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İŞLETME ANABİLİM DALI
MUHASEBE FİNANSMAN(İNG.) BİLİM DALI

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Yüksek Lisans Tezi

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Marmara Üniversitesi
Sosyal Bilimler Enstitüsü Müdürlüğü

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LIST OF ABBREVIATIONS

ABC : Activity Based Costing

ABM : Activity Based Management

ERP : Enterprise Resource Planning

SDFTM : Sürece Dayalı Faaliyet Tabanlı Maliyetleme (TDABC)

TCS : Traditional Cost System

TDABC : Time Driven Activity Based Costing

ROI : Return on Investment

PART 1: INTRODUCTION

In today's world as businesses are facing an intense competition, they need to increase their productivity and arrange their product costs in a more accurate way. Consequently, they should use new and more efficient cost systems. Cost systems are the fundamental elements of businesses for taking right and accurate decisions about their cost distributions. However, some businesses especially old ones, which do not follow innovations, encounter difficulties about efficiency. This is due to the fact that they continue to use traditional cost systems that do not permit right cost calculations.

Traditional cost systems were used to determine the cost of products or services. In the past, business life had a narrow range of products in weak competing conditions and traditional systems could easily respond to requirements in this situation. However, in recent years businesses have more complex structure which causes changes in the proportion of cost components, such as direct materials, direct labors and overhead costs, in total cost of products. Thus, these changes cause cost assigning problems in traditional cost systems and to overcome these kinds of problems they need more appropriate cost systems. Accordingly, some new systems have been developed to solve these problems. As a result these new cost systems help firms to form convenient systems to produce more accurate and efficient outcomes.

In present days, besides the developments in technology, intense competition and extend of products and service types accelerate the changes of cost components in total costs. These improvements decreased the efficiency of traditional cost systems and showed the necessities of new cost systems. Due to the insufficiencies, Traditional Cost System became an obsolete system and new cost systems have risen dramatically in all sectors. Service sector, like manufacturing sector, has affected from these changes so this sector should adapt to new cost systems.

Health sector is one of the most important fields in service sector. Because of the impact of health sector on the protection of human life**,** the health sector undertakes a vital role for society. To achieve and maintain a competitive advantage in today's global condition, this sector should increase investments in new technologies. The new technological developments certainly increase the qualities and treatments of hospitals and these better qualities increase competition and finally competition requires new cost systems. From this point, new accounting systems especially Activity Based Costing System became valuable in this sector.

Activity Based Costing System or ABC shortly, more efficient costing system than traditional cost systems, is one of the most popular systems. This system produces more accurate cost information than traditional systems. This is done by assigning costs to the activities based on the consumption of resources and these costs taken from the activities are assigned to products or services or other cost objects based on the used activities. In other words, ABC system constitutes the cause and effect relationship between activities and costs by collecting costs to functional cost pools and then allocating these costs to products on the basis of the events that drive those costs[1].

ABC system, introduced in the 1980s, offered new opportunities for businesses to determine more accurate costs for their products or services. However, much of the opportunities were never realized because of the high cost to implement and maintain ABC systems especially for large businesses. Besides expensive characteristic of ABC system, time-consuming and inaccurate results due to ignoring unused capacity have increased the necessity of a new system for businesses. Also Time Driven Activity Based Costing System has emerged[2]. Time Driven Activity Based Costing (TDABC) is a new, developed and revised system of conventional ABC. In this system, durations required for each activity and the cost of each duration are determined in a more realistic manner.

[1] Jennifer Ellis-Newman and Peter Robinson, "The Cost of Library Services: Activity-Based Costing in an Australian Academic Library", Journal of Academic Librarianship, Vol. 24, Issue 5 (Sep. 1998), pp. 373-379.
[2] Robert S. Kaplan and Steven R. Anderson, "The Speed-Reading Organization", Business Finance, Vol. 13, Issue 6 (June 2007), pp. 39-42.

Consequently, costs are assigned to all products or services at required rate in a more detailed and right way.

The aim of this thesis is to underline the importance and productivity of TDABC system and to point out how it can be applied. Thus, cost concept and traditional costing system will be given in the second section. Section three will present the definition and structures of ABC system. Afterwards, TDABC system will be given with its fundamentals in the fourth section. Furthermore, the structure of service sector will be mentioned in the fifth section. Section six, an application part of this thesis, will present the implementation of TDABC system in "Mağusa Yaşam Hospital". At the same time, the results of TDABC system will be compared with both of the traditional costing system and conventional ABC in this section. And finally, the summary remarks, conclusion and recommendations will be given in the last section.

1.1. OBJECTIVES

The main objective of this thesis is to justify the superiority of TDABC system by applying it to Mağusa Yaşam Hospital which uses traditional cost system**.** According to this objective, this thesis answers the following questions:

- What is TDABC system and what are the advantages of this system?
- How can TDABC system be applied in the hospital?
- Does TDABC system produce different and more accurate results than Conventional Cost Systems?

In the direction of objective questions, this thesis is prepared to contribute the spread of TDABC system among the businesses in Cyprus. According to this aim case study is selected from service sector in Cyprus boundaries. Firstly, the TDABC system is a new concept for this country just like other countries all over the world. With this study, applicability and efficiency of this system can be revealed in Cyprus. Secondly service sector is chosen because, in Cyprus, service sector is a dominant sector so it ensures strong and efficient business life for the development of the country.

PART 2: COST TERM AND TRADITIONAL COST ACCOUNTING

2.1. COST TERM

All of the businesses in the world are established with the idea of benefits. Consequently, getting money and making profit always become the first aim of the businesses to survive. According to this aim, businesses should perform some activities. To realize their activities they must recognize some expenses and these expenses are called cost. Variable Costs, Fixed Costs, Direct Costs and Indirect Costs are the main cost terms and these cost terms are the main items which must be followed by businesses for taking right decisions. These terms are taken into account by managers to determine the real value of investments, goods or services and to make efficient calculations for planning, analyzing, staffing, directing, coordinating and budgeting decisions. These decisions are very important for endless business life and affected by changing conditions, especially fierce competition. Therefore, changes must be pursued for more appropriate decisions. These changes performed by managers can produce more reliable outcomes. Consequently, traditional cost systems lose their importance and new systems emerge.

2.2. TRADITIONAL COST SYSTEMS AND EMERGENCE OF MODERN COSTING SYSTEMS

In present days, businesses are facing fierce competition and this situation enforces them to change their perspectives. On the other hand, traditional systems cannot meet the requirements so they become obsolete systems. Consequently, business life entails new costing systems.

2.2.1. Traditional Cost Systems

Until recent days, the traditional systems have been fairly used in business life. These systems can be divided into three respective parts. Each part provides different methods in the calculation of cost. These systems can be classified as below[3];

2.2.1.1. Depending on Manufacturing Process:

'Job Order Costing' and 'Process Costing' are two cost types of this system. When firms have different manufacturing process for different products, job order costing process can be used. In a job-order costing system, direct materials and direct labor costs do not constitute a problem because these costs are directly assigned to goods and services. However, overhead costs are traced to goods and services with a predetermined rate and this predetermined rate cause over or under cost assignments.

Process costing system can be defined as a system in which products are produced through various processes. Therefore, this system is applicable in mass production companies in which many identical products are produced.

[3] Veyis Naci Tanış, Teknolojik Değişim ve Maliyet Muhasebesi, First Edition, Adana: Nobel Kitabevi, 2005, pp. 24-29.

2.2.1.2. Depending on Cost Types:

'Actual Costing', 'Normal Costing' and 'Standard Costing' are three cost types of this system. In actual costing system, actual direct material, direct labor and factory overhead costs are used in the calculation of this system. Managers using actual costing system do not take efficient decisions because of historical costs. Therefore, this system is only applicable in countries where prices are stable.

Actual direct material, direct labor and planned overhead costs are used in normal costing. At the end of period, predetermined overhead costs and realized overhead costs are compared and then the accounts are closed.

Overhead costs are planned and all material and labor costs are standardized in standard costing system. Costs can be different from normal and actual costs because it based on both planned costs and standardized or expected costs.

2.2.1.3. Depending on The Cost Being Fixed or Variable:

'Absorption Costing' and 'Variable Costing' are the other cost types of this system. In absorption costing, all fixed and variable costs are used in the cost calculation. As short run decisions do not include fixed cost, this system becomes inefficient in short run or quick decisions.

Variable costing system includes the variable direct material, direct labor and overhead costs in cost calculations. Fixed overhead costs are not considered by this system. Consequently the proportion of fixed costs increase day by day and this system is efficient for only short run not in long run.

2.2.2. Insufficiencies of Traditional Cost Systems & Emergence of New Cost Systems

Direct material and direct labor costs do not constitute a problem for cost allocation since they are directly allocated to products. In contrast, allocation of overhead

costs always causes some problems for businesses. New cost systems are more logical than traditional cost systems and when a comparison is made with traditional systems, these systems give more appropriate approaches.

In the traditional cost systems, plantwide and departmental overhead rates can be used for the calculation of costs**.** Plantwide overhead rate is computed for the whole of production process and departmental overhead rate is computed for only unique production department. Application of departmental overhead rate needs two stages: In the first stage, all overhead costs are allocated to production departments and in the second stage, costs are allocated to production jobs[4]. However Pauline Weetman[5] states that costs are first allocated and shared to cost centers and then assigned into products. According to this, costs may be collected in the cost centers. Cost centers are identified by the structure of cost functions. After accumulation of costs in the cost centers, overhead cost rates are determined for each production. Products consume department costs and this amount is determined by calculated cost rate because this rate is used in cost allocation. Consequently, the cost of products is appeared.

Furthermore, plantwide and departmental overhead rates have been used by many firms. However, the limitations of traditional systems may result in obstacles for managers to reach worthless results. This approach is an averaging approach which produces over or understates product costs. Because of the overcosted or undercosted products, this averaging approach constitutes distorted costs. In competitive environment, distorted cost is one of the big problems of companies. Cost distortions damage the firms and increase the competitive pressures on companies. As a result, competitive pressures force companies to adapt new cost systems[6].

[4] Ronald W. Hilton, Managerial Accounting, Fourth Edition, Singapore: McGraw-Hill, 1999, pp. 87-88.
[5] Pauline Weetman, Management Accounting, First Edition, Spain: Prentice Hall Financial Times, 2006, pp. 72-94.
[6] Don R. Hansen and Maryanne M. Mowen, Management Accounting: The Cornerstone for Business Decisions, Instructors Edition, United States of America: Thomson South-Western, 2006, p. 246.

2.2.2.1 Emergence of Activity Based Costing

Business environment is changing rapidly day by day and consequently customer expectations are increasing. Nowadays, lower prices and higher quality products are demanded by customers and these well-informed customers force companies to increase their competitiveness.

In the past, firms produced a narrow range of products and direct costs were the main costs for them and they were relatively higher than overhead costs. Inadequate technological developments and high information costs created a barrier for managers to analyze real situation of business life[7].

In today's business environment, wide range of products, automation and advanced technology often dominate the commercial field. Automation decreases the rate of direct labor and advance technology requires high depreciation and maintenance costs. As a result these costs increase the proportion of overhead costs. Due to the progressive technology, information costs have decreased and the demands of organizations for getting more accurate costs have increased. As a characteristic of companies, single overhead rate, especially direct labor, were used. Therefore, errors in overhead assignments have increased so traditional cost systems become insufficient to obtain accurate results. Consequently, the new cost systems like ABC and TDABC have emerged[8].

2.2.2.2. Factors that Cause Changes in Cost Systems

Global competition, growth of the service industry, new product development, advances in information technology, customer orientation, the importance of time as a competitive element and efficiency are the main factors of changes in business life[9]. In addition to this, innovations in production technology, quality control and computer

[7] Colin Drury, Management and Cost Accounting, Third Edition, Hong-Kong: Champan-Hall, 1992, p. 274.
[8] Ray Proctor, Managerial Accounting for Business Decisions, Second Edition, Gosport: Ashford Colour Press, 2006, pp. 240-243.
[9] Hilton, pp. 12-18.

technology, progressions in communication technology are the other considerable factors of changes[10].

2.2.2.2.1. Global Competition

Intense global competition requires high goods or services quality with low costs. This new competitive environment entails new structural arrangements. Cost system is one of the most important structures for arrangement.

2.2.2.2.2. Growth of the Service Industry

Developing technology, increasing competition and societies' modernization accelerate the progress of the service industry. Therefore, traditional cost systems became insufficient under these developments. As a manner of fact, the importance of new systems in service sector has increased with the obsolescence of traditional cost systems. The overhead characteristics of costs have been increasing in service sector. Therefore, new systems such as TDABC can be used effectively and efficiently.

2.2.2.2.3. New Product Development and Innovations in Production Technology

Advanced technology gives a chance to firms to produce new products. Research and development process takes time and requires high cost for businesses. Therefore, high costs influence the managers to form Activity Costing and Management for efficient cost control.

[10] Figen Öker, Faaliyet Tabanlı Maliyetleme, First Edition, İstanbul: Literatür Yayıncılık, 2003, p. 17.

2.2.2.2.4. Advances in Information Technology and Computer Technology

Technological innovations in computer sector increase the communication between seller and buyer. Consumers can easily pursue the cost flows and they get information in very short-term duration. Therefore, managers must arrange their cost system efficiently and this can be done by using new and effective cost systems.

2.2.2.2.5. Customer Orientation

Businesses establish feedback system to obtain customer satisfaction. One way to increase customer satisfaction is to serve customers with lower prices. After they take an order, they calculate normal and shipping costs and give again response to customers. They should constitute efficient cost system to follow costs easily and provide customer dependency.

2.2.2.2.6. Time as a Competitive Element

Time is a very important factor for competitive structure. Quick respond to orders and faster innovations increase the competitiveness of companies. Furthermore, decreases in idle times increase the efficiency of company.

2.2.2.2.7. Quality Control and Efficiency

High quality increases the reputation of firms. The spread of high quality inside the organization helps to increase motivation of employees and highly motivated employee increases the efficiency of firms. This is due to the fact that highly motivated employee satisfies customer needs and also satisfied customer increases the efficiency which is needed to cost control for the continuity of firm success.

2.2.2.3. Effects of Changes on Costs

Innovations especially technological innovations have changed the structure of costs. These changes can be classified into three parts[11]:

2.2.2.3.1. Changes of Direct Materials

Although new technologies are more efficient in usage of direct material, the proportion of direct material in the production cost did not change. New opportunities that emerged with advanced technologies have stimulated new management philosophy. Consequently, non-value-added costs, such as inventories costs, have reduced to minimum level and qualities of products have increased.

2.2.2.3.2. Changes of Direct Labors

In the last decades, many processes have been made by manual but after technological innovations automatic processes have developed. Consequently, the rates of direct materials have decreased in the proportion of costs and the qualities of labors have increased. Thus, direct labor costs can be evaluated as a part of overhead costs.

2.2.2.3.2. Changes of Overhead Costs

Overhead costs are the mostly affected costs by technological changes. Competitiveness influence companies to increase their fixed investments. As long term investments have raised the depreciation, energy and other indirect costs, the rate of overhead cost have increased in the proportion of overall costs. Thus traditional cost drivers distort cost of product and new system is needed for efficiency of cost determination.

2.2.2.4. Limitations of Traditional Cost Systems

Traditional cost systems were designed in the conditions of past decades. Limited technology, single type of product and little overhead costs are the main characteristics of

[11] Tanış, pp. 29-34.

this era. Changing business environments affect the conditions and cause problems in traditional cost systems.

