughput (e.g. wages, fringe benefits, depreciation, capital charges, support costs etc.).

Throughput costs effectively become the total sales less purchased direct material. Inventory costs are not comparable to the financial accountant's goal of constantly attaching on-the-fly expenses for point-in-time valuation of work-in-process or finished goods inventories. Theory of Constraint (TOC) cost accounting obviously adapts a different view that disregards interim valuation of inventory.

This new of costs brings greater emphasis to material flow velocity and has spawned the name throughput accounting. It recognizes that capacity constraints are gating factors to making profit and that any time lost at a bottleneck is forever lost to the total business and results in lost profit.

TOC advocates assume that much or all of the overhead cost allocations can be loaded at the bottlenecked work centre. This escalates the cost of any part, product, or service that uses that work centre, which conversely reduces loaded costs to similar items going through non-bottlenecked work centres. The resulting calculations yield dramatically different product costs and clearly penalize items 'renting time' at the bottleneck. The new cost measures are used to understand directionally where incremental product profit may come from and to aid future planning for capital or resource spending.

Here is one of the rubs. TOC advocates criticize ABC data because it can produce different cost numbers than theirs. Since throughput accounting supports JIT thinking and all of the TQM-related philosophies that go with JIT, to TOC advocates ABC data appear both wrong and bad.

In practice, most operating environments are well balanced with regard to production rates and available capacities; and managers are getting increasingly better at flexibly moving people and reprioritizing schedules. Most companies are moving toward scheduling and dispatching near-term planning systems that include finite forward capacity logic with much broader views and more frequent schedule refreshing than in the past. These things are what industrial and process engineers are paid to do. The net effect is that operations are fairly well balanced; any significant imbalances, which create the bottlenecks, usually come from the demand schedule of different orders with different due dates. The implication is that the bottleneck wanders.

ABC data is not volatile. It does not concentrate on the direct costs, which vary with a high correlation with the output of primary parts, products, outputs, and services. What ABC does do is concentrate on the costs of all of the other indirect work activities? ABC acts as a proxy for a direct costing system by linking the activity costs that support the end-products and services, which appear to many people as fixed costs. ABC accomplishes this by flowing costs through an arterial assignment network of cause-and-effect drivers. Therefore, ABC more accurately captures product costs, which will vary only to degree that the quantities of their cost drivers vary – and the majority of those costs have little or nothing to do with the bottleneck or where the bottleneck is located at any moment in time.

TOC advocates find great appeal in accelerating the pipeline's velocity. By putting the measurement spotlight on the pipeline, the organization will directionally know where to spend its incremental dollars. In addition, throughput accounting removes accountability from all the support costs, which usually include the costs of the TOC advocates themselves.

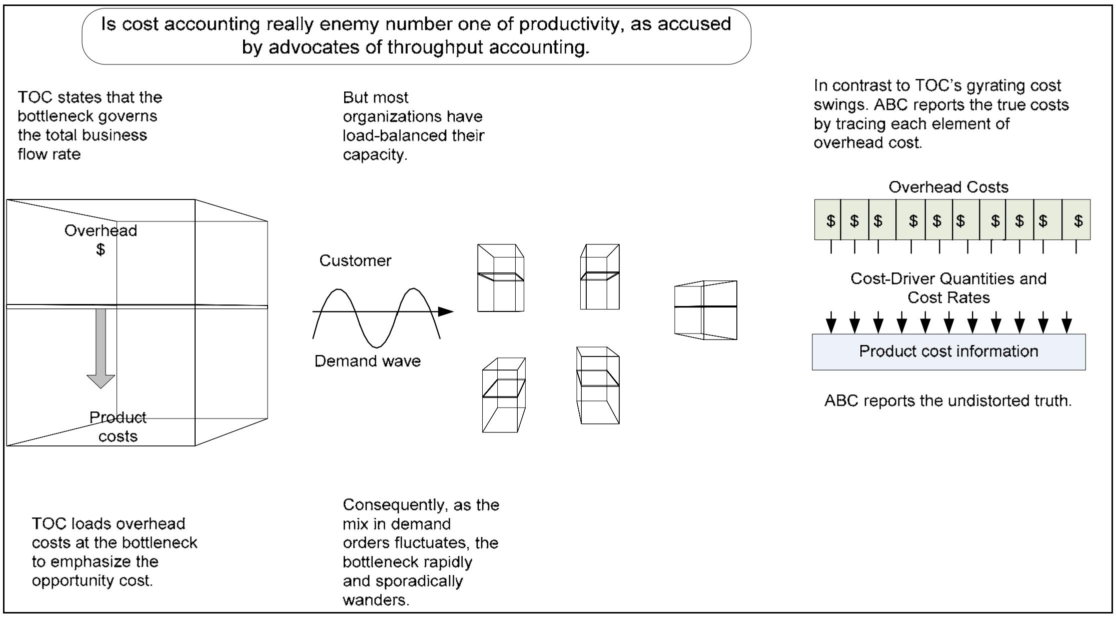


Figure 3.20 ABC versus Theory of Constraints (TOC)

ABC produces distortion-free visibility to costs, cost behaviour, and cost accumulation. It provides a foundation from which better decisions can be made, such as for marginal costing or incremental volume cost justifications. The ABC foundation is a solid web of cause-and-effect relationships. ABC costs do not gyrate; they rise and fall to the waves of customer order demand and to quantity changes of the activity cost drivers. In the end, ABC is simply a mirror in which the organization can examine its cost economics, particularly its increasingly swelling indirect costs. The time horizon is actually what seems to divide TOC and ABC advocates. For instance the TOC camp would claim that the cost of a shortage from missing 50-cent bolt is worth 100 dollars of premium airfreight, not 50 cents, if its shortage will delay shipment of a $100,000 order. The cost depends on other circumstances. Few resource costs in an enterprise are affected by a bottleneck or near-deadline delivery date. ABC reports actual costs of resource consumption, assuming normal operating conditions that reflect expediting and reacting behaviour. In contrast, TOC overstates costs and points to problems that may in fact only be temporary.

3.6 ABC and Unused Capacity Management

In defence of ABC, there is a movement to report the costs to a relevant level of detail. With more relevant data, it is hoped that the organization will behave directionally toward the aspiration that Goldratt pronounced: to make money. There will forever be natural tension between sales and production. ABC data can be reformatted to remove much of that conflict and introduce a neutral target for both sales and operations to attack for their mutual benefit. The neutral target for both groups to focus on is costly unused capacity (Cokins, 1996).

Sales can remove unused capacity by filling it with orders. Operations can remove unused capacity by streamlining, by removing capacity-consuming yield losses, and by better scheduling the product or service flow.

This ABC movement starts with the premise that true total capacity should be measured 24 hours a day, seven days a week, for an entire year. This is technically referred to as theoretical capacity. Within this truly total capacity; one can begin to measure theoretical capacity's elements as either containing:

I. Idle capacity – no use for reason of policy, union rules, legal regulations, holidays, or simply insufficient sales demand.

II. Non-productive capacity – time where resources are either being held for an expected workload; being used to produce what will subsequently be discovered as scrap loss or rework; being repaired, serviced, maintained, or trained; or being set up or changed over to produce the next scheduled product or service.

III. Productivity capacity – times used to actually work on what the customer is buying or to practice on or break in new products or new processes.

When capacity is segmented this way – at a fairly granular level, such as by each producing work centre – both sales and operations personnel can focus on a mutually enemy: non-productive capacity. Operations people can focus on removing it with faster setups and higher equipment uptime, resulting in an increase in idle capacity, which in turn provides an opportunity to fill more sales orders. Salespeople can remove non-productive capacity by adding more sales orders, which also increases productive capacity.

In attempting to understand unused capacity, ABC advocates have determined that managers can segment total theoretical capacity into the three classes above and measure ABC cost data at individual work centres to that same level of granularity. And it can even differentiate sunk costs from controllable expenses to the same level detail.

The next chapter expands on the softer, human issues of overcoming ABC/ABM implementation obstacles and getting people on board and excited about ABC/ABM.

3.7 Implementation

3.7.1 The Difference between implementation and installation

ABC/ABM project managers tend to be those pioneers mentioned earlier who constantly want to dispense with the theory and fluff. They just want to how-to instruction manual. It is best to think of ABC/ABM implementation as preparing for the project that brings about change and ABC/ABM installation. Attempts at ABC installation without first having success with the implementation is a receipt for failure. Implementation of ABC/ABM is more craft than science, and those readers desirous of rule-based designs, algorithms for computations, and linear regressions to optimize their ABC/ABM models had better step aside until about 1999 while an interviewing generation of more practical managers apply common sense and use the insights provided by the new data to make better decisions.

3.7.2 Implementation Roadmap

The roadmap should be understood for the same reason that manufacturers plea for consumers to read their instruction guide before assembling a kit – there are things to know before getting to far along into the assembly. Figure 3.21 shows a highly simplified ABC/ABM implementation roadmap.

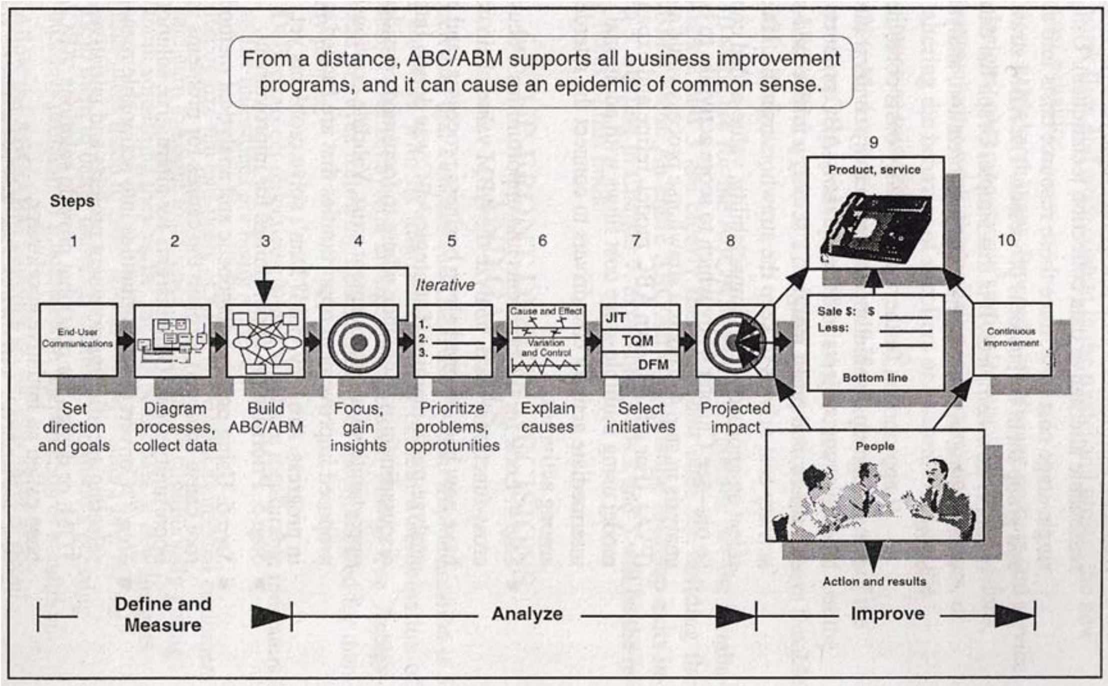


Figure 3.21 ABC/ABM implementation road map (Cokins, 1996)

3.7.2.1 Implementation Steps (Cokins, 1996)

Step 1. Determine why you are doing ABC/ABM. What is your target? What do you want to change? Who will be the end-users of the data? Meet with key end users to validate their dissatisfaction with the current accounting practices and ensure they know how ABC/ABM will make it better. Then as you progress, have a communications plan to keep them involved.

Step 2. Throw away the organization chart. Diagram the business processes at a reasonable level of detail using popular flow chart and process mapping practices and techniques. Do not make it too summarized or too detailed. Make sure that all process has inputs, outputs, and customers at the end.

Step 3. Construct and compute an ABM "strawhorse" model. Build an activity dictionary and collect very high level material and activity resource cost information based on estimates from a few good employees (or from reasonable alternative data collection techniques). Using only a single-state cost flow, trace those resource costs into activities and group them by business processes. The ABM strawhorse model is now complete. It is that simple. Graph the data for visualization to enhance end-user interpretation, analysis and effect.

If appropriate, further trace activity costs combined as common groups (activity centres) into high-level final cost objects to better quantify ABC products, customers and profit margins. Use only a few second stage final activity cost drivers to keep the straw horse simple.

Step 4. Look for the problems and opportunities. Using a cross-function team, analyze the ABM value-chain costs that have now been aligned along business processes. Interpret and discuss findings. Conclude where to focus and consider what opportunities for improvement exist. Validate previously proposed improvement opportunities that are funded and already in progress.

Step 5. Prioritize the opportunities for improvement.

Step 6. Using popular diagnostic and analytical methods (root-cause analysis), explain the causes for problems in the opportunity areas. Gain insights for alternative solutions.

Step 7. Convert the opportunities into actionable management by selecting specific improvement projects and initiatives that provide solutions. ABC/ABM has been called an initiative accelerator.

Step 8. Using the ABC/ABM data, test the potential financial impact of each project or initiative by quantifying the cost saving, cost avoidance, or revenue enhancement possibilities. Apply the planned changes to work flow and work content in the model and the project the new cost behaviour.

Step 9. Make changes. Proceed with altering product and service designs, changing people’s attitudes, creating shared visions, restructuring work, reorganizing jobs, removing barriers, or altering the behaviour of suppliers or customers. Make the processes mistake-proof.

Step 10. Are you at point B yet? If not, go back to one of the previous steps and refine. This is a continuous process, but the ABC/ABM system is a one-time construction, but always flexible in its design.

Those 10 steps are for the ABC/ABM implementation, not the installation. Steps 2 and 3 are clearly the important ones for building the ABC/ABM system. An entire ABC/ABM installation roadmap exists in side step3. Starting in installation, expanding steps 2 and 3 will be the main focus of implementation.

3.7.2.1.1 Measuring Success (Cokins, 1996)*; Question 1.* If the ABC/ABM pilot is being successful, how would we know it?

Answers:

- The business starts being managed differently.
- The pilot progresses to a next phase.
- End-user interest and requests for feedback increase.
- The new data starts being used and acted on.
- An ABC language emerges among employees.

Question 2. What would be measurable indicators of a pilot's success?

Answers:

- Cycle times are reduced and quality is increased.
- Performance measurements are reformed with a greater emphasis along business processes.
- Other continuous improvement programs request or use the ABC/ABM data.
- Additional improvement projects are simulated.
- A second ABC/ABM pilot is endorsed.
- The number of ABC literate end-users expands.
- The number of decisions applications using ABC data expands.
- A survey of nonfinancial end-users indicates satisfaction with the system.

- Additional executive-level sponsors appear.
- Requests for ABC/ABM training increase.
- ABC model updates are frequently requested.
- Products become more profitable.

3.7.3 Up-Front Design Decisions and Caveats

It has said that a successful ABC/ABM system implementation is 5 percent software with its interfaces and 95 percent a combination of model design and behavioural change management. Achieving success involves following classic principles recommended for managing project:

- Define project objectives, which will have measurable indicators as the milestones are being achieved.

- Recognize the end-users of ABC/ABM data as internal customers and earn the right to advance with them by continuously giving them something they value, such as better data or new insights.

- Allow the ABC/ABM system's scope, size, and level of detail, granularity, and accuracy to continuously unfold by working backyard from a mutually agreed-on deliverable that will help end-users solve one of their most distributing business problems. This advice may appear counter to the TQM "do it right the first time" philosophy, but rapid prototyping as a learning device for adults is just a better, more expedient and more practical approach. ABC/ABM system implementations usually stumble when they are over engineered and are without a predefined purpose.

Start with a no computerized, grease pencil drawing of your organization's ABC/ABM multistage cost flow model before constructing your spreadsheet straw-horse. The myriad of up-front ABC/ABM installation-related questions about the number of cost drivers, the number of activities, the choice of cost drivers, the frequency of model updates, and so on are ultimately best answered by first gaining experience and then constantly satisfying the internal customer's needs and wants.

A decision must be made as to whether the first ABC/ABM model is intended as a diagnostic one-time study, a baseline for a repeatable model, or a fully integrated and automated permanent production system. These three choices are depicted along a continuum in Figure 3.22.

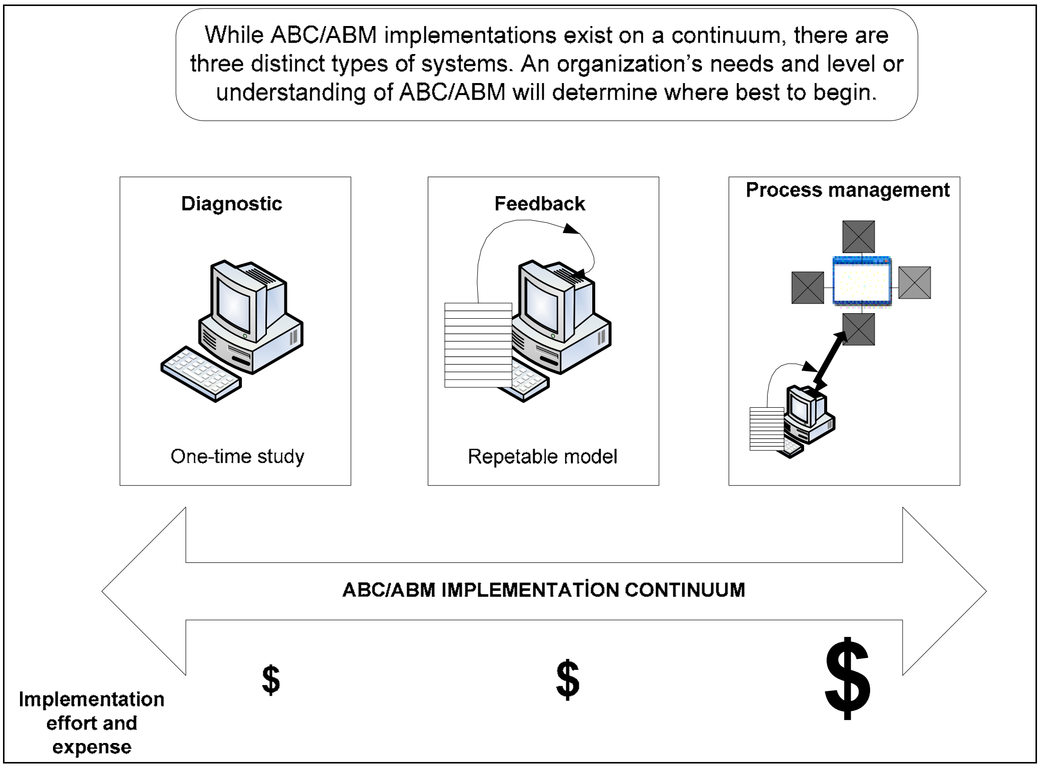


Figure 3.22 ABC/ABM implementation continuum (Cokins, 1996)

3.7.4 Defining Objectives for Success – Yardstick Measures

ABC/ABM projects can fall short of their full potential. To succeed you must do more than just (1) understand why ABC/ABM projects don't totally satisfy objective, (2) learn from those lessons, and (3) take corrective actions to not repeat others' implementation errors. Although those are noble goals, it is worth proactively establishing in advance your own yardstick measures for success of your own ABC/ABM project.

Common barriers to successful ABC/ABM implementation relate to accountability in two very different ways. One way previously discussed involves the initial resistance of internal end-users caused by anxieties that their performance may be financially measured with techniques other than the traditional measures they've artfully mastered over the years. But the second problem involves monitoring the ABC/ABM implementation project itself. How is the ABC/ABM project's success to be measured?

How to measure success

Question

If the ABC/ABM pilot is being successful, how would we know it?

Answers

- The business starts being managed differently.
- The pilot progresses to a next phase.
- End-user interest and requests for feedback increases.
- The new data srats being used and acted on.
- An ABC language emerges among employees.

Question

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Answers

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- Additional improvement projects are stimulated.
- A second ABC/ABM pilot is endorsed.
- The number of ABC literate end-users expands.
- The number of decision applications using ABC data expands.
- A survey of nonfinancial end-users indicates satisfaction with the system.
- Additional executive-level sponsors appear.
- Requests for ABC/ABM training increase.
- ABC model updates are frequently requested.
- Products become more profitable.

Figure 3.23 Measuring success (Cokins, 1996)

3.7.5 Popular Applications of ABC/ABM data

Since ABC/ABM data are basically used as means to an end, it is important identify the "end". Agree on a decision capability for the new data that end users have really wanted and that will give them positive results when they finally use it.

People will resist reforms to measures even if they know that the one's they're using are bad because they also know how to get around them for personal purposes. ABC/ABM proponents strongly believe that the use of activity based costing data and their associated practice is an eventuality.

Table 3.2 Popular applications (Cokins, 1996)

Strategic Applications	Operational Applications
How to condust business?	Where to look for opportunities?
Order quotations (pricing) Product profitability analysis Customer profitability analysis Capital expenditure justifications Performance measurements, Target costing Life-cycle costing	Business process/activity value analysis Cost-of-quality analysis Cost driver analysis (Unit costs of) Make-or-buy analysis Business process reengineering Benchmarking Activity-based budgeting Unused capacity analysis

3.7.6 Critical Success Factors for ABC/ABM Implementations

The key to successful implementation and sustained use of the ABC data is to balance the four areas explained in the following:

1. ABC model design and architecture; constructing an ABC/ABM model combines art, craft, and science.

2. Implementation and integration; It is important to select promising pilot sites and to involve individuals with information –technology skills.

3. Getting buy-in; Get the support of an executive sponsor and create widespread interest in and ownership of the data and its uses.

4. Application of the data; be sure there are end-users with strong needs for the ABC/ABM data.

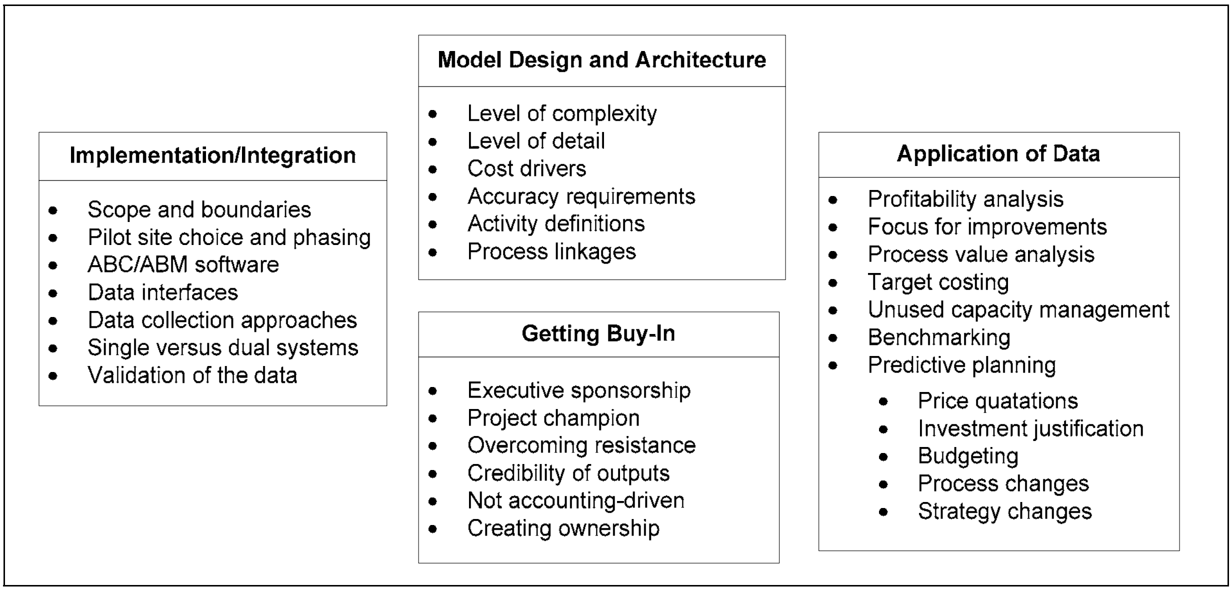


Figure 3.24 Elements of ABC/ABM success factors (Cokins, 1996)

3.8 An ABC/ABM Installation Roadmap

3.8.1 ABM as an Attention-Directing Mechanism

Staged learning allows for flexibly modifying the ABC/ABM model to meet end-users' needs prior to the model becoming too large and complicated A popular ABC/ABM installation approach includes (Cokins, 1996):

- Identify core business processes by creating enterprise wide diagrams.
- Build business process maps as supplier value chains.
- Identify the activities central and tangent to the core business processes
- Organize to collect the resource cost consumption data for activities.
- Add new activities as needed to capture 100 percent of the resource time being consumed.
- Measure or estimate labour costs.
- Measure or estimate purchased material and service costs
- Trace activity costs to intermediate and to final cost objects.
- Reconfigure the cost data and visualize the business processes.
- Analyze costs for insights and take actions.

Traditional cost accounting reports expenditures to managers by department or cost centre. This simply gives managers and employees a stovepipe view of themselves and actually blocks them from seeing how their enterprise behaves horizontally by processes and as a tool business system. In effect, traditional, general ledger cost accounting systems act like thick cloud covers.

What managers initially need is a quick glimpse of what's below those clouds. Traditional accounting systems provide little visibility to business processes, and managers need to understand costs of these processes. These dismal conditions justify why ABM supply value chain cost data need only be collected and initially reported using a fast, high altitude flyover technique- dip under those clouds and snap a few pictures of the enterprises cost use and then interpret what is seen. This high-altitude flyover in effect becomes the strawhorse mock-up for the eventual ABC/ABM cost system.

ABM as a Focusing Tool, Supplier value-chain analysis (ABM) at a high-altitude flyover stimulates managers and employees.

ABC/ABM Begins with Enterprise-wide Diagrams; the starting point of the installation roadmap is to identify business processes. A popular approach for identifying them is to use visual diagrams. This is a top-down approach.

3.8.2 ABM as a Focusing Tool

Supplier value-chain analysis (ABM) at a high-altitude flyover stimulates managers and employees. Finding the answers to the above questions ignites them to build strong business cases to take actions. In this way, ABM achieves its purpose as an attention-directing mechanism.