In traditional cost accounting systems, companies have a narrow range of products. When a company applies the traditional cost system to wide range of products, it causes distortions about cost information. In volume based costing system, predetermined or single cost driver, especially direct labor hours, can be used as a percentage rate for the allocation of overhead costs. Whereas this cost allocation system is easy and quick, it does not reflect accurate and real costs of products. Moreover, in recent days, labor-intensive production has been replaced by capital intensive production and the role of direct labor in manufacturing has reduced. Consequently cost allocation system, which based on direct labor hours, became an inconvenient system for the cost calculations[12]. This problem becomes more powerful when indirect costs increase in the proportion of total costs[13].

Indirect nature of overhead costs exposes difficulty in the cost calculations of goods and services. In the last century, the labor intensive manufacturing situation was the characteristic of business environment. In that time, single cost driver as a direct labor hour was applicable. In contrast, the usage of advanced robots and machineries has recently increased. Consequently, overhead cost has reached the bigger proportion in total costs. Thus, multiple cost driver rather than single cost driver should be used in cost calculations[14].

Direct labor hours, machine hours and other volume based measures are used in plantwide and departmental rates for cost calculations. The logic of this calculation is the same as averaging approach which cause distorted cost in product cost determination. Some

[12] A. Gunasekaran and M. Sarhadi, "Implementation of Activity-Based Costing in Manufacturing", Int. J. Production Economics, Vol. 56-57 (September 1998), pp. 231-242.
[13] Ashok K. Roy and Scott G. Goodall, "A Case for Using Activity-Based Costing as a Normative Model in University Honsing", Journal of College and University Student Housing, Vol. 33, Issue 2 (2005), pp. 14-17.
[14] Steve Jackson, Roby Sawyers and Greg Jenkins, Managerial Accounting: A Focus on Decision Making, Third Edition, Canada: Thomson South-Western, 2006, p. 104.

overhead elements may not be related with real costs and the invalid allocation base causes under or overstated product costs[15].

Arbitrary allocations distort the product and service costs. Weak relationship between the cost of services and actual efforts to produce these services decrease the efficiency of traditional cost systems and lack of the attentions to find real sources of costs diminish the usefulness of these systems[16].

As a result, the following factors which increase the requirements of new cost allocation system can be given for summarizing the insufficiencies of traditional cost systems[17]:

- Overhead proportions were relatively unimportant in total costs.
- When organizations were labor intensive, direct labor hour rate basis of overhead assignments was sufficiently appropriate system to use. But nowadays, organizations are capital intensive, rather than labor intensive, and cost assignment systems must use more appropriate cost drivers to form efficient apportionments.
- Before the technological innovations such as computerization and office automation, ABC had a huge bureaucracy. Many organizations were behaving accordance with this idea and it was not necessary to develop new systems such as ABC or TDABC.
- Competition was very law and relatively regional than today's, so detailed cost information was not necessary for companies.
- Because of less diversified organizations, there was little impact cost awareness of managers.

[15] Hansen and Mowen, pp. 246-252.
[16] Henry Yennie, "The New Cost-Cutting Tool", Behavioral Health Management, Vol. 19, Issue 5 (1999), p. 26.
[17] Duncan Williamson, Cost and Management Accounting, First Edition, London: Prentice Hall, 1996, p. 198.

PART 3: ACTIVITY BASED COSTING

Advanced technology, automation and computerization are the main characteristics of current business environment. The highly advanced nature of manufacturing and service organizations tend to change the structure of businesses from labor intensive to capital intensive. Capital intensive workforce has increased the fixed costs, marketing and administrative costs. These changing costs have decreased the reliability of direct labor hour which is an allocation base for many firms. Therefore, traditional cost systems cause distortions in the allocation of overhead costs and a new cost allocation system is needed to provide better cost information. As a result, Activity Based Costing became a new approach for business life. However, this approach was recently revised and Time-Driven Activity Based Costing, which is a more valuable tool to assist managers in cost allocation decisions, was obtained. In this part ABC system will be analyzed and the next part TDABC system will be deeply explained.

3.1. BACKGROUND OF THE ACTIVITY BASED COSTING

The ABC system was firstly introduced in Harvard Business School cases. In the early 1980s, some academics in the Harvard University concerned about the impact of global change on US manufacturing. At this time US manufacturing is seen as experiencing an unprecedented changes as a reason of threats in a fierce competition. There is the challenge from Japanese manufacturing especially for their new approaches such as advanced manufacturing technology, just-in-time and total quality management. In 1984s, Kaplan is already developing a critique of traditional accounting in the new competing environment. The insufficiency of traditional cost systems, the incorrect use of the ROI

(Return on Investment) measure and the dominance of a financial accounting mentality in enterprises are three problems he was identified[18].

One of the most important articles of Robert Kaplan is "Accounting Lag: The Obsolescence of Cost Accounting Systems". This paper has indicated the reasons of accounting lag. The basic reasons are complex and difficult modified computerized accounting systems, emphasizes on financial accounting perspective among managerial accountants, and lack of the interests of senior managers about more relevant and responsive management accounting system. These are the main factors to raise the importance of ABC [19].

Highlighting the limitations of traditional cost systems in overhead cost allocation, Cooper and Kaplan found some results according to their studies in a changing market situations. Cooper realized that the firms facing a high level of competition and having a various product mix are most likely to benefit from specific cost information and they should be cost effective by using new system. Meanwhile, Kaplan stated that many companies used single cost system to fulfill various needs such as inventory valuation and financial reporting, goods or services costing and providing operational feedback to frontline employees. However, in an advanced global environment with "product and process diversities" and "concern for excellence", the single cost system could not sufficient for all firms' needs. Siemens Electric Motor Works, John Deere Component Works and Schrader Bellows, are the main case studies were realized by Cooper and Kaplan to demonstrate that the "management objectives" and "diversity of product mix" determine the extent of the complexity in the competitive environment. This advanced

[18] Jones T. Colwyn and David Dugdale, "The ABC Bandwagon and the Juggernaut of Modernity", Accounting, Organizations and Society, Vol. 27, Issue 1-2 (2002), pp. 121-163.
[19] Robert S. Kaplan, "Accounting Lag: The Obsolescence of Cost Accounting Systems", California Management Review, Vol. 28, Issue 2 (1986).

competitive situation in which the firm is operating, drives the need for activity-based costing[20].

Another researcher, Thomas Johnson, contributed to developments of accounting systems with his studies. The paper report for Weyerhaeuser Corporation is one of the most important studies of Johnson. The main idea of Johnson's paper is quite different from that of the Harvard papers in emphasizing the management of activities rather than the more accurate measurement of product costs[21].

Kaplan and Johnson published their book, "Relevance Lost", in 1987 which mentioned that ABC system is an alternative way of traditional cost systems. The traditional accounting systems of that time failed to provide relevant information for product costing and performance evaluation at the time of "rapid technological change", "fierce competition" and "information processing revolution"[22]. Furthermore, their methodologies were firstly introduced in manufacturing industries to diminish production costs. After manufacturing industries have adapted this system, service industry considered the system as an improved way to calculate costs[23].

Standard cost systems were designed during the scientific management movements in the beginning of twenty century. In the 1980s, standard cost system did not reflect current economic reality in that periods. Organizations were now operating with distorted cost and profitability information. ABC system was emerged to solve the inaccurate allocations of overhead costs caused by standard cost systems. ABC system can solve this problem by tracing indirect and support costs first to the activities performed by the organization's shared resources and then assigning the activity costs to goods and services on the basis of the quantity of each organizational activity consumed. As a result

[20] Manoj Anand, B. S. Sahay and Subhashish Saha, "Activity-Based Cost Management Practices in India: An Empirical Study", Decision, Vol. 32, Issue 1 (2005), pp. 123-152.
[21] Colwyn and Dugdale, pp. 121-163.
[22] Anand, Sahay and Saha, pp. 123-152.
[23] Joseph P. Naughton-Travers, "Activity-Based Costing: The New Management Tool", Behavioral Health Management, Vol. 21, Issue 2 (March/April 2001), pp. 48-52.

managers have started to use ABC system to make better decisions which permit to sustainable improvements in product and customer profitability[24].

3.2 THE STRUCTURE OF ABC

Activity Based Costing is a system that provides more accurate costing by assigning costs based on activities rather than on the volume or number of units produced. ABC does not only provide actual cost calculations but it also presents information about the required stages. This system gains importance especially in new firms which have high overhead costs and miscellaneous product mix.

ABC can be defined as the one of the most suitable system for modern manufacturing and service firms. This system improves the operational performance of firm by allocate overhead costs based on the actual consumption of the resources. Companies needn't implement ABC as an entire accounting system. They can only focus on the fields where value-adding activities play a significant role in improving the competitiveness. Accurate information obtained by ABC system should enable managers to cut production and service costs. As a result, decisions about improving pricing, promotion and product design can now be made efficiently with this system. Therefore, both cost and managerial decisions are obtained by ABC to provide insights into companies' operations[25].

[24] Robert S. Kaplan and Steven R. Anderson, "The Innovation of Time-Driven Activity Based Costing", Cost Management, Vol. 21, Issue 2 (Mar/Apr 2007), p. 5.
[25] H. B. Marri, A. Gunasekaran and Y. Y. Yusuf, "Application of Activity Based Costing: Some Case Experiences", Managerial Auditing Journal, Vol. 14, Issue 6 (1999), pp. 286-293.

3.2.1. Activity Based Costing System

The main logic of ABC system is that activities consume resources and products consume activities. According to this, ABC model includes the following key components[26]:

-Cost Object; the final product or service that consumes the activity

-Resources; which are consumed by the activities

-Significant Activities; processes required to deliver the cost objects

-Activity Drivers; used to allocate the resource cost to the activities

-Cost Drivers; used to allocate activity cost to the cost objects.

Many assumptions become obvious with these key components in the definition of ABC system:

3.2.1.1. Assumptions of Activity Based Costing

Assumptions of ABC are valuable way to explain this system. Activities consume resources and products or customers consume activities are the first and second assumptions of ABC system. A third assumption is that ABC is a consumption model rather than spending model. There are numerous causes for the consumption of resources is the fourth assumption. A wide array of activities can be identified and measured is the fifth assumption. A further assumption is that all costs in each pool are variable. The last assumption of ABC is that cost pools are homogeneous. These assumptions reveal the differences of ABC system from traditional cost systems. For instance, traditional costing

[26] Peter W. Buys, "Strategic Costing Techniques", Accountancy SA; Accounting & Tax Periodicals, June 2006, p. 14.

uses a few activity measures in assigning costs to products. Not only does ABC system recognize many activity measures but it also organizes these measures into a hierarchy[27].

3.2.1.2. Hierarchy of Activities

Activities are playing an important role in ABC system. Activities can be classified in more than one subtitle. Classifications of activities are known as 'Hierarchy of Activities'.

Hierarchy of activities gives opportunities to managers to analyze structure of costs at different levels, starting at the level of the units of output and moving up to the entire business service or production facility. It can be classified as follows[28]:

3.2.1.2.1. Unit Level

Unit level costs are the costs that change with the volume of production. The costs of each unit are changed with the volume of output. Repairs and maintenance of factory machinery, direct materials, variable costs of materials and labors are the main examples of unit level costs.

3.2.1.2.2. Batch Level

Batch level costs change with the volume of batch production. These costs are fixed for a given batch of products. Goods are selling in batches and each batch brings costs such as packing, selling and administration, quality control costs.

3.2.1.2.3. Product Level

Product level costs are driven by the number of product lines. Each product line has its own costs of design, administration and sales interviews. Variety of product is the main factor that affects their costs.

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[27] Jay S Holmen, "ABC vs. TOC: It's a Manner of Time", Management Accounting, Vol. 76, Issue 7 (Jan 1995), pp. 37-40.
[28] Weetman, pp. 485-486.

3.2.1.2.4. Facility Level

Facility level costs are incurred to carry on overall business facilities and operations. These costs contribute to continuity of businesses and do not related with volume of products or types of each product. General management, rent and taxes are the main examples of facility level costs.

Hierarchy of activities contributes to managers by classifying activities in common groups for easy cost calculations. Two-stage cost allocation process is the characteristics of ABC system. The concept of 'Hierarch of Activities' is used to identify activities in the first stage.

Identification of activities and cost drivers are two main stages of ABC system to assign overhead costs to products[29]:

3.2.1.3. Identification of Activities

In the first stage, many activities can be identified and overhead costs can be traced to these activities. When an employee perform maintenance services and runs machines in the factory, his salary is divided into machining and maintenance activities. Acquisition of materials, packaging and product design are the examples of activities.

3.2.1.4. Identification of Cost Drivers

In the second stage, cost drivers for activities are selected. Cost drivers should cause the occurrence of costs and different production process requires different cost drivers. For example acquisition of materials might be driven by the number of orders. Number of new or revised products is the cost driver of product design, whereas packaging costs might be driven by the number of packages.

[29] Steve, Sawyers and Jenkins, pp. 105-106.

Unit-, batch- and product-level activities are traced to products by using valid cost drivers, whereas facility-level activities are traced to products by using arbitrary cost drivers. Depreciation of the factory building, rent, taxes and insurance are the examples of facility level costs and these costs are assigned to products by using arbitrary cost drivers such as square meters, number of employees, labor hours.

3.2.2. Activity Based Costing Process

Establishing and designing of ABC system requires the following steps[30]:

- Identify the major activities performed by the organization.
- Identify cost drivers which most closely influence the cost of an activity. Cost drivers have a direct indication of how the activity demands cost.
- Create a cost pool for each activity and assign costs to cost pools.
- Calculate a cost driver rate.
- Assign costs to products using the demand for each activity.

These steps can be showed as follows:

[30] Weetman, p. 85.

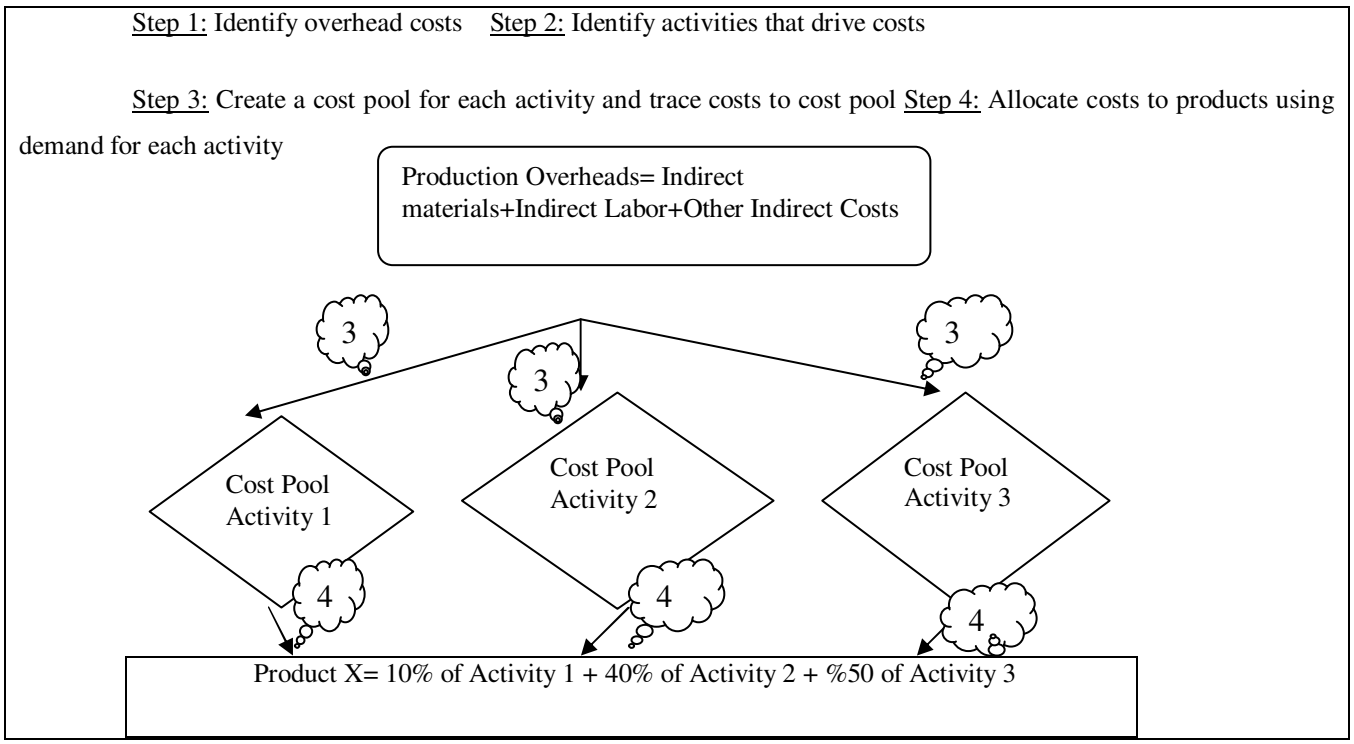

Figure 3.1: Activity Based Approach to the Flow of Overhead Costs
Source: Pauline Weetman, Management Accounting, First Edition, Spain: Prentice Hall Financial Times, 2006, p. 86.

3.2.2.1. Identify the Major Activities Performed by the Organization

In order to implement ABC system, overall business process should be separated into different set of activities. A flowchart of the business can be used to identify these main activities. Furthermore, homogeneous processes must be grouped together to establish the required activities for ABC system. The figure below exhibits the relationship among costs, activities, first stage cost drivers and second stage cost drivers. Each box represents the costs and activities and arrows show the flow of the system[31]:

[31] Narcyz Roztocki et al., "A Procedure for Smooth Implementation of Activity-Based Costing in Small Companies", Engineering Management Journal, Vol. 16, Issue 4 (December 2004), pp. 19-27.

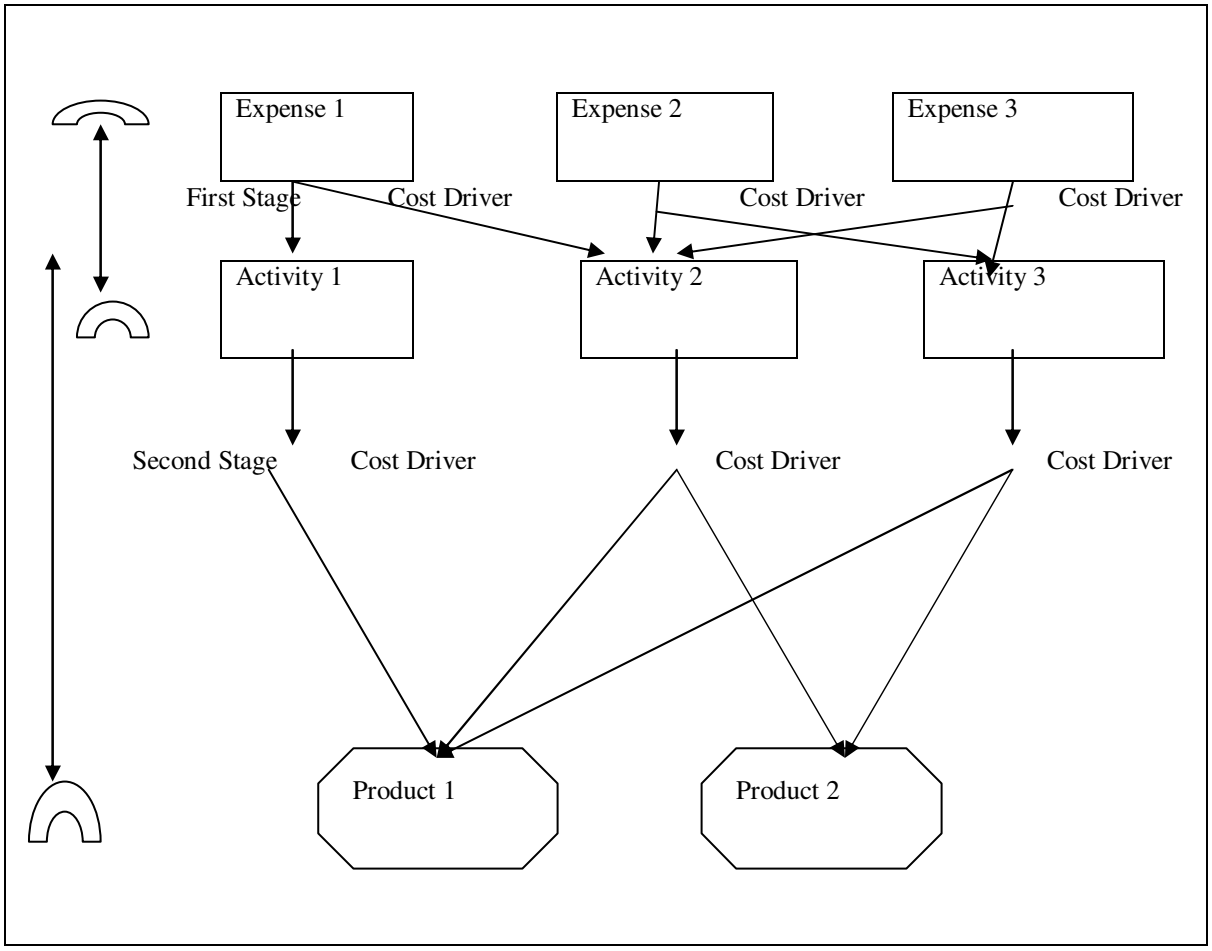

Figure 3.2: Relationship Among Expense Categories, Activities and Products
Source: Narcyz Roztocki et al., "A Procedure for Smooth Implementation of Activity-Based Costing in Small Companies", Engineering Management Journal, Vol. 16, Issue 4, December 2004, p. 20.

3.2.2.2. Identify Cost Drivers

Cost drivers are the factors that are significant determinants of the cost of an activity[32]. After the identification of activities, expenses related to each activity are assigned to activities with first stage cost drivers. Afterwards, second stage cost drivers are used to allocate costs from activities to products.

[32] Weetman, p. 85.

Different types of activity cost drivers can be selected to implement ABC system[33]:

3.2.2.2.1. Transaction Drivers

Transaction drivers, such as number of setups and number of receipts, are related with how often an activity is performed. Transaction drivers can be used when all outputs require same demands on the activity such as scheduling a production run, processing a purchase order. Despite the fact that transaction drivers are the least expensive cost driver, it could be least accurate; because same amount of resources is needed for each activity performs. On the other hand, needed resources to perform activity change from product to product and these changes demonstrate that more accurate cost drivers are needed.

3.2.2.2.2. Duration Drivers

Duration drivers refer to the amount of time to achieve an activity. Duration drivers should be used when different amount of activities are required to produce different outputs. For instance, complex products may require 5 hours for set up, while simple products may require only 10-15 minutes. In that situation, using a transaction driver will overcost the resources for simple product and will undercost the resources for complex product. As a result duration drivers should be used to overcome from this distortion. Setup hours, inspection hours and direct labor hours are the example of duration drivers which are more accurate than transaction drivers. Even though duration drivers are very accurate, they are much more expensive because they require time estimations for each activity.

3.2.2.2.3. Intensity Drivers

Intensity drivers directly charge for the resources used to complete activities. Intensity drivers are the most accurate activity cost drivers whereas they are the most difficult to implement; in addition to the job order costing system requirements to become

[33] Robert S. Kaplan and Anthony A. Atkinson, Advanced Management Accounting, Third Edition, United States of America: Prentice Hall, 1998, pp. 108-110.

realizable, time-consuming and expensive properties of this type cost drivers cause difficulties in implementation.

3.2.2.3. Create a Cost Pool for Each Activity and Assign Costs to Cost Pools

Many activities can be recognized to produce each product. These activities which can include several micro-activities should be collected into cost pools based on similar cost driver behavior. Cost pools are the cost centers to facilitate performing ABC system. After the cost pools have been identified, overhead costs are allocated to these cost pools based on the rate in which their related activities consume resources[34].

3.2.2.4. Calculate a Cost Driver Rate

An activity cost pool is the total cost of producing one type of activity in a financial period. Choosing a cost driver and computing a cost driver rate are the mechanism for accurate product cost calculation. This mechanism, which is the allocate costs from cost pool to product by choosing a cost driver and calculating a cost driver rate, can be given as follows[35]:

[34] Heather Nachtmann and Mohammad Al-Rifai, "An Application of Activity Based Costing in the Air Conditioner Manufacturing Industry", Engineering Economist, Vol. 49, Issue 3 (2004), pp. 221-236.
[35] Proctor, pp. 244-245.

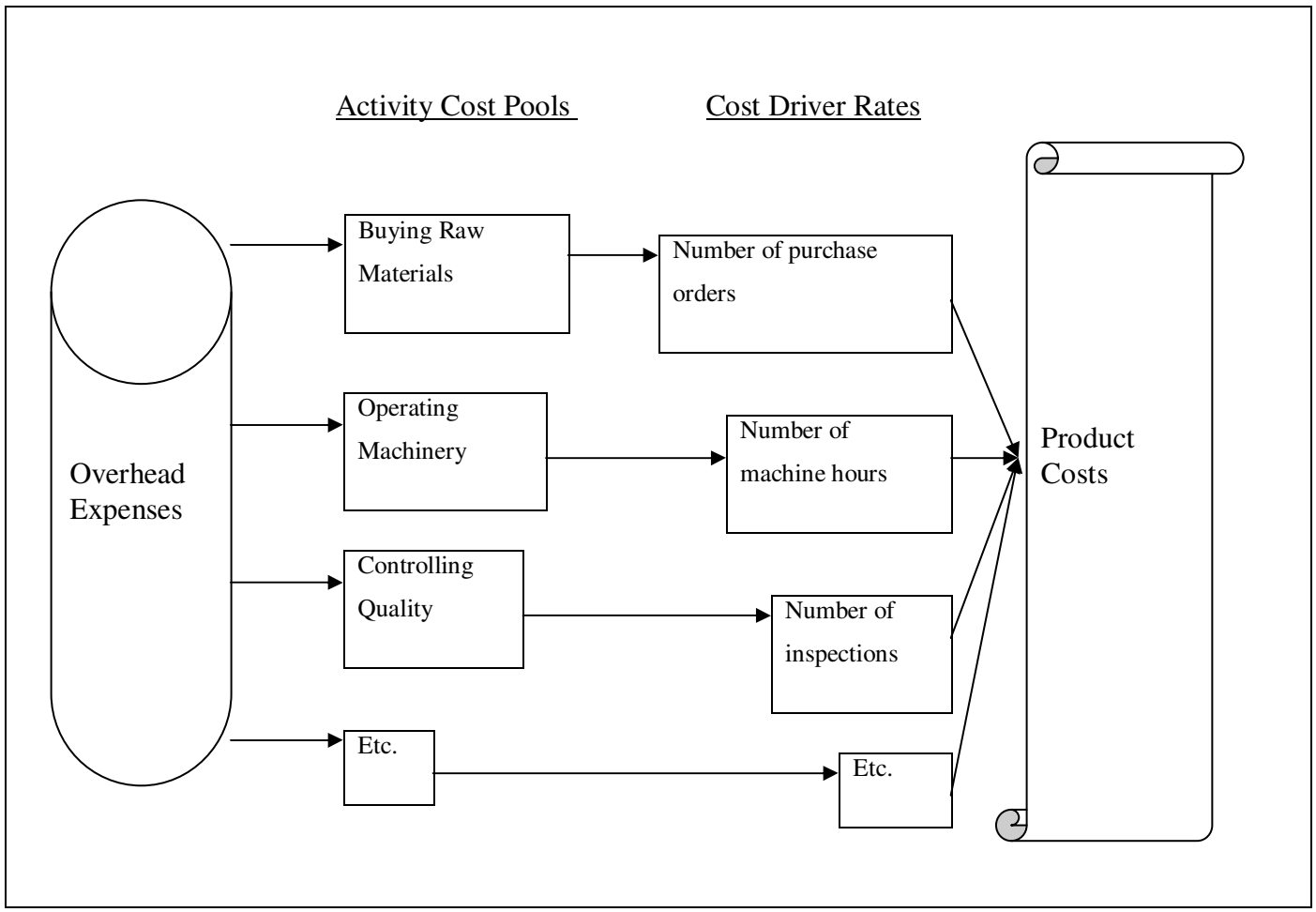

Figure 3.3: The Activity-Based Costing Mechanism

Source: Ray Proctor, Managerial Accounting for Business Decisions, Second Edition, Gosport: Ashford Colour Press, 2006, p. 245.

In the figure above, activity cost pools and its cost driver rates are given as an example. The activity cost driver rate is calculated by dividing total cost of each activity by its cost drivers. For instance; if the cost of an activity, such as operating machinery, is 100$ and total cost driver, machine hours, is 10 hours, (100/10) = 10 $ per hour become a cost driver rate of an activity.

3.2.2.5. Assign Costs to Products Using the Demand for Each Activity

Assign costs to products is the last stage of ABC system. In this stage activity costs are allocated to products based on the activity consumed by each product. Usage of activity is determined with cost driver. After the all steps are completed, the cost of activities are traced to products by cost driver so the real cost of output can be realized.

3.2.3. Conditions for a Successful Implementation

Lost production, congestion on the factory floor and lack of involvement are the some difficulties of ABC implementation. For example, if cost drivers are used to evaluate the performance of labor force in developing a reward system, manager and employees will focus too much on the cost drivers. In order to make feasible ABC system, the cost of design and implementation should be lower than the benefits gained from it[36].

Effective design and implementation of ABC system depends on the organizational and behavioral characteristics of the company. Top management commitment, education and training of employees and incentives to motivate employees are the main issues for successful implementation. These issues which ensure successful implementation of ABC are presented below[37]:

- Top management should undertake changes of cost accounting system. Top managers should encourage this change by providing suitable motivational, financial, technical, experimental supports.

- Information about the benefits and utilizations of ABC can be given easily to educated employees. Training employees will lead to open communication and better co-operation for implementing ABC in an organization. Seminars, conferences, face to face interviews should be used

[36] Marri, Gunasekaran and Yusuf, pp. 286-293.
[37] Gunasekaran and Sarhadi, pp. 231-242.

to teach ABC concepts and should be given to increase motivation of employees in the implementation process.

- To obtain the co-operation for the ABC implementation not only requires accounting personnel but also employees at the other departments should be motivated by incentives such as increase communication hours with employees, raise wages of employees. Beside incentives, employees should be empowered with a responsibility and authority on the ABC applications.

3.3. DIFFERENCES BETWEEN TRADITIONAL COST SYSTEM AND ABC

Traditional Cost System (TCS) and ABC have different process to allocate costs to products from each other. Different approach, naturally, cause different solutions. Due to more deserved costs allocated to products, ABC system is more superior system than TCS.