Building compelling business cases, however, may require more specifics and particulars than provided by the high-altitude flyover snapshots. A better, closer view gained from a 50,000-foot ABM flyby can help managers focus on the core business processes. At a granular level, with more code-intended activity levels, the process' cost consumption characteristics will provide greater resolution, become more visible, and be even better understood by end-users.

By collecting lower level, decomposed activity cost data, more hidden costs, likely to be favourably affected by a future process change, can be identified and quantified. The sum of the hidden costs of the core business processes, when scored and combined with the more obvious non-value and low-value-adding activity costs, may well tip the scales in a decision of whether or not to proceed with an improvement initiative or investment.

The ABM value-chain activity analysis can be further magnified with a more detailed and illuminating 10,000-foot flyby. This data collection and reporting exercise can also be quick and economical, accomplished in days, not months.

3.8.3 Linking ABM to Relationship Maps Using Process Mapping

Process mapping is synonymous with value-chain analysis. It helps to document the results of the relationship map and organize information to ensure its complete, understandable, and readily analyzable ABM configures the organization and assigns costs to business processes something that traditional accounting cannot achieve.

Until the next generation of managers, relationship diagrams and business process maps should probably be kept at a summary level. They will need to be graphically modelled and visualized at an intermediate-to-high level. Fortunately, this is the same level at which ABM costs should be collected, measured and reported. Therefore, the cost data can be aligned with processes and maintained in sync with the messages that are signalled to managers from relationship map.

3.8.4 Identifying Activities within Business Processes

Regardless of an organization's size or number of employees, a virtually limitless number of activities can be selected. How do you control the size and number of activities? The criteria for identification activities should include materiality as well as the objectives of the ABC/ABM data discussed in step 1 of the implementation road map.

You can maintain materiality by using common sense. Don't chase details. Strategic objectives of ABC/ABM can require identifying and defining more summarized levels of activities than if the objectives are tactical and simply for operational improvement.

3.8.5 Organizing to Collect Resource Cost Data by Activities

The ABC/ABM system must initially assign resource costs to activities. Resource costs are continuously captured via transactions in general ledger journal account balances (payroll, accounts payable, material stores issues, journal entries etc.). The assignment of these costs to activities can be done.

- By direct charging, using existing measurements (e.g., charging repairs via a work order, metering fuel consumption, charging supply issues).
- By estimation (by surveying techniques)
- With arbitrary allocations; but these should clearly be resisted because they don't aid in better understanding or modelling the economics of the business.

Direct charging with measured data consumed by its cost object is common sense. However, dealing with indirect charges requires identifying activities and estimating the labour and material consumption within each. It is easiest to collect data on labour and service-time costs before estimating external purchased materials and contractor service costs. The reason is that concentrating first on what people do defines a basis on which purchased materials and contractor services can subsequently be assigned.

Estimating can be controversial because it implies there will be some degree of error. With ABC, however, knowledgeable estimates from informed individuals are much more preferable than precise calculations of irrelevant allocations.

The first of the three estimating options relies on business process supply chains as the source for defining activities. Using a predefined process map, which arranges the organization into a network of labour-performing work, simplifies defining activities. At the lowest step of each business process, simply describe a few verb-adjective-noun activities. Repeat this for every step of every business process, and you'll eventually construct the activity dictionary.

The second estimating option is useful when there are incomplete or no documented business process flow charts. This option creates the whole (i.e., processes) from the sum of the parts (i.e., the work activities). Each stovepipe, functional department is surveyed for the employees' activities in isolation of the other departments. When all departments have been surveyed, the activity-based model for the total enterprise is then created by assembling the parts into a whole. The business processes are rationalized from examining the verb-adjective-noun activities, and then these activities are sequenced along the business processes.

Table 3.3A shows a time-effort input form that has been completed by a functional representative. The estimates have been rounded to 5 percent increments.

Table 3.3B shows the cost activities, with average salary and fringe rates used for each natural work group; the total costs appear in the last column.

Both of the above options are designed to produce rapid, non-invasive results with a minimum adverse impact on data accuracy and credibility. Both techniques are top-down and rely on a few good employees as representative estimators. That is, the ratio of employees to estimators is high. ABC/ABM implementation teams frequently rotate back and forth between these two options as empty holes of work-content get defined and filled in. These two estimating options check and balance one another because they both are describing the same thing: the work people do.

The top-down approach to achieve quick availability and visibility of activity-based cost data is more effective when the number of functional representative estimators (i.e., the few good employees) is limited, they reasonably understand their business, and a financial accounting team member is knowledgeable about general ledger accounts and balances.

Table 3.3A Time-effort input sheet

Employee and Expense Activity Effort Worksheet (%)

	Prepared by Project Manager			Date:	Page_ of _		
Activity / Avg. Wage & No. Emplyoees	Employee Names /#/Groups & Expenses						
	3 @ $20K Material Handlers	2 @ $20K Inspectors	2 @ $35K Maintenace	2 @ $25K Computer Programmers	1 @ $45K Scheduler	2 @ $ 50K Set-up Engineers	3 @ $ 50K Printers
Set-up equipment						90%	
Chase material	25%						10%
Inspect finished cards		50%					
Inspect incoming material		50%					
Maintain facility			30%				
Manage program changes				75%			
Move material	50%				25%	10%	
Plan printing schedule				25%	75%		
Store excess material	25%						
Do unscheduled maintenance			40%				
Run 1972 standard printer			25%				60%
Run 1995 personalized printer			5%				30%
Total	100%	100%	100%	100%	100%	100%	100%

Table 3.3B Cost activities

Employee and Expense Activity Effort Worksheet ($)

	Prepared by Project Manager			Date:	Page_ of _			
Activity / Avg. Wage & No. Emplyoees	Employee Names /#/Groups & Expenses							
	3 Material Handlers	2 Inspectors	2 Maintenace	2 Computer Programmers	1 Scheduler	2 Set-up Engineers	3 Printers	Total
Set-up equipment						$90,000		$90,000
Chase material	$15,000						$15,000	$30,000
Inspect finished cards		$20,000						$20,000
Inspect incoming material		$20,000						$20,000
Maintain facility			$21,000					$21,000
Manage program changes				$37,500				$37,500
Move material	$30,000				$11,250	$10,000		$51,250
Plan printing schedule				$12,500	$33,750			$46,250
Store excess material	$15,000							$15,000
Do unscheduled maintenance			$28,000					$28,000
Run 1972 standard printer			$17,500				$90,000	$107,500
Run 1995 personalized printer			$3,500				$45,000	$48,500
Total	$60,000	$40,000	$70,000	$50,000	$45,000	$100,000	$150,000	$515,500

* $135,000 direct labour cost

The third estimating option is a bottom-up, small group technique that relies on storyboarding which employs cut-and-paste bits of information and flip charts and involves inverse participation of work groups. It relies on numerous group meetings of side-by-side employees in which they define what they do and how they do it. This technique supports total quality management (TQM) improvement philosophies. Each team member of every work team formally defines work from his or her viewpoint. The employees' time is then apportioned to their known activities, and the costs are assembled in a manner similar to that used in the second option.

In practice, companies with successful ABC/ABM systems have used elements from all three of these data collection options. The advantage of the first two options is the data can be rapidly collected with relatively high accuracy, consistent definitions, and initial non-invasive impact on employees. The advantage of the story-boarding option is there is greater employee involvement, which helps change personal attitudes, may speed achievement of consensus and minimizes resistance to change. Regardless of which technique you use, be sensitive to the individuals who are being honest about the organizations activities.

3.8.6 Measuring Labour Conversion Costs by Percent

The high-altitude flyover and low-altitude flyby data collection approaches provide increased, scalable information and without distortion. This data can then be used to measure labour conversion costs. Employees' average salary and fringe benefit dollars are multiplied by estimated percentage of the total work that the employees' activities account for. Average salaries can be identified at the same department levels as used during the annual budget exercise.

In practice, gaining estimating accuracy through scaling is accomplished by merely expanding the size of the activity-by-employee-group matrix or using more work representative estimators. The followings are ways to get more accuracy:

- The number of natural work groups that are estimated for can be further subdivided, but the total number of employees will always remain the same. Natural work groups are two or more employees, not necessarily from the same department, who perform common activities with related outputs, like purchasing agents and receiving dock workers. Note that despite subdividing, the ratio of total employees to estimators remains unchanged.

- The verb-adjective-noun activity convention remains unaffected, but the lowest-level activity column can be expanded by adding an intended column to the activity dictionary, thus providing another level in detail.
- The number of functional representative estimators can be doubled or tripled to achieve a more accurate estimate of the incrementally lower level of costs from the further subdivided natural work groups of employees. This lowers the ratio of employees to estimators. More estimators assure a greater familiarity with how work time is apportioned by the employees within natural work groups.

3.8.7 Measuring Labour Conversion Costs by Cycle-Time Outputs

The cycle-time approach requires a start-to-end process flow chart. An average cycle time is estimated for each activity, or group of activities. For example, assume that travel reservationists handle completed ticket reservations and customer inquiries about schedule times, departures, arrivals, or ticket prices. Also assume the following (Cokins, 1996):

Average time per completed reservation	= 7.50 minutes/output
Number of completed reservations per month	= 10,000
Average time per inquiry	= 4.00 minutes/output
Number of inquiries per month	= 19,650
Number of travel reservationists	= 20
Average monthly salary and fringe /employee	= $3,000
Average employee hours worked/week	= 40.0 hours
Average break time per worker/week	= 8.0 hours

A cost per completed reservation and per inquiry can be computed as follows:

$3,000 * 20 =$60,000 payroll per month

40 hours/week – 8 hours week break time = 32 hours * 4 weeks/month =128 hours/month

128 * 20 employees = 2560 person-hours/month

Cost factor = \$60,000 (load)/2560 (rate)
= \$23.4375 /hour or
= \$.390625 /minute

Cost per completed reservation @ 7.5 minutes = \$2.929688
Cost per inquiry @ 4.0 minutes = \$1.5625

One of the complications with the cycle time output approach is reconciling the total costs. By continuing the cost math:

10,000 reservations @ \$2.929688 each	= \$29,296.87
19,650 inquires @ \$1.5625 each	= \$30,703.13
Total	= \$60,000.00

In this example, the total monthly costs of the reservations and inquiries fall short of the \$60,000 payroll. In addition perhaps the reservations performed a third untracked activity like cancelling tickets. A complication with the cycle-time output measure approach involves:

- Cost and time of the processor (the reservationist).
- The cycle time of the process/activity (reservation, inquiries).
- The quantity of the processes (reservations, inquiries).

The cost-load rates, average processing cycle-time rates, and total cost are usually determined during measurement periods that differ from the period for which costs are being accounted.

Correcting this situation is not a major issue. If a complete reconciliation with period expenditures is the goal, the cost rates can be modified upward or downward to force the complete reconciliation.

3.8.8 Estimating Purchased Material and Service Costs

The attention thus far for data collection has been strictly on the employee-related time-effort expenditures (salary, fringe benefits etc.) How do no payroll-related and purchased material expenditures from third parties get assigned from the general ledger into activities? It is best to restrict these assigned costs to those activities already defined for what people and machines do. That is, do not create new activities.

A practical estimating approach involves first isolating a Pareto ranking of roughly 90 percent of non-wage general ledger account balances for expenses (e.g. supplies, travel, etc.). Then assign the cost of the larger dollar accounts to one of three broad categories:

1. Direct charge to an activity (i.e,, to within a business process).
2. An enterprisewide or infrastructure-sustaining activity.
3. Employee-related use and occupancy, called super fringe benefits

These three costs assignment paths are shown in Figure 3.25.

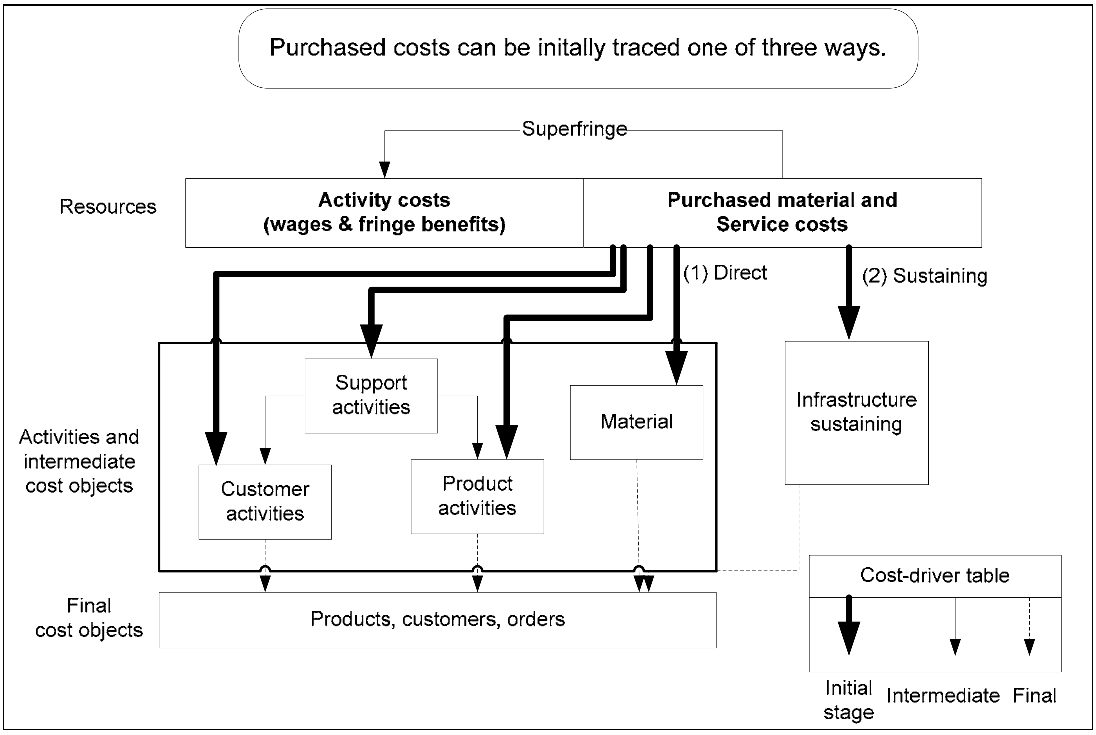


Figure 3.25 Estimating purchased items (Cokins, 1996)

For some ledger accounts, it may be worth the effort to retain the originating cost centre or department identification rather than using the total, across-the-organization expense. However, often the purchasing location is not where the activity cost is incurred. Therefore, it may be simpler to first assign the entire account expenditures to one of the three aforementioned categories to disconnect the expense relationships from its cost centre; and then apportion further from there, if necessary. Here are further descriptions of the three expenditure categories:

1. Direct charge to a business *process activity*. Many purchased items or services can be naturally associated with the verb-adjective-noun activities already defined for people. They are simply consumed as employees do the work activity. For example, the cost for corrugated boxes is likely consumed when people pack material. In some cases, the purchased cost may be consumed by two or more activities located in proximity of one another.