Different approaches have different treatments and these treatments can be given as below:

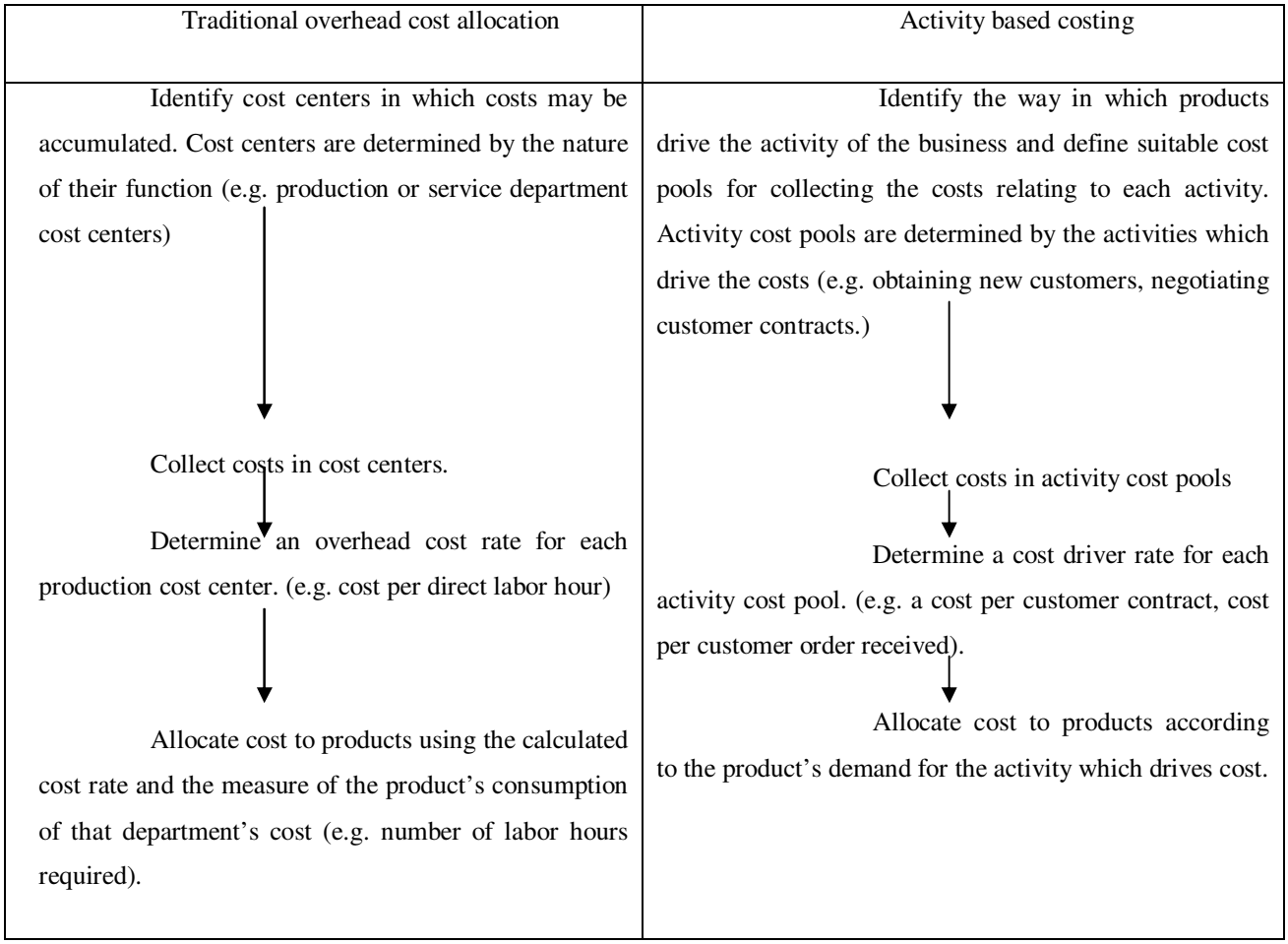

Figure 3.4: Contrasting ABC and Traditional Overhead Cost Allocation
Source: Pauline Weetman, Management Accounting, First Edition, Spain: Prentice Hall Financial Times, 2006, p. 94.

There are some differences between ABC and TCS. The key differences of ABC system from TCS are[38]:

- Indirect cost pools are activity oriented, not department oriented.

- Indirect costs are split into a larger number of more homogeneous and distinct cost pools.

- There is a better cause-and-effect relationship between activity cost pools and drivers.

ABC system analyzes the relationship of products or services with overhead costs to transform indirect costs to direct costs. Furthermore, value added activities are identified by ABC. Thus ABC accounting is a mirror of the firm's cost[39]. The main differences between traditional costing and ABC are presented in a systematically in Table 3.1 as an alternative way of above manners;

[38] K. D. Barber, Dewhurst F. and Pritchard M. C.. "Cost Allocation for Business Process Simulation Models", Proceedings of the Institution of Mechanical Engineers -- Part B— J. Engineering Manufacture, Vol. 220, Issue 5 (May 2006), pp. 695-705.
[39] Roy and Goodall, pp. 14-17.

Table 3.1
Differences Between Traditional Costing and ABC

TCS	ABC
-Accumulates costs into departmental or facility-wide cost pools. -Allocates costs using volume-based allocation (e.g., direct labor input, revenue). -Estimates costs as being driven by volume or service delivered. -Inability to align allocation bases with cost drivers leads to over or under costing.	-Accumulates costs into activity cost pools. -Allocates costs based on cost drivers of activity costs. -Recognizes some costs are not caused by number of units (hierarchy of costs). -Ability to align allocation bases with cost drivers provides more accurate information.

Source: Ashok K Roy and Scott G. Goodall, "A Case for Using Activity-Based Costing as a Normative Model in University Honsing", Journal of College and University Student Housing, Vol. 33, Issue 2, 2005, p. 16.

According to these differences, ABC system has the following advantages[40].

- ABC defines activity and process cost
- ABC displays the root causes of cost
- ABC highlights and assists in focusing on important costs
- ABC gives more accurate and reliable cost information
- ABC gives operational managers the ability to manage activities and business processes, not just dollars.

[40] Yennie, p. 26.

In spite of these advantages, ABC system has some limitations which will be reflected in next paragraphs as a reason to emerge of Time Driven Activity Based Costing.

3.4 ACTIVITY BASED MANAGEMENT

Using an ABC system to develop the organization performance is called Activity Based Management (ABM). ABC and ABM have found broad usage in the service sector as well as manufacturing. The overall objectives of ABC and ABM in service organizations are same as in manufacturing firms. Managers want more accurate information about cost of goods or services. The basic approach of identifying activities, activity cost pools and cost drivers may be used in the service sector as same as in manufacturing[41].

3.4.1. ABM Dimensions

As shown in Figure 3.5, a cost and a process are two dimensions of ABM. The cost dimension presents cost knowledge about resources, activities and cost objects of interest. The purpose of the cost dimension is developing the accuracy of costing products, services and other cost objects. Whereas, the purpose of process dimension is to provide information about what activities are performed, why they are performed and how well they are performed[42]:

[41] Hilton, pp. 178-179.
[42] Jackson, Sawyers and Jenkins, p. 457.

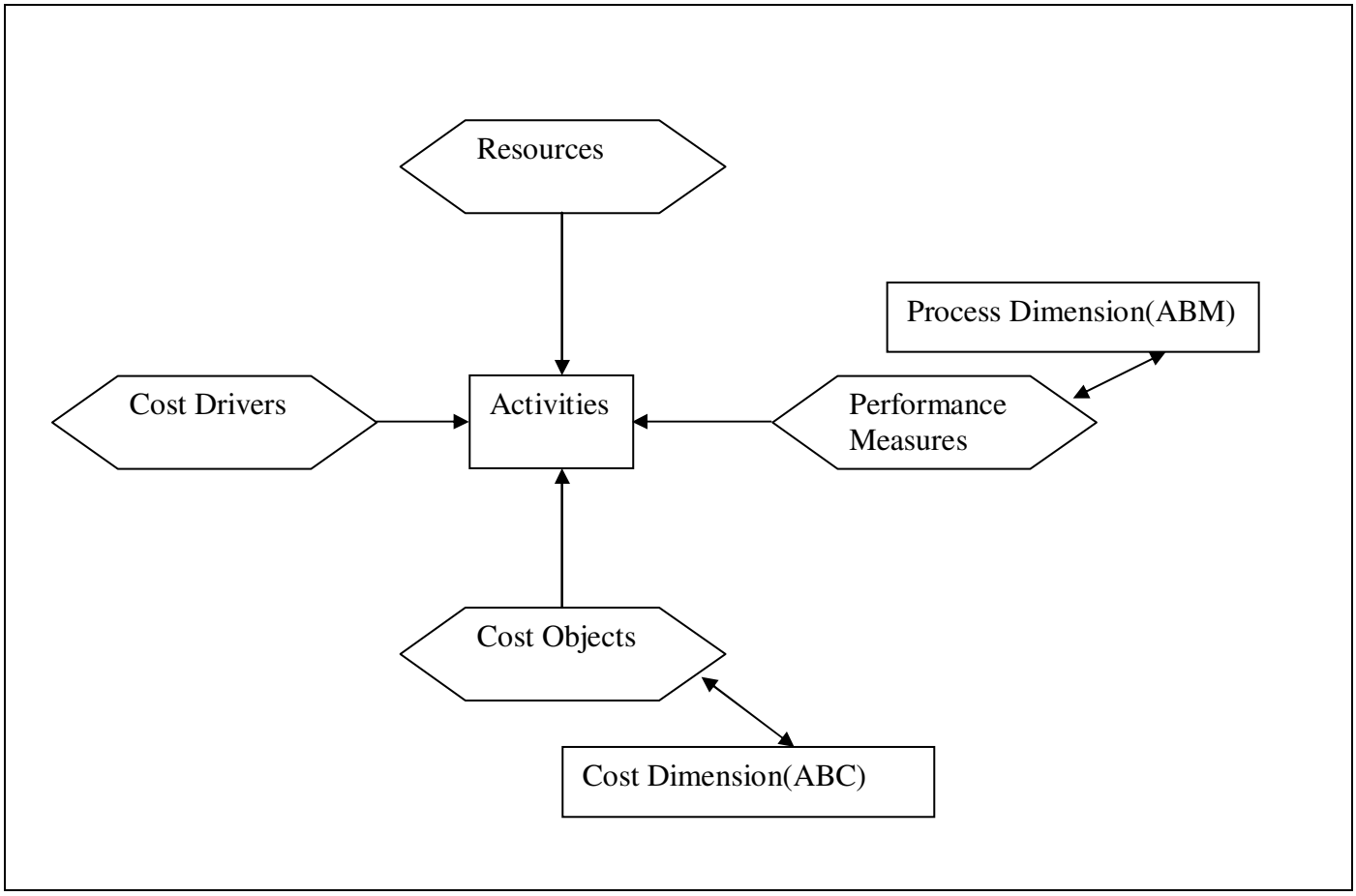

Figure 3.5: The Cost and Process Dimensions of Activity Based Management
Source: Steve Jackson, Roby Sawyers and Greg Jenkins, Managerial Accounting: A Focus on Decision Making, Third Edition, Canada: Thomson South-Western, 2006, p. 457.

3.4.2. Categories of ABM[43]

Activity based management can be divided into two categories; operational ABM and strategic ABM:

The meanings of operational ABM and strategic ABM are doing things right and doing the right things respectively. The main objectives of operational ABM are to decrease the cost of the activities and to increase capacity by improving efficiency.

[43] Proctor, p. 101.

Operational ABM starts by identifying possible improvements to existing processes, prioritizing them and allocating resources to achieve them. The next stage includes monitoring the results of these activities to identify variances between planned and actual situation. The variances between planned and actual resource consumption should show clearly whether the expected benefits have or have not occurred.

Increasing the demand for high profitability activities and decreasing the demand for low profitability ones are the major objectives of strategic ABM. The ABC system gives knowledge about the profitability of individual products or customers. This allows managers to concentrate on the most profitable products or customers. On the other hand, strategic ABM can inform choices about new product development and supplier relationships by emphasizing their demands on organizational activities and resources.

3.4.3. Outputs of ABM

ABM can produce the following outputs in relation to any potential management decision[44]:

- Information on the cost of activities and business processes
- The cost of activities that do not add value, such as wastage
- Performance measures based on activities, such as scorecard
- Projected costs of products and services
- Cost drivers

[44] Weetman, p. 485.

To sum up, ABM helps managers to analyze data obtained by ABC system and to convert them easily in strategic decision form. Managers can increase efficiency by analyzing these valuable data such as resource consumption variances, non-value-added activities and customer profitability. However, due to its limitations, ABC system does not provide these data as an adequately so it may result in insufficient information for ABM. Therefore, the following paragraphs are presented to exhibit its limitations.

3.5. LIMITATIONS OF CONVENTIONAL ACTIVITY BASED COSTING

3.5.1. Problems of ABC

Despite its attractive value, implementing and maintaining conventional ABC encountered the following significant problems[45]:

-The interviewing and surveying process was time consuming and costly.

-The data for ABC model were subjective and difficult to validate.

-The data were expensive to store, process and report.

-Most ABC models were local and did not provide an integrated view of enterprisewide profitability opportunities.

-The ABC model could not be easily updated to accommodate changing circumstances.

-The ABC model was theoretically incorrect when it ignored the potential for unused capacity.

[45] Robert S. Kaplan and Steven R. Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, First Edition, Boston: Harvard Business School Press, 2007, pp. 5-7.

The process to interview and survey employees to get their time allocations to several activities is time consuming and costly. The high time and cost to estimate an ABC model and to maintain it through re-interviews and re-surveys has been a major obstacle to widespread ABC adoption. Moreover, as a reason of the high cost of continually updating the ABC model, many ABC systems are updated only infrequently, leading to out-of-date activity cost driver rates and incorrect estimates of process, product and customer costs[46]. Indeed, setting up an ABC system can be very costly, particularly if the current accounting system does not support the collection of ABC information[47] and implementing ABC especially in too complex organizations, whose product types, inputs and processes are too many, requires highly time consuming studies.

A measurement error is another problem of the ABC. The people or employee supplying the data might bias or distort their responses. Thus, the personal estimates made by employee on the percentages of their spent on various activities cause this type of error which leads to less accurate cost information. Apart from the measurement error introduced by employees' best attempts to recall their time allocations, ABC model was not accurate enough to cover the complexity of actual operations. Furthermore, in an expanding complexity of business structure, new activities might be added to the ABC model. When employees must be reinterviewed and asked to estimate their time across a broader set of activities and more complex structure, cost allocations generally become more subjective and incorrect[48].

The ABC implementation not only was lacking an integration plan in terms of overall performance management style, but it lacked any planning in terms of connectivity

[46] Robert S. Kaplan and Steven R. Anderson, "Time Driven Activity Based Costing", Harvard Business Review, Vol. 82, Issue 11 (Nov. 2004), pp. 131-138.
[47] Eli Pernot, Filip Roodhooft and Alexandra Van den Abbeele, "Time Driven Activity Based Costing For Inter-Library Services: A Case Study In A University", The Journal of Academic Librarianship, Vol.33, No. 5 (2007), pp. 551-560.
[48] Kaplan and Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, pp. 5-7.

to the general ledger or enterprise resource planning system from a managerial perspective[49].

Further, as ABC system designers expand the activity dictionary to reflect details about activities performed, the demands on the computer model used to store and process the data rise dramatically. Addition to the data processing difficulties, estimating which is required to form knowledge in data processing, becomes a serious problem for ABC implementers. When people try to find how much time they spent on a list of activities handed to them, habitually they report percentages that up to 100 percent. Consequently, ABC systems calculate cost driver rates assuming that resources work at full capacity so ABC cost driver rates should be determined at practical capacity not at actual utilization[50].

Those reasons for failure are common in many ABC initiatives and this situation has led many cost management practitioners to study on new or developed costing methodology within the context of a broader management accounting framework[51]. Consequently, TDABC system can be used to overcome the problems of ABC. By using TDABC system, managers can easily take strategic decisions and they increase goodwill of firm by reducing costs according to their vital and crucial decisions.

3.5.2. Why ABC is Sustainable?

Activity Based Costing System has shortcomings as mentioned above. However, due to its high popularity, this system has not been fully abandoned by organizations. The popularity of ABC system is based on four factors[52]:

[49] Jeff Thomson and Jim Gurowka, "Sorting Out the Clutter", Strategic Finance, Vol. 87, Issue 2 (Aug 2005), pp. 27-33.
[50] Kaplan and Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, pp. 6-7.
[51] Thomson and Gurowka, pp. 27-33.
[52] Richard Barrett, "Time Driven Costing: The Bottom Line on the New ABC", Business Performance Management, Vol. 3, Issue 1 (March 2005), pp. 35-39.

Increasing numbers of organizations are investing in ABC is the first factor to create high popularity by producing growing list of success stories.

Second factor is that ABC projects tent to be more practical than they were in the past. Today's enterprises focus on smaller number of activities and on getting the right information to decision makers at all levels of the business.

A third factor in the renewed interest in ABC is web-based applications allow managers to refresh data in their models more frequently and to access reports from their desktop.

Finally, ABC is gaining some new interest because its founding father, Professor Robert Kaplan, has revisited it. He has proposed a new methodology, Time Driven Activity Based Costing System, as an option for overcoming the shortcomings of conventional ABC.

PART 4: TIME DRIVEN ACTIVITY BASED COSTING

In today's hyper-competitive global business environment, TCS can be considered as a major obstacle in front of the success of any advance service or manufacturing strategy for the reason that these systems are insufficient to achieve organizations' objectives of strategic planning, budgeting and cost control, product pricing, profit determination and employee motivation[53].

ABC system became an alternative way of TCS to manage a company's limited resources for managers. However, many companies have abandoned ABC system since it did not cover the complexity of their operations and it took too long time to implement. Furthermore, employee irritation and too expensive to build and maintain are the other main reasons to cause revising studies for managers. As a result, Time Driven Activity Based Costing has emerged as a new and revised model of ABC system[54].

Time Driven Activity Based Costing (TDABC) gives organizations an elegant, well designed and practical option for determining the cost and capacity utilization of their processes and the profitability of orders, products and customers. TDABC enables organizations to enhance their cost management systems. Managers obtain correct and adequate cost and profitability information to set priorities for process improvements, rationalize their product diversity and mix, price customer orders, and manage customer relationships in ways that utility both parties[55].

[53] Robert Hutchinson, "Linking Manufacturing Strategy to Product Cost: Toward Time-Based Accounting", Management Accounting Quarterly, Vol. 9, Issue 1 (Fall 2007), pp. 31-41.
[54] Kaplan and Anderson, Time Driven Activity Based Costing, pp. 131-138.
[55] Kaplan and Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, p. 4.

4.1 STRUCTURE OF TIME DRIVEN ACTIVITY BASED COSTING

ABC problems motivated Kaplan and Anderson to develop TDABC, a revised version of ABC, for solving its shortcomings without losing the benefits[56]. Shortcomings of ABC model have caused many organizations to either avoid or abandon activity based costing applications. TDABC provides a simpler and less costly alternative with relatively little sacrifice to costing precision[57].

The origins for TDABC go back to 1997, when it was developed and applied by Steven Anderson through his company Acorn Systems. In 2001, Kaplan joined Acorn's board of directors and began to collaborate with Anderson on how to make their approach even more powerful. As a result they reach to TDABC which simplifies the costing process by eliminating the need to interview and survey employees for allocating resource costs to activities before driving them down to customers or products[58].

TDABC is an elegantly simple but powerful approach of business process costing to produce comprehensive profit and loss reporting for even the most complex organizations. This model achieves its simplicity by requiring that only two parameters be estimated for each department; the unit cost of supplying resources(cost of unit time) and the consumption of capacity(the time needed to perform an activity) by each transaction, product or customer[59]. The steps of TDABC can be classified as follows[60]:

-Identify the various groups of resources that perform activities

-Estimate the cost of each group of resources

-Estimate the practical time capacity of each group of resources (i.e. available working hours in a department)

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[56] Pernot, Roodhooft and Abbeele, pp. 551-560.
[57] Anthony Atkinson, "Fixed Factor Fine Tuning", CMA Management, Vol. 81, Issue 7 (Nov. 2007), pp. 42-46.
[58] Kaplan and Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, pp. 1-8.
[59] Kaplan and Anderson, The Speed-Reading Organization, pp. 39-42.
[60] Werner Bruggeman et al., "Modeling Logistics Costs using Time-Driven ABC: A case in a Distribution Company", Working Paper of Universiteit Gent, September 2005.

-Calculate the unit cost of each group of resource by dividing the total cost of the resource group by the practical capacity

-Determine the required time for each event of an activity based on different time drivers

-Multiply the unit cost by the time required to trace costs to cost objects.

4.1.1. Necessary Phases for a Successful Implementation

Besides the list above, there are some necessary phases for a successful implementation. Preparation of the model is the first phase. The second phase includes defining needed data, determining access to data and data analysis. Decision on a pilot model is the third one. The last one is the development of an enterprise model where software is used to generate preliminary cost and profitability information. The information is approved and an initial analysis is done on how to increase profitability[61]. The figure below describes the framework of each phase:

[61] Christine Lambino, "Time Driven Activity Based Costing", Government Finance Review, Vol. 23, Issue 4 (Aug. 2007), pp. 74-75.

Phase	1.Preparation →	2.Analysis →	3.Pilot Model →	4.Rollout
Purpose	Develop a game plan and team for the TDABC study	Gather Data and conduct department interviews	Build TDABC model template and validate	Roll out template and customize across organization
Actions	-Formulate game plan -Develop model -Estimate project cost -Determine data requirements and availability -Select team composition	-Perform time studies -Estimate time equations and capacity cost rates -Finalize data requirements -Finalize pilot model	-Embed time equations into software -Import cost object data -Run model -Validate model	-Develop rollout schedule -Educate facility -Gather data and build model by facility -Review findings with facility management and ABC steering committee.

Figure 4.1: Typical Time Driven ABC Implementation

Source: Robert S. Kaplan and Steven R. Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, Boston: Harvard Business School Press, 2007, p. 68.

4.1.2. Time Equations

In general, activities are divided into many subactivities which cause complications and difficulties in organizations. In order to decrease complexity and increase efficiency, time equations can be formed for each main activity. Thus, time equation should be used by managers for business success.

By using time equations, the time consumed by the event of an activity can be expressed mathematically as follows[62]:

Cost of an individual event *k* of activity $j = t_{j,k}.c_i$

Where c_i: the cost per time unit (minute) of resource pool i

$t_{j,k}$: the time consumed by event *k* of activity *j*.

The total cost for a cost object is then estimated by summing up all the activity costs, which can be expressed as:

Total Cost of a Cost Object= $\sum_{i=1}^{n}\sum_{j=1}^{m}\sum_{k=1}^{l} t_{j,k} \cdot c_i$

Where c_i: the cost per time unit (minute) of resource pool i

$t_{j,k}$: the time consumed by event *k* of activity *j*.

n: the number of resource pools.

m: the number of activities.

l: the number of times activity *j* is performed (or the number of events of a particular activity *j*)

The general time equation in Figure 4.2 describes the time required for an event *k* of activity *j*, with *p* possible time drivers. The cost of an activity, then, is calculated by multiplying the time needed for the activity by the cost per time unit[63]:

[62] Patricia Everaert and Werner Bruggeman, "Time Driven Activity Based Costing: Exploring the Underlying Model", Cost Management, Vol. 21, Issue 2 (2007), pp. 16-20.
[63] Ibid.

$t_{j,k} = \beta_0 + \beta_1 .X_1 + \beta_1 .X_1 + \ldots + \beta_p .X_p$ where

$t_{j,k}$ = time required to perform event *k* of activity *j*

β_0 = constant amount of time for activity *j*, independent of the characteristics of event *k*

β_1 = time consumption for one unit of time driver 1 when $X_2 \ldots . X_p$ are held constant

X_1 = time driver 1, X_2 = time driver 2, …, X_p = time driver *p*

p = the number of time drivers that determine the time needed to perform activity *j*.

Figure 4.2: General Time Equation

Source: Patricia Everaert and Werner Bruggeman, "Time Driven Activity Based Costing: Exploring the Underlying Model", Cost Management, Vol. 21, Issue 2, 2007, p.18.

The accuracy of a TDABC system arises from its ability to capture the resource demands from various operations by only adding more terms to the departmental time equation. TDABC system allows all activities to be combined into one process with one equation. In contrast, conventional ABC requires a geometric expansion to capture the complexity in process. A typical TDABC model entails fewer equations than the number of activities used in a conventional ABC system. The feature of permitting much more variety and complexity adds accuracy to the model at little additional cost and effort[64]. The accuracy and simplicity of time equation is presented in the following example:

[64] Kaplan and Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, pp. 14-15.

Company X is a manufacturing company in Famagusta and it produces oven. It wants to sell products to customer so it takes orders from clients. Company X has clients from three different places: Famagusta (Local Customers), Nicosia and Kyrenia. In a loading process to pickup, an oven requires only five minutes. In addition, it requires 25 minutes for delivering to local customers. Moreover, it requires 40 minutes for Nicosia and 65 minutes for Kyrenia. The following equation is convenient for this situation:

Time Equation: 5+ 25 (if an order comes from Famagusta) +40 (if an order comes from Nicosia) + 65 (if an order comes from Kyrenia).

4.1.3. Model Updating

The efficient characteristics of TDABC system, which can be easily analyzed and rapidly updated, give an opportunity to managers to easily direct it according to changing conditions. The time equation emphasizes that when the time needed for any activity has changed or when the cost of unit time has changed, it may be easily represented in time equations. For instance, if delivering time has changed from 25 to 35 for Famagusta it can be presented that 5 + 35 = 40 and when the new unit cost became 10$, the total cost is= 40*10 = 400$. In addition to this, when unexpected costs have occurred, they can easily be added to TDABC model and this situation displays the efficiency of TDABC model.

Hence, TDABC model allows easy updating of the cost system when product or service offerings change, or when production and service processes are redesigned. This characteristic makes TDABC suitable for fast-changing environments for organizations' success[65].

[65] Everaert and Bruggeman, Time Driven Activity Based Costing: Exploring the Underlying Model, pp. 16-20.

4.2 DIFFERENCES BETWEEN TIME DRIVEN AND CONVENTIONAL ABC

Comparison of time driven and conventional ABC can be presented theoretically as a matrix[66]. This presentation is showed in Table 4.1. Moreover, a practical example can be given to emphasize the differences between them.

4.2.1. TDABC & ABC Matrix

A matrix has been prepared to compare conventional and time driven ABC systems for different conditions on the basis of assumptions representing typical situations that might be encountered in practice[67]:

- All departments whose costs are driven directly to cost objects are functional
- There are five activities per department
- Each facility has twenty-five departments
- Model runs are made monthly
- A small enterprise has twenty facilities
- A large enterprise has one thousand facilities

According to table below, differences between two systems may not be significant enough to notice for single department and facility models. However, the increasing

[66] Kaplan and Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, p. 82.
[67] Ibid, p. 81.

volume of transactions and effort may be noticed easily and it makes the investment in time driven models worthwhile[68].

Table 4.1
Conventional Versus Time Driven Models

a) Departmental Model	**Conventional ABC**	**TDABC**
# models	1	1
# departments	1	1
# activities	5	1
# initial interviews	1	1
# interviews/year	12	0
b) Facility Model	**Conventional ABC**	**TDABC**
# models	1	1
# departments	25	25
# activities	125	25
# initial interviews	25	25
# interviews/year	300	0
c) Small Enterprise	**Conventional ABC**	**TDABC**
# models	20	1
# departments	500	500
# activities	2500	500
# initial interviews	500	25-500
# interviews/year	6000	0
d) Large Enterprise	**Conventional ABC**	**TDABC**
# models	1000	1
# departments	25000	25000
# activities	125000	25000
# initial interviews	25000	25-25000
# interviews/year	300000	0

Source: Robert S. Kaplan and Steven R. Anderson, Time Driven Activity Based Costing: A Simpler and More Powerful Path To Higher Profits, Boston: Harvard Business School Press, 2007, p. 82.

[68] Ibid.

4.2.2. An Example of the Differences between Time Driven and Conventional ABC Systems

Mathematical example is one of the efficient ways to demonstrate main differences between time driven and conventional ABC. Assume that Company X is a shipping company and it has sea buses in maritime traffic for crossing between city A and city B. Four main activities are recognized and total resource cost is 13000 ytl per month. The calculation of ABC system can be showed as follows:

Table 4.2
Calculation of Conventional ABC

Activities	Time Spent (%)	Assigned cost	Cost Driver Quantity	Cost Driver Rate(ytl/quantity)
- Passenger Control	30	3900 ytl	2600	1.5 ytl
-Passenger Waiting In The Salon	30	3900	2600	1.5 ytl
-Taking Passenger On Board	20	2600	2600	1 ytl
-Taking Passenger Off Board	20	2600	2600	1 ytl
Total	100	13000 ytl		

Results of table emphasize that costs are assigned to products or customers by considering the usage of each activity. This calculation is not true because it uses theoretical capacity so it is not an actual situation. Therefore, it produces invalid results. Furthermore, it may be very costly and time-consuming in complex organizations.

TDABC model avoids the high cost, subjective activity surveying task and time consuming properties of conventional ABC. It uses time equations that directly allocate resource costs to the activities performed. Only two factors need to be estimated: The capacity cost rate for the department and the capacity usage by each transaction processed in the department. TDABC approach generally considers the practical capacity as 80-85 percent of theoretical capacity[69] so it ensures more reliable results for managers. Contrary to ABC, the calculation of TDABC system can be demonstrated as follows:

Company X has 12 employees and each employee works an average of 208 hours (26 days*8 hours/day) per month. The practical capacity for Company X is %85 or 12 employees*8 hours/day*26 day/month*60min/hour*%85=127,296 minutes. Afterwards, capacity cost rate should be calculated and required time for each activity should be obtained:

Capacity cost rate= 13000 ytl/ 127296 min. = 0.10 ytl/minute

	Unit times	*	Cap.Rate	=	Unit cost
- Passenger Control	10 min.		0.10 ytl/min		1 ytl
- Passenger Waiting in the Salon	8 min.		0.10		0.8
- Taking Passenger On Board	7 min.		0.10		0.7
- Taking Passenger Off Board	6 min.		0.10		0.6

[69] Ibid, pp. 10-11.

Table 4.3
Calculation of TDABC

Activities	Unit Time(min)	Quantity	Total Minutes	Total Cost(0.10ytl/min)
- Passenger Control	10	2600	26000	2600 ytl
- Passenger Waiting in the Salon	8	2600	20800	2080 ytl
-Taking Passenger On Board	7	2600	18200	1820 ytl
-Taking Passenger Off Board	6	2600	15600	1560 ytl
Used Capacity			80600 min.	8060 ytl
Unused Capacity (%38)			46696 min	4940 ytl
Total			127,296 min	13000 ytl

Table 4.3 discloses that only about % 62 of practical capacity is used by company X. 13000 ytl is the total cost of this company but only 62 percent of the total expenses, which equals to 8060 ytl, is assigned to customers. Differences between capacity supplied and capacity used may result in idle capacity and managers may try to minimize unused (idle) capacity by using valuable strategies such as concentrating on less but more specialized labor and increasing the demand.

4.3. ADVANTAGES AND DISADVANTAGES OF TDABC SYSTEM

The difficulties of implementing and maintaining a conventional ABC system have prevented to being an effective, timely and up-to-date management tool. TDABC model overcomes these obstacles and ensures ABC model to move from a complex, expensive characteristics to a tool that provides accurate data to managers quickly, frequently and inexpensively. Consequently, TDABC has the following advantages[70]:

- Easier and faster to build an accurate model
- Integrates well with data now available from Enterprise Resource Planning (ERP) and customer relationship management systems (this makes the system more dynamic and less people intensive.)
- Drivers costs to transactions and orders using specific characteristics of particular orders, processes, suppliers, and customers
- Can be run monthly to capture the economics of the most recent operations
- Provides visibility to process efficiencies and capacity utilization
- Forecasts resource demands, allowing companies to budget for resource capacity on the basis of predicted order quantities and complexity
- Is easily scalable to enterprisewide models via enterprise-scalable applications software and database technologies
- Enables fast and inexpensive model maintenance

[70] Ibid, p. 18.