2. Enterprise sustaining activities. Some purchased items or services like building rent, taxes, lawn-cutting services or the company picnic are arguably not directly required by business processes or by their final cost objects. They are pure support be combined with the people-related infrastructure-sustaining activities. When full-absorption, fully burdened costing is absolutely required for decisions segment the reporting for these overhead costs as a tax or surcharge to their cost objects.

3. Employee use and occupancy. Some purchases like office furniture, laptop computers, travel, and phone bills are highly correlated with the number of employees. These costs, once isolated, can simply be combined with cost of salaries and fringe benefits. In effect, these purchases are costs to support employees as resources, which is why they are called superfringe. These costs will then get baked into the activity costs via the employee wage-related assignment and estimating exercise.

In summary, an increased magnitude of visibility (i.e., granularity) comes only from the expansion of the verb-adjective-noun activities at their lowest level; for example, going from about 75 activities for the high-altitude flyover to roughly 250 activities for the low-altitude flyby. Any improvement in the ABC/ABM model’s accuracy comes either from (1) the expanded segmenting of activities if the same flyover functional representatives do the estimating or (2) the greater familiarity with employee work-time by enlisting additional estimators who are more likely to be more familiar with and closer to where work gets done by people.

3.8.9 Converting ABM into ABC: Assigning Activity Costs to Final Cost Objects

This section describes how to use cost drivers to perform the product and service costing calculations. Activity cost drivers are used to integrate the cost flow from activities to other activities and eventually to final cost objects. Activity cost drivers can be defined as any event that causes a change in the consumption of an activity by other activities, products, suppliers, or customers (fig. 3.26).

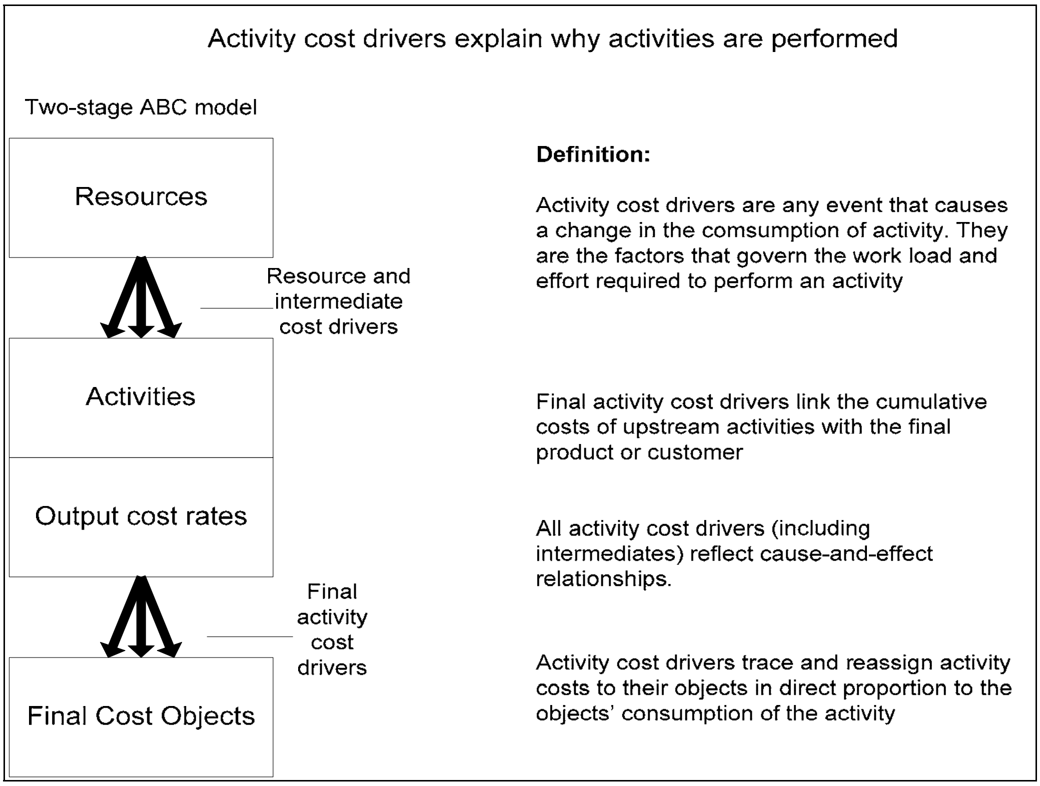


Figure 3.26 Defining activity cost drivers

A way to identify an activity cost driver is to ask an employee, who performs a specific activity, "What would make the magnitude of your time spent on your activity appreciably go up or go down?" For example, the activity "process invoices" would have the number of invoices as its activity cost driver. Figure 3.27 expands on how to identify activity cost drivers. Cost drivers should ideally be discretely measurable in quantity and traceable to unique cost objects.

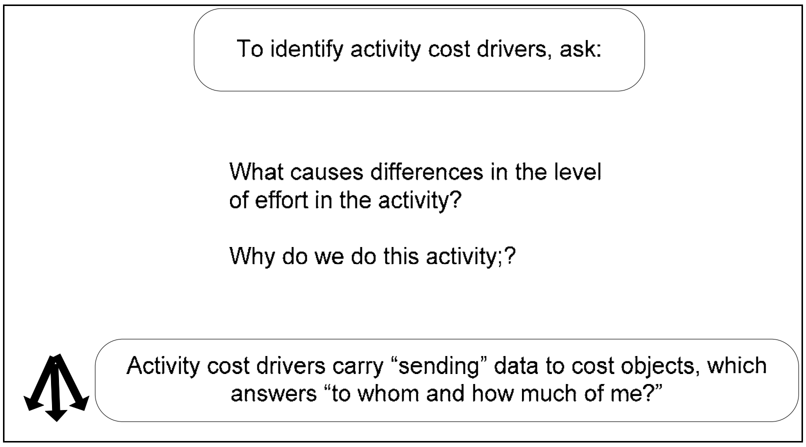


Figure 3.27 Identifying cost drivers

In sum, an activity cost driver measures the frequency and intensity of the demands placed on activities by cost objects, as illustrated in figure 3.28. They are individually variable and can best explain the behaviour of an activity cost.

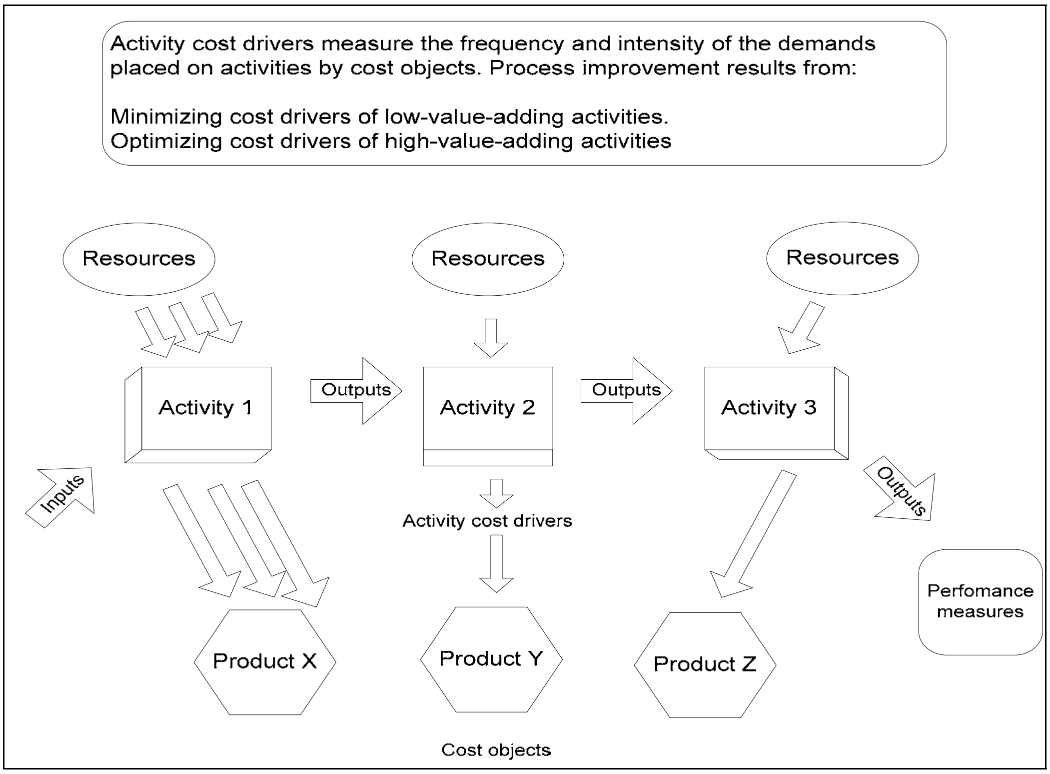


Figure 3.28 Visualizing cost driver consumptions (Cokins, 1996)

Figure 3.29 provides a sampling of popular product-related and customer-related activity cost drivers.

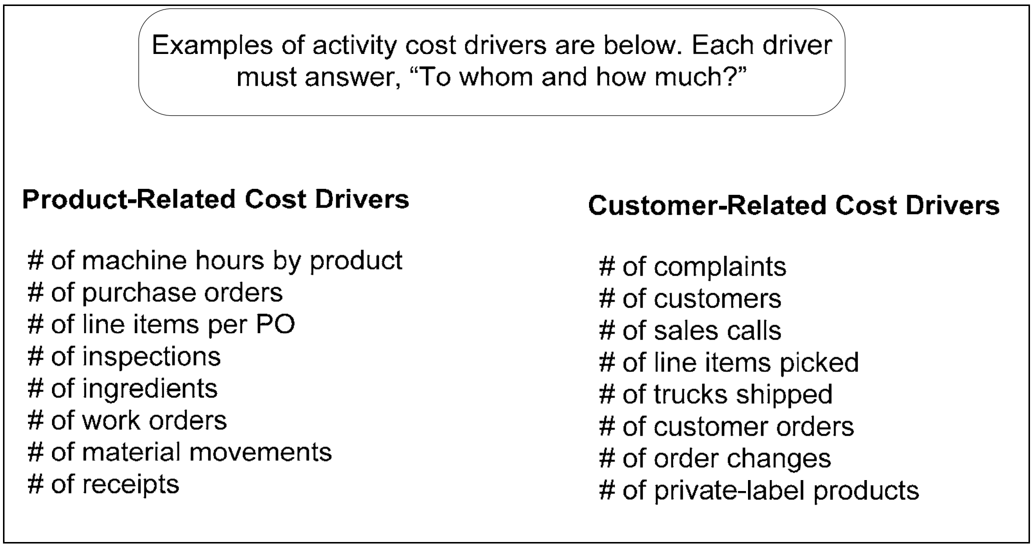


Figure 3.29 Examples of activity cost drivers

3.8.10 Analyzing Costs for Insights

ABC/ABM data have previously been mentioned as a means to an end, where the end is the decision made and actions taken. Figure 3.30 shows a high-level view of how data is transformed with tools and analysis into results.

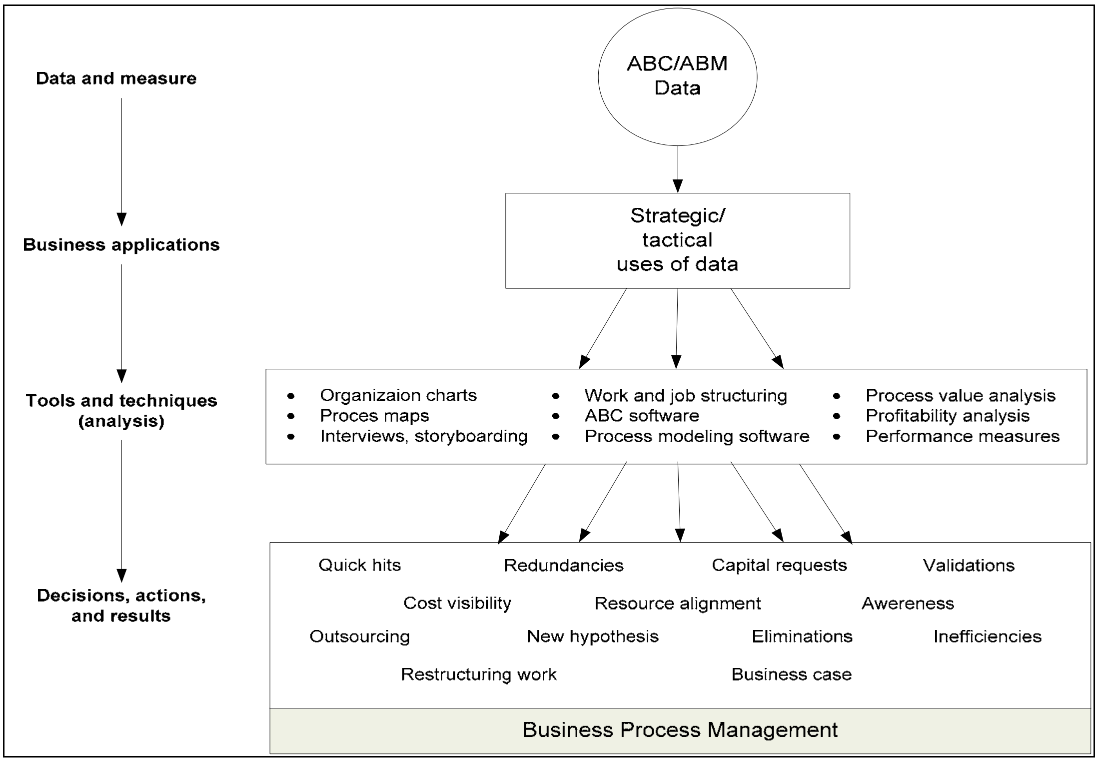


Figure 3.30 Using the data (Cokins, 1996)

Figure 3.31 shows the four major flow paths with which the ABM data can be analyzed:

- Business process cost visibility – new views as to where the costs accumulate in the business process and at what rates.

- Business process change impact cost/benefit analysis
  - Capabilities to score or grade the value content of work and resource consumption.
  - Ability to quantify the work and the costs that may go away with changes.

- Root cost analysis
  - Identification of cost drivers and their magnitudes to determine what causes work and costs to occur.
  - These cost relationships are also used for product and customer profitability analysis, activity-based budgeting, product and service line costing, and what-if scenario planning.

- Worker fragmentation analysis – How is the mix of work either concentrated or widely distributed among employees?
  - If too concentrated, the work may be dispersed to existing employees.
  - If too widely distributed, there may be excess redundancy and overlap, which can be consolidated among fewer employees.

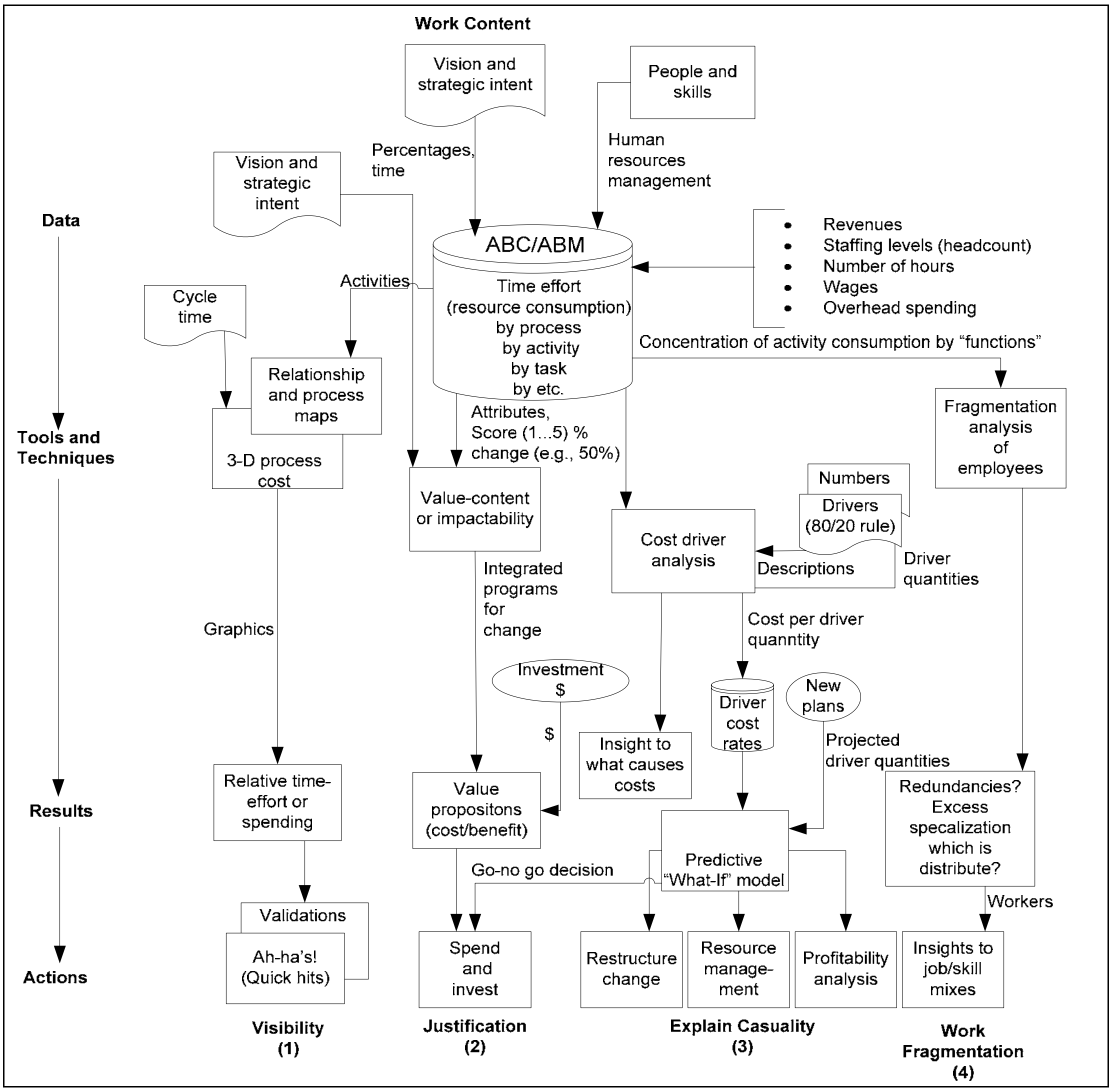


Figure 3.31 from Data to analysis to action (detail)

Although all four broad uses of the ABC/ABM data are of great value, root cause analysis may well be the best. By definition causes reflect the reason an activity exists, whereas effects describe the activity after the cause. ABC/ABM data reveal more effect than cause. In other words, costs are really symptoms of more deep-seated processes.

3.9 The Path to ABC/ABM Success

A lowest path drops downward into "the valley of despair" following employee disillusion with the ABC/ABM project and resulting drop in interest and support. The reasons are described below. Since the direction toward process-based managing techniques is inevitable, these ABC/ABM projects will eventually remerge from their dormant state. Renewed or resurrected ABC/ABM projects can possibly result from a turnover in managers or too many unplanned surprises, that is, bad and costly decisions caused by the existing traditional accounting system.

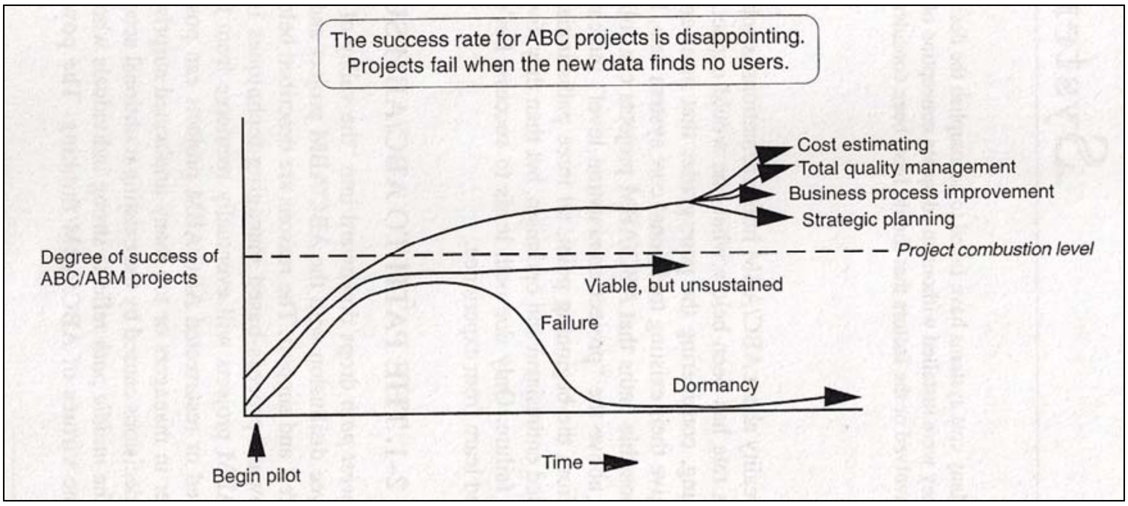


Figure 3.32 Possible paths of ABC/ABM projects (Cokins, 1996)

The middle path reflects strong individuals who continue to champion the virtues of ABC/ABM thinking. The power of their strong personalities keeps the ABC/ABM implementation project afloat. Unfortunately, the usefulness of the new cost data they produce has not been sufficiently recognized by employees to break above that combustion level for success, where any project or system takes off on its own merits.

The top path represents the successful ABC/ABM projects that are pulled through by the unabashed interests of the individuals to use the data to do their jobs better and make better decisions.

3.10 Causes for ABC/ABM Failures

A good approach is to not repeat mistakes of others and to correct for why many other ABC/ABM projects have stumbled. Unfortunately, there are so many reasons that ABC/ABM projects have had difficulties that it is probably more useful to divide the problems into four broad categories based on the severity (Cokins, 1996):

- The biggies or showstoppers

- The user rejections
- The organizational obstacles
- The nuisances

The biggies or showstoppers:

- When ABC/ABM projects are launched from the finance or accounting department, they are usually perceived by those that the project is intended to help as another meaningless financial or managerial exercise.
- Financial accounting tends to be “outside the comfort zone” of most individuals. The new accounting data cannot be forced upon potential users.
- The new ABC/ABM initiative is routinely approached without predefining tangible, results-oriented objectives. That is, the ABC/ABM model or system was installed with a “Field of Dreams” illusion as in the recent Hollywood movie: “if we (the ABC/ABM project team) build it, they (the data users) will come.” That is nonsense. They won’t come if there were no problem sets earlier identified for the new data better solve.
- There is an impression that simply computing the new ABC/ABM data for users is a gracious act. Without a plan, even if people look at the data, they will learn a lot, but they won’t necessarily get anything done.
- The ABC/ABM information becomes “a second set of books,” thus competing with the “official” accounting system. Employee performance measures are often linked to the official system, which can consequently encourage bad behaviour.
- The magnitude of resistance to change is grossly underestimated. Business people not trained in financial accounting tend to think a successful accounting system is one that regularly generates financial reports or that balances the financial books monthly.
- The degree of disbelief of the newly calculated numbers is always underestimated by the ABC/ABM project team. With accurate tracing of

costs, the resulting costs of certain products, services or process outputs can differ dramatically from their costs as allocated in traditional methods. The organizational shock is substantial.

- Some parties are adversely affected by ABC. For example, product line managers responsible for products with marginal profitability as calculated with the traditional allocation data will balk when they recognize that the ABC calculations can further shift costs into their products and therefore make their products unprofitable.

- The design of the ABC/ABM system is over engineered, excessively detailed, or flawed in some manner such that the data are not viewed as useful. Credibility is compromised. The system design flunks the "closeness beats precision" test too many times. Other flaws include poorly defining the activities without a verb-noun grammar convention, using too many activities cost drivers, or not identifying the true cost objects that consume activities.

Users might reject an ABC/ABM system because of the following:

- Sales and marketing personnel do not know how to react nor take appropriate actions once they are confronted with the new winners and losers of profitability, whether they are products, services, or customers.

- ABC/ABM does not provide all the information for product and customer planners to make decisions. It simply reflects the disproportionate and diverse consumption of resources in terms of costs. It sheds little light, for example, on the potential that customers might bring to future market or product migration strategies, or where existing products or markets are in their life cycle.

- The ABC/ABM project is viewed as another competing improvement program rather than as enabling data to aid existing improvements programs.

➢ Acting on the data can involve pain for somebody. The data can lead to reorganizing people and restructuring their work in different ways that may eliminate or replace some of the existing people and equipment.

The organizational obstacles to ABC/ABM success:

❖ Brisk pace was not maintained after the ABC/ABM project began. If ABC/ABM projects take too long, they lose momentum and people lose interest.

❖ If the pilot site is strictly a cost centre without profit-and-loss responsibility or not based on market-driven selling prices, people pay less attention.

❖ There is minimal diversity in the number of features of end products or services.

❖ A higher-level organization unit autocratically mandates ABC/ABM. It stipulates a predefined, standard set of activity definitions.