- Supplies granular information to assist users with identifying the root cause of problems

- Can be used in any industry or company with complexity in customers, products, channels, segments, and processes and large amounts of people and capital expenditures.

Besides these advantages, TDABC model has some disadvantages[71]:

- To deliver an acceptable level of accuracy, time driven ABC depends on robust and reliable data as much as any other methodology does. For this reason, to obtain right information in an accurate way may cause difficulties to fulfill TDABC system.

- To be accurate, TDABC requires as much data collection as does traditional ABC. Each time a model is refreshed and recalculated, the duration drivers should be updated even in the most repetitive processes change. Keeping the costing model up to date and intense data collection requirements may be difficult for managers.

- Out-of-date information may cause seriously mistakes in the TDABC model. If the data comes from systems such as automated call-handling software and is regularly updated, then results will be accurate. On the other hand, if the information is out of date, or if it's based on estimates, the resulting cost information may include substantial errors.

- TDABC is not an appropriate methodology for all situations. In any organization, some functions such as marketing, research, includes activities that are far from homogeneous and repetitive. Trying to force a

[71] Barrett, pp. 35-39.

time driven methodology onto activities in which cycle times vary wildly is inappropriate for those activities.

When managers become careful in TDABC application, disadvantages may be eliminated. Furthermore, it has many advantages and it realizes more gaining than its cost. As a result TDABC can be considered as an efficient and accurate system for organizations and also managers can increase organizations' efficiency by using this system.

PART 5: SERVICE SECTOR

Each country has an economic system for the social prosperity of its people. These systems are based on two separate sector; service and manufacturing sector. Manufacturing sector meets the fundamental necessities such as clothes and food, in a productive way. On the other hand, service sector fulfill people's requirements by providing service in its specific way. Service is a different and specific concept which reflects the essence of new, competitive market condition requirements in an economic area.

5.1. DEFINITION OF SERVICES

Services are economic activities that produce time, place, form or psychological utilities. A good is a tangible item that can be created and sold or used later. In contrast to definition of good, a service is intangible and perishable which is created and consumed simultaneously. Many other definitions can be given but reaching the broad definition is very difficult since the distinction between goods and services is not very clear. For this reason, the definition of services has been a continuing problem and this problem can be overcome by analyzing the distinctive characteristics of services[72].

5.2. DISTINCTIVE CHARACTERISTICS OF SERVICES

There are five characteristics that differentiate services from goods. These are given as follows[73]:

[72] Robert G. Murdick, Barry Render and Roberta S. Russell, Service Operations Management, First edition, United States of America: Allyn and Bacon, 1990, pp. 4-25.
[73] James A. Fitzsimmons and Mona J. Fitzsimmons, Service Management, Fifth Edition, Singapore: McGraw-Hill, 2006, pp. 21-25.

5.2.1. Customer Participation in the Service Process

The service system should interact with the customers. Customers are participant and they play an active part in the service process. For instance, patient and doctor get together and constitute a medical service.

5.2.2. Simultaneity

Services are created and consumed simultaneously. It cannot be stored as an inventory. Inventory control is a main issue in manufacturing operations whereas the customer waiting or queuing is the major problem for services. Furthermore, the simultaneous production and consumption in services eliminates chances for quality control intervention.

5.2.3. Perishability

A service is a perishable for the reason that it cannot be stored. It is lost forever when not used. The full utilization of service capacity becomes a management challenge since demand for services exhibits very fluctuating behavior. These fluctuations enforce managers to take advertising and pricing decisions.

5.2.4. Intangibility

Services are ideas, whereas, products are things. The intangible nature of services represents a problem for customers. When buying a product, customers are able to see this product, feel it and test its performance before purchase. For a service, customers do not have these chances so they must rely on goodwill of the service firm.

5.2.5. Heterogeneity

The combination of the intangible characteristic of services and the customer as a participant in the service delivery system results in variation of service from customer to

customer. Various and peculiar characteristics of customers and the interaction between different customers and different employees creates the heterogeneity of service system.

5.3 TYPES OF SERVICE ORGANIZATIONS

For-profit and nonprofit organizations are two main types of service organizations which can be recognized in a service sector. Household operations, medical and health care, private education, professional business service, financial service, transportation and communications are examples of for-profit businesses. Educational, cultural, religious, social concerns, professional and trade, healthcare and political are examples of nonprofit businesses. These nonprofit businesses have a profit goal because growth and continued existence depend on generating revenue in excess of its cost[74].

The same type of business can be classified in both for-profit and nonprofit organizations based on the types of its profit aim. For example health care is recognized both for-profit and nonprofit sector. Indeed, some health care institutions' goal is to get profit as a primary goal for surplus, while other institutions' goal is to get profit in order to create job opportunities for society's prosperity.

5.3.1 Health Sector

Countries, especially undeveloped and developing ones, continue to face hard challenges in meeting the health needs of their populations. The problem is not just lack of resources, but also how to use existing resources more fairly and more efficiently. The progress of health care sector in one country is closely related with its overall political, social and economic systems development. Because of these considerations, governments of most countries have become central of the health policies during the twentieth century[75]. In addition, health sector is crucial in today's advanced economic condition for a nation's

[74] Michael J. Etzel, Bruce J. Walker and William J. Stanton, Marketing, Twelfth Edition, New York: McGraw-Hill, 2001, pp. 293-298.
[75] Liu Yuanli et al., "Health Care in China: The Role of Non-Government Providers", Health Policy, Vol. 77, Issue 2 (2006), pp. 212–220.

social welfare and comfort and it protects the importance in a service sector with its own specific characteristics.

5.3.1.1. Characteristics of the Health Care

Over the last twenty years, governments all around the world have attempted to enhance the nature of market and competition in health care industries in order to increase efficiency and reduce costs. Health care markets have their specific characteristics that relate to product differentiation, information asymmetry and nonprofit ownership status[76]. Furthermore, difficulties in substitution, low demand and sociality are the other main characteristics of health care markets. Preventative health care, primary, secondary and tertiary health care, psychiatric and emergency health care are the main types of health care by means of which the characteristics of this sector are carried on[77].

5.3.1.2. The Changing Health Care Environment

Healthcare worldwide is undergoing a dramatic change consistent with the global changes in many major industries. Struggling public health systems are unable to meet the needs and expectations of patients. Inefficient health system, educated and well-informed consumers and highly trained personnel are some of the forces behind the demand for globalization in healthcare. The discrepancy between countries in the healthcare is currently available and the expectation for quality, access, and timeliness is shaping an unprecedented demand. With huge access to information throughout the information technology, educated customers recognize the inadequate parts of their health systems so they force their countries to provide new healthcare opportunities. Consequently, the radical changes are realized in a healthcare area[78].

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[76] Zoe Boutsioli, "Concentration in the Greek Private Hospital Sector: A Descriptive Analysis", Health Policy, Volume 82, Issue 2 (July 2007), pp. 212-225.

[77] Nurcan Turan, Türkiye'de Sağlık Hizmetleri ve Sağlık Sektöründe Temel Sorunlar: Çözüm İçin Sağlık Kooperatifçiliğinden Yararlanma Gereği ve Olanakları, Anadolu Üniversitesi İktisadi ve İdari Bilimler Fakültesi Yayınları, No. 182, 2004.

[78] Lynn Schroth and Ruthy Khawaja, "Globalization of Healthcare", Frontiers of Health Services Management, Vol. 24, Issue 2 (Winter 2007), pp. 19-30.

5.4. THE ROLE OF SERVICES IN AN ECONOMY

Services play a critical role in the economy of countries. The range of services within societies may be quite broad[79] since service sector provides many opportunities such as job opportunities, welfare and prestige opportunities, so it is supported by governments. Government services provide a stable environment for investment and economic growth. For example, infrastructure services, such as transportation and communication, are the essential services among all sectors of the economy. Health care, public education, well maintained roads and public safety are the other services which are realized by government in order to increase economic and social welfare[80].

Modern advanced economies are dominated by employment in the service companies. This represents a natural development of economies from preindustrial to industrial and finally to postindustrial societies. Moreover, service sector can be explored in terms of employment opportunities, contributions to economic stability and source of economic leadership[81].

5.5. THE CHANGING SERVICE SECTOR

The current wave of technological and management transformation is altering the perspectives and expectations of service firms around the world and creating new service organizations and philosophies. The new firms face the difficult task of simultaneously improving quality, customer service and reducing cost. Consequently, 1920s accounting system is not appropriate for modern firms. Thus, managers must change management accounting system for new types of requirements[82].

[79] Murdick, Render and Russell, p. 10.
[80] Fitzsimmons and Fitzsimmons, p. 3.
[81] Ibid, p. 4.
[82] James A. Brimson and John Antos, Activity-Based Management: For Service Industries, Government Entities and Nonprofit Organizations, First Edition, United States of America: John Wiley Sons Inc., 1994, pp. 31-59.

5.6. COST OF SERVICES

Many similarities exist between the costing of products in manufacturing and service organizations. Like product costs, direct material, direct labor and overhead are three elements of the cost of services. However, the proportions of elements of service sector may different than manufacturing sector. Few material costs and large amounts of labor and overhead costs are common characteristics of service companies. While service firms have both direct and indirect costs, they generally have larger percentages of indirect costs[83].

Cost is a crucial factor for managers in pricing strategies. In a service organization pricing has a difficult structure because services are perishable, they cannot be stored and they have imbalances in supply and demand. Price is the amount of money needed to obtain goods and services. Price is a basic regulator of the economic system due to the fact that it influences the allocation of the factors of production such as land, labor and capital. As a result pricing strategies of a product or service should consider its cost[84].

5.7. ACTIVITY COSTING IN SERVICE SECTOR

Activity based costing can be implemented in the healthcare institutions. Healthcare institutions are labor-intensive industrials and there is a need to recognize what services actually cost and what activities are the most efficient. ABC allows a more effective planning, control and decision making compared with the traditional cost system[85]. Activity based cost information allows managers to take reliable decisions like pricing. In order to get valuable decisions, managers must determine and manage the cost of services to answer following questions[86]:

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[83] Jackson, Sawyers and Jenkins, p. 43.
[84] Etzel, Walker and Stanton, pp. 324-334.
[85] Suthummanon Sakesun, Vincent K. Omachonu and Mehmet Akcin, "Applying Activity-Based Costing to the Nuclear Medicine Unit", Health Services Management Research, Vol. 18, Issue 3 (Aug. 2005), pp. 141-150.
[86] Naughton-Travers, pp. 48-52.

- How much does it cost to render a particular service and how does this compare to the revenue stream associated with it?
- What are the primary activities that make up the cost of a service?
- What are the inefficient or unnecessary activities that can be reduced or eliminated to reduce costs?
- What changes in staff time and other resources would be necessary if the processes and procedures were changed?

Besides determination and management of service costs, evaluation of outsourcing options, developing "what if" scenarios for service expansion or reduction, assisting marketing staff in product design and service pricing, developing budgets and measuring performance become fundamentals of organizations' operations and this situation also reflects ABC is a valuable tool for organizations[87].

On the other hand, applying ABC in service organizations is not without its problem. One widespread problem is that the type of work done in service organizations tends to be nonrepetitive. Analyzing the activities of a service organization can be difficult when the activities differ seriously for each customer or service[88]. To overcome these problems quickly, TDABC system can be used in a service sector as well as manufacturing sector.

[87] Ibid.
[88] Jackson, Sawyers and Jenkins, p. 114.

PART 6: AN IMPLEMENTATION OF TIME DRIVEN ACTIVITY BASED COSTING SYSTEM IN THE SERVICE SECTOR

An implementation was realized in a service sector to justify applicability and efficiency of Time Driven Activity Based Costing System. In order to easily recognize the superiority of this system, current costing system should be analyzed. In addition to this, conventional ABC system can be applied to understand the differences between them.

6.1. GENERAL INFORMATION ABOUT THE HOSPITAL

Mağusa Yaşam Hospital is the first well-equipped private hospital in Cyprus. It started to give services in Famagusta in May 2003. It has 2 operating rooms, 1 intensive care unit and 14 private rooms. It provides 24-hour emergency service for patients. The hospital contains 70 personnel in total; 17 doctors, 4 ambulance drivers, 18 nurses, 3 radiologists, 4 kitchen personnel, 5 cleaners, 10 information personnel, 4 accountants, and 5 laboratory personnel.

Mağusa Yaşam Hospital has 20 branches. These are; General Surgery, Internal Medicine, Orthopedics, Gynecology and Obstetrics, Test-Tube Baby Center, Radiology, Dermatology, Urology, Pediatrics, Eye Center, Ear-Nose-Throat, Neurology, Neurosurgery, Psychiatry, Physical Therapy, Cardiology, Plastic Surgery, Anesthesiology, Dentistry, and Nutrition & Diet Center.

Mağusa Yaşam Hospital was established in 3000m2 area. 960 patients come to the hospital for different complaints and 60 surgical operations in average are done per month. The General Surgery Department is 300m2, and it has 120 patients in average. 15 surgical operations are done per month (11520 patient and 720 surgical operations for overall hospital, 1440 patient and 180 surgical operations for general surgery per year). 100 patients out of these 120 patients come to General Surgery Center due to gall complaints. While 13 surgical operations are realized out of 100 patients who have gall problems, there are only 2 surgical operations done out of 20 remaining patients [These data related to the

year 2007, are obtained from a comprehensive observations and interviews with hospital management]. Three open and ten close gallbladder operations are respectively being done out of 13 gallbladder operations which are realized in general surgery.

According to the observations and interviews, general surgery department is divided into four patient groups. The first patient group is not exposed to surgical operations and they need only medical control. Moreover, other three patient groups are exposed to open, close and other surgical operations. Five days are necessary for patients to stay in hospital after the open gallbladder operations (Traditional Method) and only one day is enough for patients to stay in hospital after the close gallbladder operations (Laparoscopic Method). Consequently, each of two other different surgical operations requires 2 patient days and 26 patients out of 105 patients without surgical operations, need to stay in hospital for one day. Thus, 55 patient- days are totally found per month in the general surgery department. Additionally, it can be mathematically represented as follows:

Open gallbladder operations: 3 patients*5days= 15 patient-day,

Close gallbladder operations: 10 patients*1day= 10 patient-day,

Other surgical operations: 2 patients*2 days= 4 patient-day,

Patients without surgical operations: 26 patients*1 day= 26 patient-day.

6.1.1. Organization Chart & Service Flow Chart

Organization Chart of Mağusa Yaşam Hospital and Service Flow Chart of the General Surgery Department are given respectively in Figure 6.1 and 6.2:

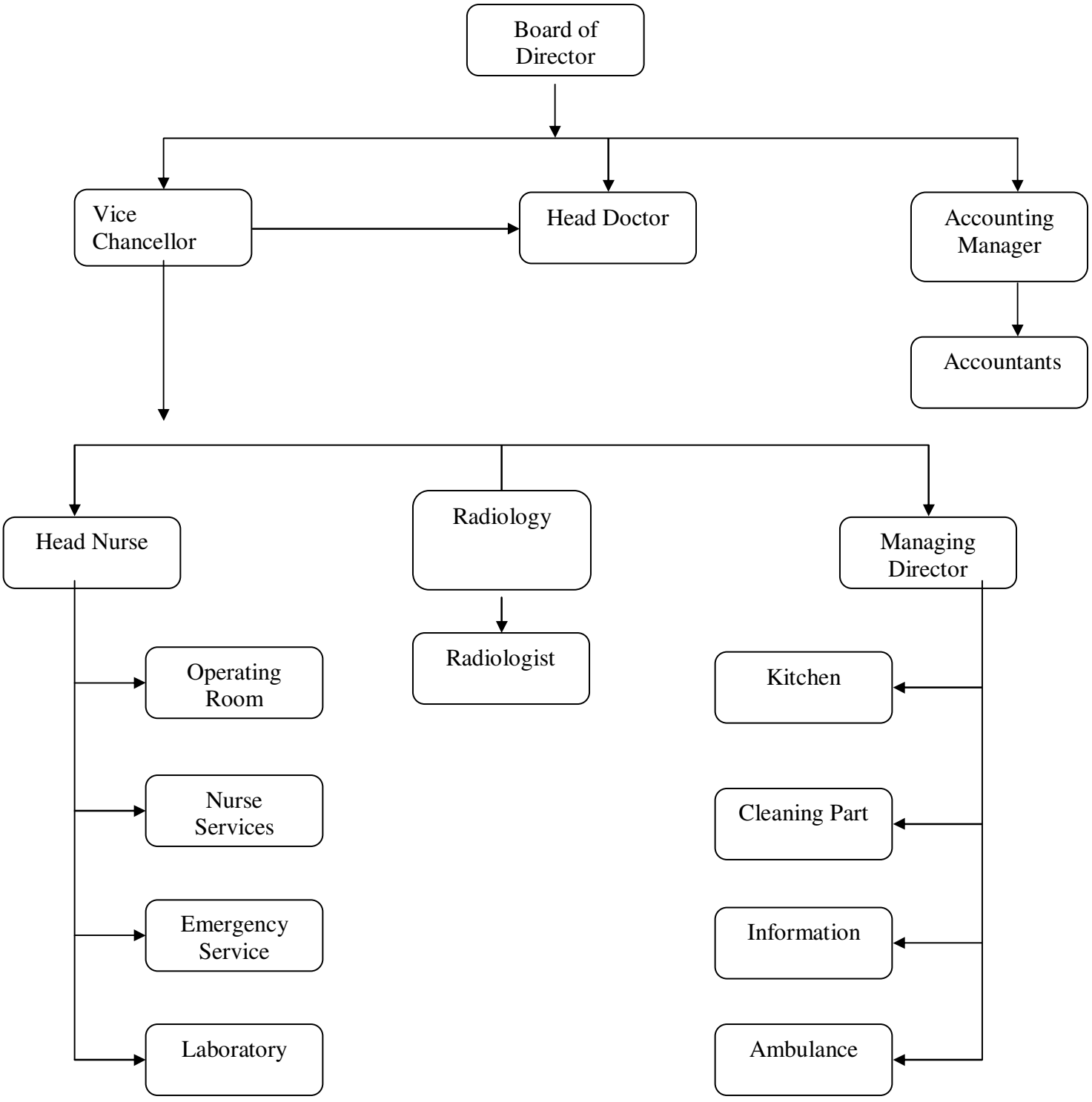


Figure 6.1: Organization Chart of Mağusa Yaşam Hospital

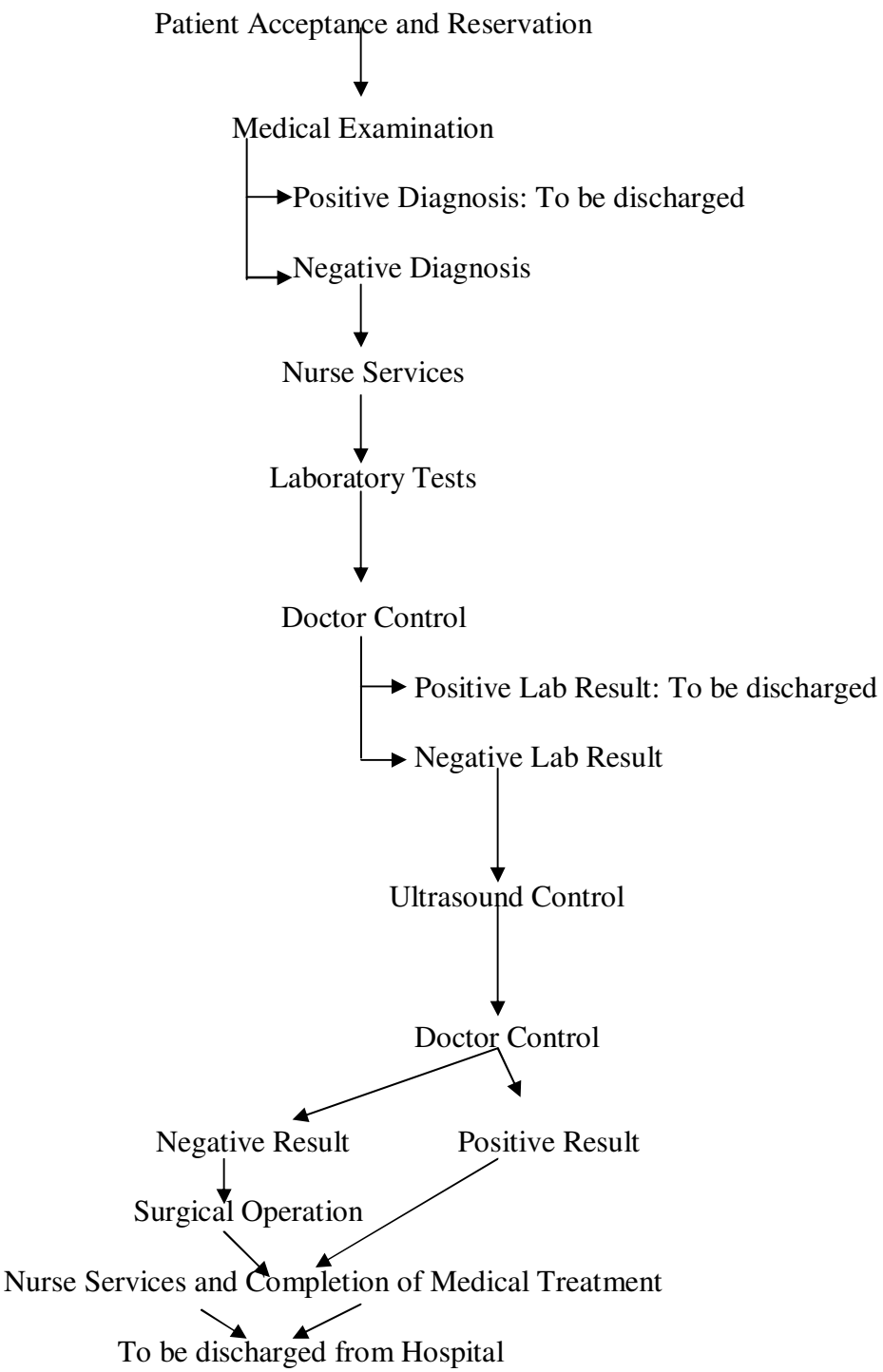


Figure 6.2: Service Flow Chart of the General Surgery Department

6.2. GALLBLADDER OPERATIONS

The deformation of gall structure causes the formation of gall stones in gall bladder and they cannot be treated by medicine. They should be taken out by surgical operation. There are two main types of surgical operation:

Open Method: This operation requires 120 minutes and patients need 5 days to stay in hospital.

Laparoscopic (Close) Method: It requires 90 minutes and patients need 1 day to stay in hospital.

Although the laparoscopic type operation is more developed, progressed and cheaper than open operation, the reasons of the continuity of open operation can be given as follows:

-When the patient had an abdominal operation because of arbitrary reason such as shooting.

-When the size of gallstone is too big, it cannot be taken out by laparoscopic method.

- High-Risk Patients; if the tissues touch to the liver, it cannot be interfered by laparoscopic operations.

6.3 THE CURRENT COSTING SYSTEM

Open and laparoscopic methods are main cost objects of this study and Mağusa Yaşam Hospital determine their costs by using traditional cost system. In this system, direct costs such as doctor costs, nurse and medicine costs, are allocated directly to open and laparoscopic methods. In addition, overhead costs are assigned to cost objects based on patient-day. This system is not efficient because the costs which are transferred to open and laparoscopic operation by hospital managers do not reflect real costs. Thus, firstly, the results of both traditional cost system and conventional ABC system will be given and then TDABC approach will be carried out to the same data to display the differences between these approaches.

6.3.1. Direct Costs of Open and Laparoscopic Surgery

The data below and Table 6.1 exhibit the direct costs of open and laparoscopic surgery:

Laparoscopic Surgery: The operation requires 90 minutes and patients need 1 day to stay in hospital. 1 Doctor*300 ytl + 1 Assistant Doctor*200 ytl + 1 Anesthetist*250 ytl= 750 ytl.

Open (Traditional) Surgery: The operation requires 120 minutes and patients need 5 days to stay in hospital. 1 Doctor*350 ytl + 1 Assistant Doctor*250 ytl + 1 Anesthetist * 300 ytl= 900 ytl (Costs are higher than laparoscopic method because of its high duration).

Table 6.1
Direct Costs of Open and Laparoscopic Operations

Open (3 times per month) Op.		Laparoscopic (10 times per month) Op.	
Doctor(1dr.,1assist.,1 anesthetist)	750 ytl	Doctor(1dr.,1assist.,1 anesthetist)	900 ytl
Nurse (3nurse*50ytl)	150 ytl	Nurse (3nurse*50ytl)	150 ytl
Medicine	120 ytl	Medicine	250 ytl
Room	100 ytl	Room	500 ytl
Operation and Anesthesia	300 ytl	Operation and Anesthesia	300 ytl
Total Direct Cost:	1420 ytl	Total Direct Cost:	2100 ytl

6.3.2. Indirect (Overhead) Costs of General Surgery Department

1. Management Costs

2. Personnel Costs

3. Maintenance and Repairing Costs of Medical Instruments and Materials

4. Depreciation Costs of Medical Instruments and Materials

5. Insurance Costs of Medical Instruments and Materials

6. Building Insurance Costs

7. Building Depreciation Costs

8. Building Maintenance and Repairing Costs

9. Electricity Consumption Costs

10. Communication Costs

11. Water Consumption Costs

12. Cleaning Costs

13. General Medical Materials and Fuel-Oil Costs

14. Accounting Department Costs

15. Meal (Kitchen) Costs

16. Laundry Costs

17. Office Requisites and Miscellaneous Costs

18. Information System Costs

The calculation of each cost can be given as follows:

1. Management Costs

1 Doctor*2500= 2500 ytl (30000 ytl per year/12 months= 2500 ytl per month)

1 Assistant Doctor = 1500 ytl per month

1 Anesthetist *2000/4= 500 ytl [(60/15=4) There are 60 surgical operation (720 operation per year) in the hospital and out of this amount, 15 surgical operation take place in General Surgery Department per month (180 operation per year)]

8 Secretaries*860/20= 344 ytl (They give an equal level of service to all branches of hospital)

Total= 4844 ytl/month for General Surgery Department.

2. Personnel Costs

18 Nurses*1000 ytl/month= 18000/20 (They give an equal level of service to all 20 branches) = 900 ytl per month for General Surgery Department

4 Kitchen Personnel*860/20= 172 ytl

4 Ambulance Driver*860/20= 172 ytl

5 Laboratory Personnel*1000/20= 250 ytl

3 Radiologists*2000 ytl*%25= 1500 ytl (Out of 60 surgical operation, 15 operation realize in general surgery department so radiologists spend %25 of their time for this department)

Total= 2994 ytl/month

3. Maintenance and Repairing Costs of Medical Instruments and Materials

Maintenance & Repairing Costs of Laboratory Instruments= 14400 ytl per year= 14400/12= 1200/ 20= 60 ytl per month for General Surgery Department

Maintenance & Repairing Costs of Surgical Operation Instruments = 2400 ytl per year= 200 ytl per month

Ambulance Costs per year= 3000, 3000/12= 250 ytl/20= 12.5 ytl per month

General Surgery Ultrasound Costs= 900 ytl per year= 900/12= 75 ytl per month

General Surgery Medical Control Instruments and Materials= 1050 ytl per year= 87.5 ytl (1050/12) per month

Total= 435 ytl/month

4. Depreciation Costs of Medical Instruments and Materials

Cost of Laboratory Instruments= 345600 ytl per year= 28800 ytl per month= 2400 ytl /20 (They are used equally by each department) = 120 ytl per month for General Surgery Department

Cost of Operation Instruments= 9600 ytl per year= 800 ytl per month.

Ambulance Costs= 9600 ytl per year = 9600/12= 800 ytl per month/20 department= 40 ytl per month.

General Surgery Medical Control Instruments and Materials= 1500 ytl per year/12= 125 ytl per month.

General Surgery Ultrasound Costs: 1800 ytl per year=1800/12= 150 ytl per month.

Total= 1235 ytl/month

5. Insurance Costs of Medical Instruments and Materials

General Surgery Medical Control Instruments and Materials= 1200 ytl per year= 100 ytl/month

Cost of Laboratory Instruments= 19200 per year=19200/12= 1600/20= 80 ytl/month

Cost of Operation Instruments= 4200 per year= 4200/12= 350 ytl/month

Ambulance Costs per year= 4800 ytl= 400 ytl per month/20= 20 ytl/month

Ultrasound Costs= 960 ytl per year/12= 80 ytl/month

Total= 630 ytl/month

6. Building Insurance Costs

18000 ytl per year= 1500 ytl per month for overall hospital or 3000m2(total area of hospital). The area of General Surgery Department is 300m2, then 300/3000= 0.10 and 0.10*1500= *150 ytl/month for General Surgery Department*

7. Building Depreciation Costs

24000 ytl per year= 2000 ytl per month for 3000m2. The area of General Surgery Department is 300m2, then 300/3000= 0.10 and 0.10*2000= *200 ytl/month*

8. Building Maintenance and Repairing Costs

6000 ytl per year= 500 ytl per month for 3000m2. The area of General Surgery Department is 300m2, then 300/3000=0.10 and 0.10*500= *50 ytl/month*

9. Electricity Consumption Costs

240000 ytl per year= 20000 ytl per month for 3000m2. The area of General Surgery Department is 300m2= 300/3000=0.10 and 0.10*20000= *2000 ytl/month*

10. Communication Costs

27600 ytl per year for overall hospital= 2300 ytl per month= Telephone: 1500 ytl, Net: 500 ytl, Fax: 300 ytl= 2300/20= *115 ytl/month*

11. Water Consumption Costs

4800 ytl per year for overall hospital= 4800/12= 400 ytl per month/20=*20 ytl/month*

12. Cleaning Costs

5 Cleaners + Cleaning Materials= 60000 per year= 5*860+700 ytl = 5000 ytl per month/20= *250 ytl/month*

13. General Medical Materials and Fuel-Oil Costs

General Medical Materials= 240000 ytl per year= 20000 ytl per month + Fuel-Oil Costs= 24000 ytl per year= 2000 ytl per month: Total= 22000 ytl per month. This amount represents the whole cost of the hospital which is composed by 960 patients. General Surgery Department has only 120 patients so 120/960= 0.125= 22000*0.125= *2750 ytl/month*

14. Accounting Department Costs

48000 ytl per year for overall hospital= 48000/12= 4000 ytl (4*1000) per month. This amount represents the 960 patients' cost as a whole cost of the hospital. On the other hand, General Surgery Department has only 120 patients so 120/960= 0.125= 4000*0.125= *500 ytl/month*

15. Meal Costs

180000 ytl per year for overall hospital= 180000/12= 15000 ytl per month/20 department= *750 ytl/month*

16. Laundry Costs

Mağusa Yaşam Hospital pays 30000 ytl as a fixed cost to a laundry company for every year. It equals to 2500 ytl per month. This expense is equally recognized by each department= 2500/ 20= *125 ytl/month*

17. Office Requisites and Miscellaneous Costs

2400 ytl per year for overall hospital=2400/12= 200 ytl per month. This amount represents the 960 patients' cost. Furthermore, General Surgery Department has only 120 patients so 120/960= 0.125= 200*0.125= 2*5 ytl/month*

18. Information System Costs

This expense category is occurred by 2 secretaries and computers' costs. 2*860/20= 86 ytl per month, and the total amount of maintenance, repairing and depreciation is 6000 ytl per year which is equal to 500 ytl per month/20 department= 25 ytl/month= 25 ytl+86 ytl= *111 ytl/month*

As a result, overhead costs of general surgery department are summarized in the table below:

Table 6.2
Overhead Costs of General Surgery Department

Indirect Costs	Total(ytl/month)
1. Management Costs	4844 ytl/month
2. Personnel Costs	2994
3. Maintenance and Repairing Costs of Medical Instruments and Materials	435
4. Depreciation Costs of Medical Instruments and Materials	1235
5. Insurance Costs of Medical Instruments and Materials	630
6. Building Insurance Costs	150
7. Building Depreciation Costs	200
8. Building Maintenance and Repairing C.	50
9. Electricity Consumption Costs	2000
10. Communication Costs	115
11. Water Consumption Costs	20
12. Cleaning Costs	250
13. General Medical Materials and Fuel-Oil	2750
14. Accounting Department Costs	500
15. Meal (Kitchen) Costs	750
16. Laundry Costs	125
17. Office requisites and Miscellaneous C.	25
18. Information System Costs	111
Total:	17184 ytl

As mentioned before, there are 55 patient-day per month for the general surgery department:

Open Surgery: 3 patients*5 days= 15 patient-day,

Laparoscopic (Close) Surgery: 10 patients*1 day= 10 patient-day,

Other surgical operations: 2 patients*2 days= 4 patient-day,

Patients without surgical operations: 26 patients*1 day= 26 patient-day.