❖ ABC/ABM's reputation as a business improvement tool has been maligned by naysayers as being too costly or ineffective.

The smaller nuisances affecting ABC/ABM success are:

- The project team leader lacks that "fire in the belly" needed to create change.
- ABC/ABM training and awareness occurs too early for the eventual internal users to benefit from. There are insufficient cause-and-effect relationships between cost flows.
- Activity cost drivers do not adequately reflect the consumption rate and pattern of their respective activities.
- Hard, measurable data, such as the number of material moves, are unavailable or inaccessible.

CHAPTER FOUR
CASE STUDY

The Industrial Manufacturing Company is considered in this study. We will try to calculate the unit cost of each product by applying both Traditional and Activity-Based Costing method. The main aim in this study is to show that Activity-Based Costing System is better and more accurate than the Traditional Costing System in estimating the product costs. We will compare the results obtained from by applying two costing systems.

4.1 The Definition of the Company

The company produces 20 various products in the market. It has the share of 2 % in the sector. The company has 333 employees in different departments such as purchasing (2 staffs), warehousing (2 staffs), production (322 staffs, as 313 workers and 4 engineers and 5 technicians), marketing (1 staff), sales and shipping (2 staffs) addition to 1 manager, 2 vice-managers and 1 production director. They produce products in standard specifications and according to customers' requirements. The purchasing, production, warehousing, marketing and shipping of all these parts are the main activity of the company. The company works in a traditional way and all activities are carried out manually. The company's present costing system is traditional. There are only three elements of the total cost, direct material cost, direct labour cost and overhead cost.

The products of the company are respectively P_1, P_2, P_3,…,P_{20}. The monthly production amount is 89,560 parts. The monthly production amounts of the company per the product groups, the raw-material costs of the products and also the labour costs of ones are shown in table 4.1, respectively:

Table 4.1 The monthly production amount, the raw-material costs, the direct labour costs

The monthly production amount

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
4500	3750	2850	5150	6000	5360	6200	4250	4100	3900	3500	2750	2600	3600	4000	4800	5100	6450	5700	5000

The raw material costs ($)

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
18,50	20,25	16,50	15,30	26,40	17,20	28,50	19,50	14,35	21,80	22,60	11,30	13,25	12,45	27,75	23,50	24,30	30,00	29,10	25,50

The direct labour cost ($)

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
8,10	7,50	5,25	3,75	12,50	6,75	14,30	4,80	3,60	9,50	10,25	5,75	6,00	5,35	13,85	9,00	8,25	14,75	13,50	12,00

Addition to the company for the manufacturing activity has 50.000 hours-man for 313 manufacturing stuffs and also 20 working days in a month and 8 working hours in a working day were considered.

The Overhead costs group of the company are machine and building depreciation, insurance, interest, taxes, advertising, office costs, travel costs, utilities costs, set-up labour, administrative wages, supplies, material handling, energy costs, indirect materials, engineering, packing, shipping, maintaining and repair costs.

As the set-up time, the maintaining duration and the repairing duration are respectively 1250, 3500 and 1500 hours addition to 50,000 hours-man for the manufacturing.

The manufacturing-related costs of the overhead cost are differently computed in the costing that are traditional and ABC. Therefore, we considered the costing systems in different sub-capitals.

4.2 The Calculations in the Cost Systems of the Case Study

Traditional Costing and ABC systems are applied to the accounting.

4.2.1 The Calculations in Traditional Costing System

In this costing system, direct material and labour costs are directly traced as a part of the cost of the product. Supposed that overhead cost group that was obtained by direct labour costs method is considered as 420% of the direct labour costs. Hence, we got the overhead costs with 4.2 by multiplying direct labour costs per the product, respectively. Obtained results are respectively $34.02, $31.50, $22.05, $15.75, $52.50, $28.35, $60.06, $20.16, $15.12, $39.90, $43.05, $24.15, $25.20, $22.47, $58.17, $37.80, $34.65, $61.95, $56.70, $50.40. Finding the total overhead cost, firstly the relative cost by multiplying part number and then the obtained results are summed. This cost is total overhead cost of the company. The total overhead cost consists of 19 different cost sub-groups such as machine depreciation, insurance, set-up labour costs. Previously, each of them was proportioned and was computed by multiplying the total overhead cost. Obtained results give the costs of overhead cost group that is shown in table 4.3.

The building depreciation per year was computed by dividing building value considered scrap rate ($90,658,932.00*0.90 = $81,593,038.80) by life cycle that was assumed as 30 years. The scrap value was considered as 10% of the building value. The building depreciation per month was calculated by dividing the one per year ($81,593,038.80/30 = $2,719,767.96) with 12 months ($2,719,767.96/12 = 226,647.33).

The machine depreciation per year was calculated by Incremental Depreciation technique which depreciation portion value (d) is considered as 1.5 of Straight-line Depreciation (d = 1.5/n, n: life cycle). The life cycle of machinery is considered 10 years and the present value of them is $48,258,445.56 also, the scrap value at the end of the life-cycle period is 19.69% of present value. According to Incremental Depreciation Technique, depreciation value at the end of each year is obtained by multiplying d (1.5/10 = 0.15) by declining balance. Hence, first-year machine depreciation value ($48,258,445.56*0.15) is $7,238,766.84 and first year value per month ($7,238,766.84/12 = $603,230.57). Calculating second-year machine depreciation, by multiplying with the declining balance ($48,258,445.56 - $7,238,766.84 = $41,019,678.73) and the counting continues respectively.

The insurance cost was considered as \$41,842.58 according to following equality.

$$The\ \ Insurance\ \ Cost\ \ monthly(\$) = \frac{\begin{pmatrix} The\ \ building\ \ value \\ +The\ \ machine\ \ value \\ +The\ \ raw\ \ material\ \ stock \end{pmatrix} \times 3.81 \times 10^{-3} \begin{pmatrix} insurance \\ premium \\ rate \end{pmatrix}}{12\ \ months}$$

Taken depth is for partially funding in the raw material purchasing that is \$10,460,650. This cost is assigned to the raw material cost, but the interest amount is a separate cost that is interest cost that was obtained as \$87,172.05 (Fund rate annually = 10%):

$$Interest\ \ \cos t\ \ monthly = \frac{depth(\$10,460,650) \times interest\ \ percentage(10\%)}{12\ \ months}$$

depth for the raw material fund

When taxes was counted as \$209,212.92 according to following equality:

$$Taxes\ \ monthly(\$) = \frac{\$41,842,584 \begin{pmatrix} Overhead \\ \cos t\ \ annually(\$) \end{pmatrix} \times 6\% \begin{pmatrix} taxes \\ rate \end{pmatrix}}{12\ \ months}$$

The advertising cost was cost as \$104,606.46. Office, travel and utilities costs are respectively \$8,717.21, \$52,303.23 and \$209,212.92.

Set-up labour was considered as \$26,151.62 according to following equality:

$$Set-up\ \ labour(\$) = 1,250h \begin{pmatrix} set-up \\ time\ \ monthly \end{pmatrix} \times \$ / h20.92 \begin{pmatrix} set\_up\ \ \cos t \\ per\ \ hour \end{pmatrix}$$

Indirect labour was considered based on traditionally as \$69,737.64 according to following summing:

$$Indirect \quad labour \quad cost \quad monthly(\$) = \begin{pmatrix} Total \quad engineer \quad wages \\ + \\ Total \quad Technician \quad wages \\ + \\ Total \quad other\_personnel \quad wages \end{pmatrix}$$

Administrator wages was considered as $69,737.64 according to following summing:

$$Ad\min istrator \quad wages \quad monthly(\$) = \begin{pmatrix} Manager \quad wage \\ + \\ Vice \quad managers \quad wages \\ + \\ \Pr od. \quad Director \quad wage \end{pmatrix}$$

Following table shows the stuff numbers and wages.

Table 4.2. The stuff numbers and wages

Personnel	Manager	Vice Manager	Production Director	Engineer	Technician	Worker	Other
Number	1	2	1	4	5	313	7
Wages per stuff	$24,000.00	$18,868.82	$8,000.00	$6,000.00	$3,828.00	$16.60/h	$3,800.00

The other overhead costs which consist of supplies, material handling, energy costs, indirect materials, engineering, packing and shipping, maintenance and repairs shown as in table 4.3.

Supplies cost was counted as $146,449.04 according to following equality:

$$Supplies \quad monthly(\$) = 896orders \begin{pmatrix} Total \\ order \\ number \end{pmatrix} \times \$/o163.52 \begin{pmatrix} Cost \\ per \\ order \end{pmatrix}$$

$$A \quad order \quad consists \quad of \quad 100 \quad raw\_parts$$

Material handling cost was counted as $676,455.11 according to following equality:

$$Material \quad Handling(\$) = 1791.2\begin{pmatrix} run \quad number \\ per \quad month \end{pmatrix} \times \$377.66\begin{pmatrix} \cos t \\ per \\ handling \end{pmatrix}$$

$$part \quad number \quad per \quad handling = 50$$

Obtaining the total material cost, the produced products are multiplied by unit material costs (4500parts*$18.50/part +…+ 5000parts*$25.50/part = $1,963,074.50), respectively. To find out the total labour cost, the working hours is multiplied by unit-labour cost per hour (50,000hours*$16.60/hour = $830,210.00) or the produced products are multiplied by unit-labour cost per product group.

The standard unit costs were calculated by summing of the direct material cost, the direct labour cost and the overhead cost per part that are shown in table 4.3. The unit costs from product 1 to product 20 are $60.62, $59.25, $43.80, $34.80, $91.40, $52.30, $102.86, $44.46, $33.07, $71.20, $75.90, $41.12, $44.45, $40.27, $99.77, $70.30, $67.20, $106.70, $99.30, $87.90.

Tablo 4.3 Traditional costing method results

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
Monthly Production	4500	3750	2850	5150	6000	5360	6200	4250	4100	3900	3500	2750	2600	3600	4000	4800	5100	6450	5700	5000
Material cost ($/part)	18,50	20,25	16,50	15,30	26,40	17,20	28,50	19,50	14,35	21,80	22,60	11,30	13,25	12,45	27,75	23,50	24,30	30,00	29,10	25,50
Direct labour cost ($/part)	8,10	7,50	5,25	3,75	12,50	6,75	14,30	4,80	3,60	9,50	10,25	5,75	6,00	5,35	13,85	9,00	8,25	14,75	13,50	12,00
Overhead @ 420% of Direct labour ($/part)	34,02	31,50	22,05	15,75	52,50	28,35	60,06	20,16	15,12	39,90	43,05	24,15	25,20	22,47	58,17	37,80	34,65	61,95	56,70	50,40
Standard unit cost (Traditional costing) ($/part)	**60,62**	**59,25**	**43,80**	**34,80**	**91,40**	**52,30**	**102,86**	**44,46**	**33,07**	**71,20**	**75,90**	**41,12**	**44,45**	**40,27**	**99,77**	**70,30**	**67,20**	**106,70**	**99,30**	**87,90**

Overhead

Machine depreciation	$603.230,59	(17,30%)
Building depreciation	$226.647,33	(6,50%)
Insurance	$41.842,58	(1,20%)
Interest	$87.172,05	(2,50%)
Taxes	$209.212,92	(6,00%)
Advertising	$104.606,46	(3,00%)
Office costs	$8.717,21	(0,25%)
Travel costs	$52.303,23	(1,50%)
Utilities costs	$174.344,10	(5,00%)
Set-up labour	$26.151,62	(0,75%)
Administrative wages	$69.737,64	(2,00%)
Supplies	$146.449,04	(4,20%)
Material handling	$676.455,11	(19,40%)
Energy costs	$174.344,10	(5,00%)
Indirect Labour	$69.737,64	(2,00%)
Indirect Materials	$139.475,28	(4,00%)
Stockroom space	$20.921,29	(0,60%)
Engineering	$348.688,20	(10,00%)
Packing and shipping	$87.172,05	(2,50%)
Maintenance	$156.909,69	(4,50%)
Repairs	$62.763,88	(1,80%)
Total Overhead costs	$3.486.882,00	(100,00%)

Monthly Accounting

Total Production Cost = a + b + c

Total Production Cost = $6.280.166,5

(a)Total labour costs = 50.000 hours * $16,60/hour = $830.210,00

(b)Total material costs = (4500parts)*($18,50/part) + … + (5000parts)*($25,50/part) = $1.963.074,50

(c)Overhead rate = $3.486.882,00/$830.210,00 = 420%

P: Product

4.2.2 The Calculations in Activity-Based Costing System

In this costing system, direct material and labour costs are directly traced as a part of the cost of the product as in traditional costing. However, the overhead costs in ABC are calculated differently from the ones in traditional costing. Firstly, we should show that the resources and their costs. The resources in the firm are supplies, depreciation, building, utilities, energy, stockroom space, indirect materials, indirect labourers, engineering activities, administrator wages, and other administrating costs (insurance, interest, advertising, office, travel costs and taxes) and their costs are \$146,449.04, \$603,230.57, \$226,647.33, \$174,344.10, \$382,510.95, \$20,921.29, \$215,838.00, \$759,791.61, \$348,688.20, \$69,737.64, \$503,854.45, respectively and totally \$3,486,882.00. The resources and the costs are shown in table 4.4.

Table 4.4 Resources and the costs

Number	Resources	Costs
1	Supplies	\$146,449.04
2	Depreciation	\$603,230.57
3	Building	\$226,647.33
4	Utilities	\$174,344.10
5	Energy	\$382,510.95
6	Stockroom space	\$20,921.29
7	Indirect materials	\$215,838.00
8	Indirect labourers	\$794,660.43
9	Engineering activities	\$348,688.20
10	Adminisrator wages	\$69,737.64
11	The sum of Insurance, interest, advertising, office, travel costs, taxes	\$503,854.45
Total		\$3,486,882.00

The set-up, supplies, material handling, machine depreciation, building, utilities, stockroom space, engineering, administrator wages and other costs were explained and detailed in the traditional costing episode.

Energy cost was counted as \$382,510.95 according to following equality:

$$Energy\ \ cost(\$) = \begin{pmatrix} 50,000h(machining\ \ hours) \times \$/h3.487(energy\ \ cost\ \ per\ \ hour) \\ +\$5,230.33\ \ (20\%\ \ of\ \ set\_up\ \ cost) \\ +\$202,936.53\ \ (30\%\ \ of\ \ material\ \ handling\ \ cost) \end{pmatrix}$$

Indirect material cost was calculated as $215,838.00 according to following equality:

$$Indirect\ \ material\ \ cost(\$) = \begin{pmatrix} 50,000h\begin{pmatrix} machining \\ hours \end{pmatrix} \times \$/h2.79 \begin{pmatrix} indirect\ \ material \\ cost\ \ per\ \ hour \end{pmatrix} \\ +\$31,381.94\ \ (20\%\ \ of\ \ maintaining\ \ cost) \\ +\$18,829.16\ \ (30\%\ \ of\ \ repair\ \ cost) \\ +\$26,151.62\ \ (30\%\ \ of\ \ packing\ \ and\ \ shipping) \end{pmatrix}$$

Indirect labourer cost was calculated as $794,660.43 according to following equality:

$$Indirect\ \ labourer(\$) = \begin{pmatrix} \$69,737.64\ \ (indirect\ \ personnel\ \ wages) \\ +\$20,921.30\ \ (80\%\ \ of\ \ set\_up\ \ cost) \\ +\$473,518.58\ \ (70\%\ \ of\ \ material\ \ handling) \\ +\$125,527.75\ \ (70\%\ \ of\ \ maintaining\ \ cost) \\ +\$43,934.72\ \ (70\%\ \ of\ \ repair\ \ cost) \\ +\$61,020.44\ \ (70\%\ \ of\ \ packing\ \ and\ \ shipping) \end{pmatrix}$$

Machining based on ABC was considered as $1,296,248.37 according to following equality:

$$Machining\ \ cost(\$) = \begin{pmatrix} \$603,230.57\ \ (100\%\ \ of\ \ machine\ \ depreciation\ \ cost) \\ +\$209,212.92\ \ (100\%\ \ of\ \ utilities\ \ cost) \\ +\$169,985.50\ \ (75\%\ \ of\ \ building\ \ depreciation) \\ +\$174,344.10\ \ (50,000h \times \$/h3.487\ \ "energy\ \ costs") \\ +\$139,475.28\ \ (50,000h \times \$/h2.79\ \ "indirect\ \ materials") \end{pmatrix}$$

Inventory cost was counted as $54,918.39 according to following equality:

$$Inventory\ \ cost(\$) = \begin{pmatrix} \$20,921.29\ \ (100\%\ \ of\ \ stockroom\ \ space) \\ +\$33,997.10\ \ (15\%\ \ of\ \ building\ \ depreciation) \end{pmatrix}$$

Control cost was calculated as $139,475.28 according to following equality:

$$Control\ \ cost(\$) = \begin{pmatrix} +\$69,737.64 \ \ (100\% \ \ of \ \ administrator \ \ cost) \\ +\$69,737.64 \ \ \begin{pmatrix} the \ \ sum \ \ of \ \ indirect \\ personnel \ \ wages \end{pmatrix} \end{pmatrix}$$

Packing and shipping cost was counted as \$87,172.05 according to following equality:

$$Packing\ \ and\ \ shipping\ \ cost(\$) = \$/p0.9733 \begin{pmatrix} packing \ \ and \\ shipping \ \ cost \\ per \ \ product \end{pmatrix} \times 89,560p \begin{pmatrix} total \ \ production \\ amount \ \ monthly \end{pmatrix}$$

Maintaining cost was considered as \$156,909.69 according to following equality:

$$Maintaining\ \ cost(\$) = 3,500h \begin{pmatrix} maintaining \\ hours \end{pmatrix} \times \$/h44.83 \begin{pmatrix} maintaining \\ cost \ \ per \ \ hour \end{pmatrix}$$

Repair cost was counted as \$85,428.61 according to following equality:

$$Repair\ \ cost(\$) = \begin{pmatrix} 1,500h \begin{pmatrix} total \ \ repair \\ hours \end{pmatrix} \times \$/h41.843 \begin{pmatrix} repair \ \ cost \\ per \ \ hours \end{pmatrix} \\ +\$22,664.73 \ \ (10\% \ \ of \ \ building \ \ depreciation) \end{pmatrix}$$

Secondly, we show that which activity consumes which resource. The activities in the firm are set-up, orders, machining, material handling, inventory, maintaining, repairs, control, engineering, packing and shipping, other administrating costs, respectively. Also, the resources consumed by activities are shown in table 4.5.

Table 4.5 Activities and resources

Activities	Resources consumed by Activities
Set up	Indirect labourers, energy
Orders	Supplies
Machining	Depreciaton, utilities, building,energy, indirect materials
Material handling	Indirect labourers, energy
Inventory	Stockroom space, building
Maintaining	Indirect labourers, Indirect materials
Repairs	Indirect labourers, indirect materials, building
Control	Indirect labourers, administrator wages
Engineering	Engineering activities
Packing and shipping	Indirect materials, indirect labourers
Other administrating costs	Insurance, interest, advertising, office, travel costs, taxes

Thirdly, Cost drivers are included in the calculations and shown matches between activities and cost drivers in table 4.6. The cost drivers are material receipts, set-up time, machining hours, production runs, products, maintaining and repairing hours. Cost drivers have some proportions over the products and some proportion numbers, for example, cost driver machining hours are related to total direct labour hours but some not for instance, orders.

Whereas cost driver proportions by related the value of activities are set-up time, machining hours, maintaining and repairing hours, ones by not related the value of activities are material receipts, production runs and products. Their proportions were assigned according to the previous records of the company in related departments and cost driver rates were counted by dividing activity costs with total proportions per activity as shown in table 4.6.

After obtaining the proportions for overall products, finding out the product costs per product group, cost driver rates were multiplied by product proportions. The obtained results for overhead costs per product group are shown in table 4.7.

Table 4.6 Activity costs and their allocation to products

Activities	Cost	Cost Drivers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	Total	Cost Driver Rates
			4500	3750	2850	5150	6000	5360	6200	4250	4100	3900	3500	2750	2600	3600	4000	4800	5100	6450	5700	5000		
Orders	$146.449,04	Material receipts	45	37,5	28,5	51,5	60	53,6	62	42,5	41	39	35	27,5	26	36	40	48	51	64,5	57	50	895,60	163,52
Set up	$26.151,62	Set-up time (hours)	40	37	55	75	45	80	83	51	47	64	62	52	76	82	74	64	81	90	49	43	1250,00	20,92
Machining	$1.261.379,55	Machining hours	2020	2750	2070	2875	2885	2495	2935	2345	2015	1980	1800	2385	2155	2670	2225	2725	2595	3245	3030	2800	50000,00	25,23
Material handling	$676.455,11	Production runs	90	75	57	103	120	107,2	124	85	82	78	70	55	52	72	80	96	102	129	114	100	1791,20	377,66
Inventory	$54.918,39	Products	45	37,5	28,5	51,5	60	53,6	62	42,5	41	39	35	27,5	26	36	40	48	51	64,5	57	50	895,60	61,32
Maintaining	$156.909,69	Maintaining hours	200	175	155	235	265	245	280	140	115	100	95	85	90	110	135	150	185	300	210	230	3500,00	44,83
Repairs	$85.428,61	Repairing hours	80	62	67	80	100	94	115	65	45	44	48	43	51	52	58	76	88	135	96	101	1500,00	56,95
Control	$139.475,28	Products	5,86	4,39	3,63	6,28	7,21	5,96	7,50	5,04	5,45	4,16	3,39	2,52	2,23	3,63	4,16	4,80	4,92	6,74	5,92	6,21	100,00	1.394,75
Engineering	$348.688,20	Engineering rate	5,50	3,75	3,25	4,85	6,05	5,70	6,20	5,40	5,00	4,80	4,25	3,10	2,90	4,60	4,20	4,95	6,05	7,50	6,90	5,05	100,00	3.486,88
Packing and shipping	$87.172,05	Products	5,02	4,20	3,19	5,75	6,70	5,98	6,92	4,75	4,58	4,35	3,91	3,07	2,90	4,02	4,47	5,36	5,69	7,20	6,36	5,58	100,00	871,72
Other administrating costs	$503.854,45	Products	4,30	3,85	3,60	6,15	7,05	6,25	7,40	3,90	3,75	3,55	3,35	3,05	2,90	3,45	5,00	5,80	6,40	7,00	6,70	6,55	100,00	5.038,55

Obtaining the unit costs per product group, firstly total direct material and labour cost were separately counted by multiplying direct material cost and direct labour cost with total product amount per product group. The results were summed with overhead total costs, respectively and total production cost was obtained.

The unit costs per product group according to activity-based costing were computed by dividing total production cost with total product number per product group. The obtained results are shown in table 4.7.

As seen, the obtained unit costs according to traditional costing are different from the ones according to ABC. This difference takes place because of different computing method of ABC and traditional costing.

Activity based costing method with more reasonable way can compute the product costs closing the actual, since overhead costs are assumed as a part of operating cost via activities, cost driver and cost driver rates.

Table 4.7a Activity-based costing for the products

Activities	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Direct Material ($/part)	18,50	20,25	16,50	15,30	26,40	17,20	28,50	19,50	14,35	21,80
Direct Labour ($/part)	8,10	7,50	5,25	3,75	12,50	6,75	14,30	4,80	3,60	9,50
Total Direct Material ($)	83250,00	75937,50	47025,00	78795,00	158400,00	92192,00	176700,00	82875,00	58835,00	85020,00
Total Direct Labour ($)	36450,00	28125,00	14962,50	19312,50	75000,00	36180,00	88660,00	20400,00	14760,00	37050,00
Overhead ($)										
Orders	7358,40	6132,00	4660,32	8421,28	9811,20	8764,67	10138,24	6949,60	6704,32	6377,28
Set up	836,80	774,04	1150,60	1569,00	941,40	1673,60	1736,36	1066,92	983,24	1338,88
Machining	50959,73	69375,87	52221,10	72529,32	72781,59	62942,84	74042,98	59158,70	50833,59	49950,62
Material handling	33988,95	28324,13	21526,34	38898,47	45318,60	40484,62	46829,22	32100,68	30967,71	29457,09
Inventory	2759,40	2299,50	1747,62	3157,98	3679,20	3286,75	3801,84	2606,10	2514,12	2391,48
Maintaining	8966,20	7845,43	6948,81	10535,30	11880,20	10983,60	12552,70	6276,34	5155,57	4483,10
Repairs	4556,16	3531,02	3815,78	4556,16	5695,20	5353,49	6549,48	3701,88	2562,84	2505,89
Control	8173,25	6122,96	5062,95	8759,04	10056,17	8312,73	10460,65	7029,55	7601,40	5802,17
Engineering	19177,85	13075,81	11332,37	16911,38	21095,64	19875,23	21618,67	18829,16	17434,41	16737,03
Packing and shipping	4376,03	3661,23	2780,79	5012,39	5840,52	5212,89	6032,30	4140,67	3992,48	3791,98
Other administrating costs	21665,77	19398,42	18138,78	30987,08	35521,78	31490,94	37285,27	19650,35	18894,56	17886,85
Total Overhead ($)	162818,54	160540,41	129385,46	201337,40	222621,50	198381,36	231047,71	161509,95	147644,24	140722,37
Total Production Cost ($)	282518,54	264602,91	191372,96	299444,90	456021,50	326753,36	496407,71	264784,95	221239,24	262792,37
Total Product Number ($)	4500	3750	2850	5150	6000	5360	6200	4250	4100	3900
The Unit Cost (ABC) ($/part)	**62,78**	**70,56**	**67,15**	**58,14**	**76,00**	**60,96**	**80,07**	**62,30**	**53,96**	**67,38**

Table 4.7b Activity-based costing for the products (continue).

Activities	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	Total
Direct Material ($/part)	22,60	11,30	13,25	12,45	27,75	23,50	24,30	30,00	29,10	25,50	-
Direct Labour ($/part)	10,25	5,75	6,00	5,35	13,85	9,00	8,25	14,75	13,50	12,00	
Total Direct Material ($)	79100,00	31075,00	34450,00	44820,00	111000,00	112800,00	123930,00	193500,00	165870,00	127500,00	1963074,50
Total Direct Labour ($)	35875,00	15812,50	15600,00	19260,00	55400,00	43200,00	42075,00	95137,50	76950,00	60000,00	830210,00
Overhead ($)											
Orders	5723,20	4496,80	4251,52	5886,72	6540,80	7848,96	8339,52	10547,04	9320,64	8176,00	146448,51
Set up	1297,04	1087,84	1589,92	1715,44	1548,08	1338,88	1694,52	1882,80	1025,08	899,56	26150,00
Machining	45409,66	60167,80	54365,46	67357,66	56131,39	68745,18	65465,60	81863,53	76439,60	70637,25	1261379,47
Material handling	26435,85	20771,03	19638,06	27190,80	30212,00	36254,40	38520,30	48716,85	43052,10	37765,00	676452,20
Inventory	2146,20	1686,30	1594,32	2207,52	2452,80	2943,36	3127,32	3955,14	3495,24	3066,00	54918,19
Maintaining	4258,95	3810,64	4034,79	4931,41	6052,19	6724,65	8293,74	13449,30	9414,51	10311,10	156908,53
Repairs	2733,70	2448,94	2904,55	2961,50	3303,22	4328,35	5011,78	7688,52	5467,39	5752,15	85428,00
Control	4728,21	3514,78	3110,30	5062,95	5802,17	6694,81	6862,18	9400,63	8256,94	8661,42	139475,26
Engineering	14819,25	10809,33	10111,96	16039,66	14644,90	17260,07	21095,64	26151,62	24059,49	17608,75	348688,22
Packing and shipping	3408,43	2676,18	2527,99	3504,32	3896,59	4672,42	4960,09	6276,38	5544,14	4864,20	87172,02
Other administrating costs	16879,14	15367,58	14611,80	17383,00	25192,75	29223,59	32246,72	35269,85	33758,29	33002,50	503855,02
Total Overhead ($)	127839,63	126837,22	118740,67	154240,98	155776,89	186034,67	195617,41	245201,66	219833,42	200743,93	3486875,42
Total Production Cost ($)	242814,63	173724,72	168790,67	218320,98	322176,89	342034,67	361622,41	533839,16	462653,42	388243,93	**6280159,92**
Total Product Number ($)	3500	2750	2600	3600	4000	4800	5100	6450	5700	5000	**89560**
The Unit Cost (ABC) ($/part)	**69,38**	**63,17**	**64,92**	**60,64**	**80,54**	**71,26**	**70,91**	**82,77**	**81,17**	**77,65**	**-**

4.3 The Comparing of Two Costing Systems

The unit costs by computed Traditional and Activity Based Costing are shown in the table 4.8. The following table also shows difference amount and percentage between unit costs of traditional costing and ABC. According to ABC system, over-cost products in following table are P_5, P_7, P_{10}, P_{11}, P_{15}, P_{18}, P_{19}, $P_{20,}$ whereas under-cost products in the same table are P_1, P_2, P_3, P_4, P_6, P_8, P_9, P_{12}, P_{13}, P_{14}, P_{16}, P_{17} as showed.

Table 4.8 Comparing traditional costing and activity based costing unit costs

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Traditional Costing ($)	60,62	59,25	43,80	34,80	91,40	52,30	102,86	44,46	33,07	71,20
Activity Based Costing ($)	62,78	70,56	67,15	58,14	76,00	60,96	80,07	62,30	53,96	67,38
Difference ($)	2,16	11,31	23,35	23,34	-15,40	8,66	-22,79	17,84	20,89	-3,82
Difference Percentage (%)	3,56%	19,09%	53,31%	67,07%	-16,85%	16,56%	-22,16%	40,13%	63,17%	-5,37%

	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
Traditional Costing ($)	75,90	41,12	44,45	40,27	99,77	70,30	67,20	106,70	99,30	87,90
Activity Based Costing ($)	69,38	63,17	64,92	60,64	80,54	71,26	70,91	82,77	81,17	77,65
Difference ($)	-6,52	22,05	20,47	20,37	-19,23	0,96	3,71	-23,93	-18,13	-10,25
Difference Percentage (%)	-8,59%	53,62%	46,05%	50,58%	-19,27%	1,37%	5,52%	-22,43%	-18,26%	-11,66%

If the traditional costing values are shown the fluctuations of the ABC values can also be plotted as can be seen in figure 4.1 and 4.2.

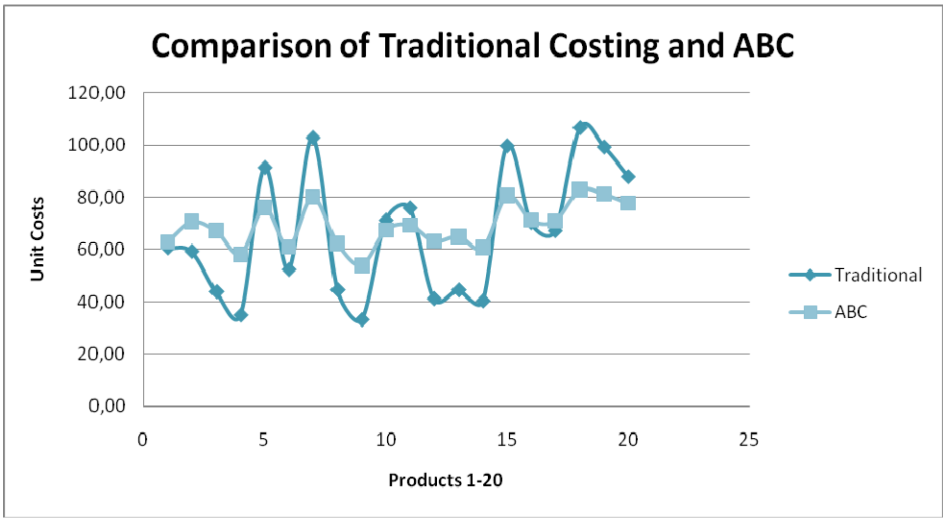
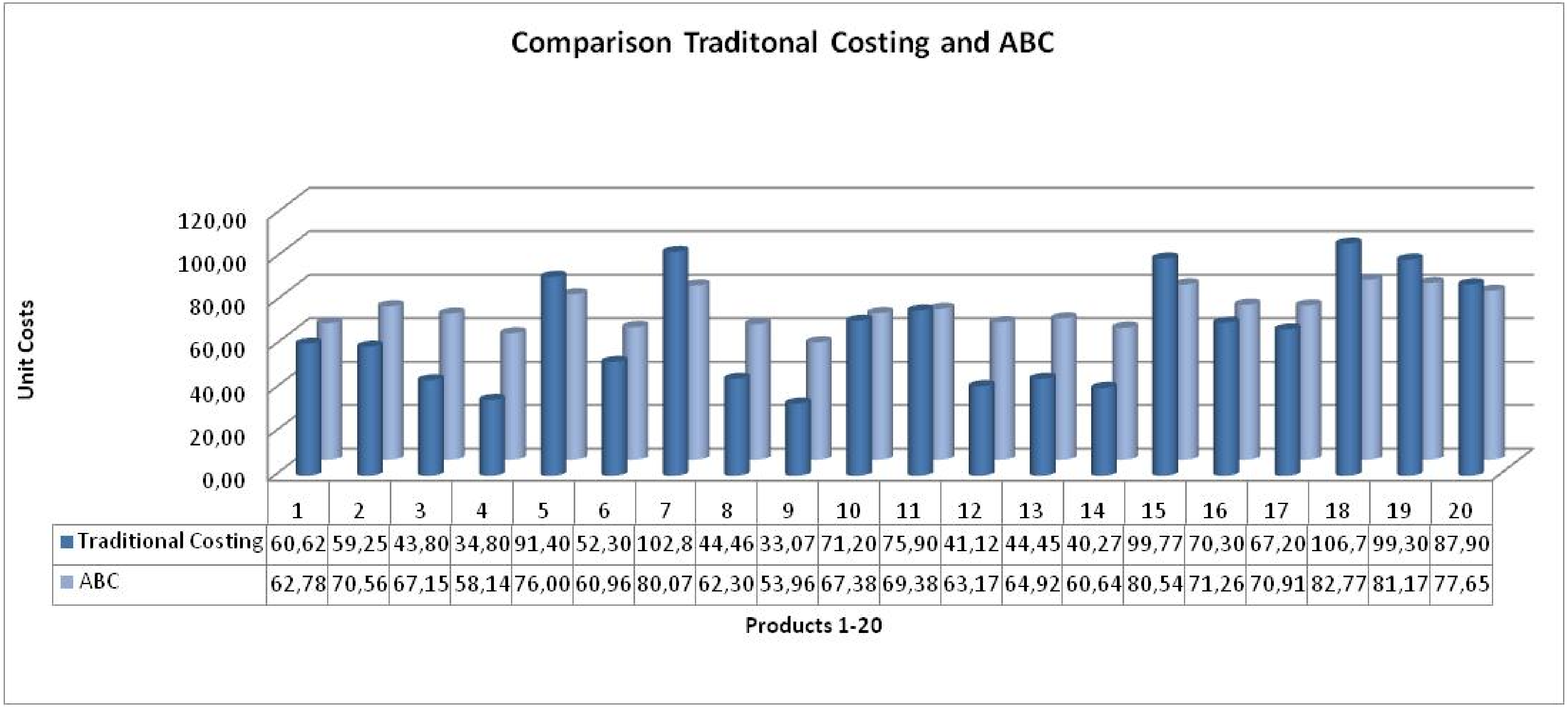


Figure 4.1 The comparison scatter chart of two costing methods



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Traditional Costing	60,62	59,25	43,80	34,80	91,40	52,30	102,8	44,46	33,07	71,20	75,90	41,12	44,45	40,27	99,77	70,30	67,20	106,7	99,30	87,90
ABC	62,78	70,56	67,15	58,14	76,00	60,96	80,07	62,30	53,96	67,38	69,38	63,17	64,92	60,64	80,54	71,26	70,91	82,77	81,17	77,65

Figure 4.2 The comparison column chart for two costing methods

Results of the two costing systems were different in computing the unit product costs. The present cost system that was used by the managers accepted the production amount as the measure in the charging of indirect activities on to products. Every product is not been possible to consume resources at the same rate. It was clearly understood that it is necessary to charge indirect costs on to every product in different rates while research and studies related to ABC were being made.

4.4 Conclusion

In this thesis, the importance and the necessity of the application of the ABC system in product costing have been emphasized. It has also been pointed out that obtained costing information by used traditional costing is not correct and reliable in the companies. Consequently, the ABC system has been developed because traditional costing systems lead to misinformation in product costing. Because costing information affects the decisions of the managers about marketing, costing and selling, the correct costing system is vitally important for the companies. It is inevitable that the companies incur losses if inaccurate cost information like traditional costing method is used. Therefore, a trustworthy costing method like activity based costing is vitally important for the companies.

When the course of ABC's development is examined, the system can be seen to have gone through some various stages until now. It was at first used to reach correct product costing, but nowadays it is being used for different purposes. The ABC system is applied successfully not only in the production sector but also in the service sector as well.

In chapter one of the thesis, literature review has ABC applications in various fields which are manufacturing and service sectors. In chapter two, traditional costing methods with some case studies were examined, and following chapter presented ABC which is main focus in the study. Clarifying what ABC, ABM, the method, various business improvements approaching, implementation stages, causes for ABC, ABM failure and the path to ones success were detailed and examined. The last chapter presents the case study of the thesis. In this chapter, a manufacturing company was examined by traditional costing and ABC methods. Firstly, the product costs were calculated based on traditional costing system which allocates overhead costs to products and the results were showed in table 4.3. Secondly, the product costs were calculated based on ABC which assigns the overhead costs to products via cost driver and the results were presented in table 4.7. Two results obtained from application of traditional costing and ABC system were compared in table 4.8 and figure 4.1, graphically. The cost data in table 4.8 presents based on ABC system over-cost and under-cost products. According to ABC system, over-cost products are P_5, P_7, P_{10}, P_{11}, P_{15}, P_{18}, P_{19}, P_{20} which took place hidden-profit, whereas under-cost products are P_1, P_2, P_3, P_4, P_6, P_8, P_9, P_{12}, P_{13}, P_{14}, P_{16}, P_{17} which took place hidden loss. Over-cost products present more costing than the normal costs, whereas under-cost products present less costing than the normal costs.

It is inevitable to come across some obstacles in the companies no matter where the ABC system is applied. The reasons of these obstacles can be categorized into two main groups. Firstly, the difficulties occur due to the selected scientific method. The executives are highly sensitive about secrecy and are not sympathetic to studies related to this subject especially when the information is cost related. Secondly, the ABC system requires sensitive computations, deep analysis and detailed information because of its structure. Acquisition of the information necessary for the completion of an ABC system can be quite costly in terms of both time and task force.

At the end of the application, the research and reviews of opinion that the ABC system is more useful and will give more reliable results has been reached. Because it presents valuable information, except for the unit costs of products, to managers, it provides the possibility to identify, solve and prevent the problem about effectiveness of the activity and the cost control, especially by identifying the costing of the activity. It gives detailed information about the organizational form of the company and production process.

ABC system facilitates a departmental assessment of the company, an effective cost control, and the measurement of the effectiveness of every activity that takes place in it. Therefore, it is understood that ABC can be used as a strategic management instrument. Also, by taking the recent studies into consideration, this system can be used with different techniques (TQM, BPR, etc.). In this respect, the techniques which were not used in the past can be determined and the suitable ones can be used with the ABC system.

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