Total: 55 patient-day per month

Allocation of General Surgery Department Costs= Total Overhead Costs/ patient-day per month= 17184/55 patient-day = 312.44 ytl/ patient-day

Open surgery for 1 patient: 5 days * 312.44 ytl/ patient-day = 1562.2 ytl per open operation

Close surgery: 312.44 ytl/patient-day * 1 day= 312.44 ytl per close (Laparoscopic) operation

Table 6.3
Costs of Open and Laparoscopic Operations in Traditional System

	Open Surgery	Laparoscopic Surgery
Direct	2100 ytl	1420 ytl
Indirect	1562.2 ytl	312.44 ytl
Total	**3662.2 ytl**	**1732.44 ytl**
Sales Price	4000 ytl	3000 ytl

6.4 IMPLEMENTING ACTIVITY BASED COSTING TO THE MAĞUSA YAŞAM HOSPITAL

In order to implement activity based costing system, activities, cost drivers, relations between activities and costs must be determined. Therefore, firstly, activities of the General Surgery Department of Mağusa Yaşam Hospital will be presented as follows:

6.4.1. Identifying the Activities of the General Surgery Department

After comprehensive observations and interviews, nine major activities were identified. These activities which are given as below are realized in General Surgery Department;

A1: Patient Acceptance and Discharging: Patient acceptance, reservation, ambulance services, and discharging.

A2: Medical Examination of Patient: Patient control**,** negative or positive diagnosis.

A3: Laboratory tests: Bloodletting, measuring blood pressure and blood clot, determine blood group, HIV test.

A4: Ultrasound Control: Patient check-up with ultrasound and determine gallstones.

A5: Nurse Services before Hospitalization: Preparing the patient, giving an injection to the patient, gives an attention to the relation with the patient.

A6: Surgical Operation: Taking patient to the operating room, giving a narcosis, doing operation, using medical instruments and materials, and finalizing the operation.

A7: Nurse Services after Hospitalization: Patient controls, taking care of the patient, gives information to the patient.

A8: Meal (Kitchen) Services: Planning the meals, taking the required ingredients, cooking and distributing them.

A9: Giving Morale, Completion of Treatment and Patient Discharging: Patient control, instruct to patient, giving an attention to the relation with the patient and discharging.

6.4.2. The Determination of First Stage Cost Drivers

After the activities are determined, the next step is to allocate costs to the activities by using appropriate cost drivers. Therefore, first stage cost drivers are given in Table 6.4 and then, relation between first stage cost drivers and activities are presented in Table 6.5:

Table 6.4
First Stage Cost Drivers

Indirect Costs	Cost Driver
1. Management Costs	Number of Employee
2. Personnel Costs	Number of Employee
3. Maintenance and Repairing Costs of Medical Instruments and Materials	Number of Medical Instruments
4. Depreciation Costs of Medical Instruments and Materials	Number of Medical Instruments
5. Insurance Costs of Medical Instruments and Materials	Number of Medical Instruments
6. Building Insurance Costs	m2
7. Building Depreciation Costs	m2
8. Building Maintenance and Repairing C.	m2
9. Electricity Consumption Costs	m2
10. Communication Costs	Number of Patient
11. Water Consumption Costs	Number of Patient
12. Cleaning Costs	m2
13. General Medical Materials and Fuel-Oil C.	Number of Used Medical Materials
14. Accounting Department Costs	Number of Patient
15. Meal Costs	Number of Meal
16. Laundry Costs	Number of Patient
17. Office Requisites and Miscellaneous C.	Number of Patient
18. Information System Costs	Number of Computer

Table 6.5
Relationship Between First Stage Cost Drivers and Activities

Activities	Number of Employee	Number of Medical Instruments	m2(General Surgery)	No. of Patient	No. of Used Medical Materials	Number of Meal	No. of Comp.
A1: Patient Acceptance and Discharging	8/20 secretaries 4/20 amb. drivers	3/20 ambulance	28m2	120	-		3
A2: Medical Examination of Patient	2doctors(They spend %60 of their time)	2	88m2	120	360		1
A3: Lab test.	5 laboratory personnel/20 departments	6/20	8m2	70	350		1
A4: Ultrasound	3/4 radiologists(They spend %25 of their time)	1	10m2	50	100		1
A5: Nurse Services before Hospitalization	6/20 nurses	-	20m2	107	214		
A6: Surgical Operation	2 doctors(%40 of their time) 0.25 anesthetist, 3/20 nurses	6	100m2	15	150		1
A7: Nurse Services after Hospitalization	7/20 nurses	-	20m2	41	82		1
A8: Meal Services	4/20 kitchen personnel	-	6m2	91	-	315	
A 9: Giving Morale and Patient Discharging	2/20 nurses	-	20m2	120	120		
Total:			300m2	734	1376	315	8

6.4.3. Determine the Cost of the Activities

Before the determination of cost of the activities, the relationship between expenses and activities should be known so Table 6.6 shows this relationship between them:

Table 6.6
Relationship Between Expenses and Activities

Costs	A1	A2	A3	A4	A5	A6	A7	A8	A9
1. Management Costs	x	x				x			
2. Personnel C.	x		x	x	x	x	x	x	x
3. Maintenance and Repairing Costs of Medical Instruments and Materials	x	x	x	x		x			
4. Depreciation Costs of Medical Instruments and Materials	x	x	x	x		x			
5. Insurance Costs of Medical Instruments and Materials	x	x	x	x		x			
6. Building Insurance Costs	x	x	x	x	x	x	x	x	x
7. Building	x	x	x	x	x	x	x	x	x

Depreciation C.	A1	A2	A3	A4	A5	A6	A7	A8	A9
8. Building Maintenance and Repairing Costs	x	x	x	x	x	x	x	x	x
9. Electricity Consumption	x	x	x	x	x	x	x	x	x
10. Communication	x	x	x	x	x	x	x	x	x
11. Water Consumption	x	x	x	x	x	x	x	x	x
12. Cleaning Costs	x	x	x	x	x	x	x	x	x
13. General Medical Materials and Fuel-Oil C.		x	x	x	x	x	x		x
14. Accounting Department Costs	x	x	x	x	x	x	x	x	x
15. Meal Costs								x	
16. Laundry Costs	x	x	x	x	x	x	x	x	x
17. Office Requisites and Miscellaneous Costs	x	x	x	x	x	x	x	x	x
18. Information System Costs	x	x	x	x		x	x		

6.4.4. Allocating Costs to the Activities

- Management Costs:

A2: 1 Doctor*2500= 2500 ytl*0.60= 1500 ytl + 1 Assistant Doctor= 1500 ytl*0.60= 900 ytl

A6: 0.40 Doctor*2500= 1000 ytl + 0.40 Assistant Doctor*1500= 600 ytl +

0.25 Anesthetist * 2000= 500 ytl

A1: 8 Secretaries*860/20= 344 ytl (They spend their time equally in 20 branches of hospital)

- Personnel Costs

18 Nurses*1000 ytl/month= 18000/20 (Equally services for 20 branches) = 900 ytl per month for General Surgery Department. It can be allocated to these activities= **A5:** 6/20*1000= 300 ytl, **A6:** 3/20*1000= 150 ytl, **A7:** 7/20*1000= 350 ytl, **A9:** 2/20*1000= 100 ytl

4 Kitchen Personnel*860/20= 172 ytl**: A8**

4 Ambulance Driver*860/20= 172 ytl**: A1**

5 Laboratory Personnel*1000/20= 250 ytl**: A3**

3 Radiologists*2000 ytl*%25=1500 (Out of 60 surgical operation, 15 operation realize in General Surgery Department. Therefore, radiologists spend %25 of their time for this department)**: A4**

- Maintenance and Repairing Costs of Medical Instruments and Materials

Ambulance Costs per year=3000, 3000/12= 250 ytl/20= 12.5 ytl per month**: A1**

General Surgery Ultrasound Costs=900 ytl per year=900/12= 75 ytl per month**: A4**

Maintenance&Repairing Costs of Laboratory Instruments= 14400 ytl per year= 14400/12= 1200/ 20= 60 ytl per month for General Surgery Department**: A3**

Maintenance&Repairing Costs of Surgical Operation Instruments = 2400 ytl per year= 200 ytl-per month**: A6**

General Surgery Medical Control Instruments and Materials= 1050 ytl per year= (1050/12) 87.5 ytl per month**: A2**

- Depreciation Costs of Medical Instruments and Materials

Cost of Laboratory Instruments= 345600 ytl per year= 28800 ytl per month= 2400 ytl /20 (They are used equally by each department) =120 ytl-per month for General Surgery Department**: A3**

Cost of Operation Instruments= 9600 ytl per year= 800 ytl per month**: A6**

Ambulance Costs per year 9600 ytl=9600/12=800 ytl per month/20 department= 40 ytl**: A1**

General Surgery Medical Control Instruments and Materials= 1500 ytl per year/12= 125 ytl per month**: A2**

General Surgery Ultrasound Costs: 1800 ytl per year= 1800/12= 150 ytl per month**: A4**

- Insurance Costs of Medical Instruments and Materials

General Surgery Medical Control Instruments and Materials= 1200 ytl per month= 100 ytl/month**: A2**

Cost of Laboratory Instruments= 19200 per year=19200/12= 1600/20= 80 ytl/month**: A3**

Cost of Operation Instruments= 4200 per year= 4200/12= 350 ytl/month**: A6**

Ambulance Costs per year 4800 ytl= 400 ytl per month/20= 20 ytl/month**: A1**

Ultrasound Costs= 960 ytl per year/12= 80 ytl/month**: A4**

- Building Insurance Costs

18000 ytl per year= 1500 ytl per month for overall hospital (3000m2 is the total area of the hospital). The area of General Surgery Department is 300m2, then 300/3000=0.10 and 0.10*1500= *150 ytl/month* for General Surgery Department

150 ytl/300m2= 0.5 ytl/m2

A1: 28m2*0.5 ytl/m2 = 14 ytl, **A2:** 88m2*0.5 ytl/m2 = 44 ytl, **A3:** 0.5 ytl/m2 *8m2= 4 ytl, **A4:** 0.5 ytl/m2 *10m2= 5 ytl, **A5:** 0.5 ytl/m2 *20m2=10 ytl, **A6:** 0.5 ytl/m2 *100m2= 50 ytl , **A7:** 0.5 ytl/m2 *20m2= 10 ytl , **A8:** 0.5 ytl/m2 *6m2= 3 ytl , **A9:** 0.5 ytl/m2 *20m2= 10 ytl

- Building Depreciation Costs

24000 ytl per year= 2000 ytl per month for 3000m2. The area of General Surgery Department is 300m2, then 300/3000=0.10 and 0.10*2000= *200 ytl/month*

200 ytl/300m2= 0.667 ytl/m2

A1: 28m2*0.667 ytl/m2= 18.68 ytl, **A2:** 88m2*0.667 ytl/m2= 58.70 ytl, **A3:** 0.667 ytl/m2*8m2= 5.34 ytl, **A4:** 0.667 ytl/m2*10m2= 6.67 ytl, **A5:** 0.667 ytl/m2*20m2= 13.34 ytl, **A6:** 0.667 ytl/m2*100m2= 66.7 ytl, **A7:** 0.667ytl/m2*20m2= 13.34 ytl, **A8:** 0.667 ytl/m2*6m2= 4 ytl, **A9:** 0.667 ytl/m2*20m2= 13.34 ytl

- Building Maintenance and Repairing Costs

6000 ytl per year= 500 ytl per month for 3000m2. The area of General Surgery Department is 300m2= 300/3000=0.10 and 0.10*500= *50 ytl/month*

50 ytl/300m2= 0.167 ytl/m2

A1: 28m2*0.167 ytl/m2= 4.68 ytl, **A2:** 88m2*0.167 ytl/m2= 14.70 ytl, **A3:** 0.167 ytl/m2*8m2= 1.34 ytl, **A4:** 0.167 ytl/m2*10m2= 1.67 ytl, **A5:** 0.167 ytl/m2*20m2= 3.34 ytl, **A6:** 0.167ytl/m2*100m2= 16.7 ytl, **A7:** 0.167 ytl/m2*20m2= 3.34 ytl, **A8:** 0.167 ytl/m2*6m2= 1 ytl, **A9:** 0.167 ytl/m2*20m2= 3.34 ytl

- Electricity Consumption Costs

240000 ytl per year= 20000 ytl per month for 3000m2. The area of General Surgery Department is 300m2= 300/3000=0.10 and 0.10*20000= *2000 ytl/month*

2000 ytl/300m2= 6.67 ytl/m2

A1: 28m2*6.67 ytl/m2=186.76 ytl, **A2:** 88m2*6.67 ytl/m2= 586.96 ytl, **A3:** 6.67 ytl/m2*8m2= 53.36 ytl, **A4:** 6.67 ytl/m2*10m2= 66.7 ytl, **A5:** 6.67 ytl/m2*20m2= 133.4 ytl, A6: 6.67 ytl/m2*100m2= 667 ytl, **A7:** 6.67 ytl/m2*20m2= 133.4 ytl, **A8:** 6.67 ytl/m2*6m2= 40 ytl, **A9:** 6.67 ytl/m2*20m2= 133.4 ytl

- Communication Costs

27600 ytl per year for overall hospital= 2300 ytl per month= Telephone: 1500 ytl, Net: 500 ytl, Fax: 300 ytl= 2300/20= *115 ytl/month*

115 ytl-month/734 patient= 0.157 ytl/ patient

A1: 0.157 ytl/patient *120 patient=18.84 ytl, **A2:** 0.157 *120=18.84 ytl, **A3:** 0.157 *70= 10.99 ytl, **A4:** 0.157 *50= 7.85 ytl, **A5:** 0.157 *107= 16.799 ytl, **A6:** 0.157 *15= 2.355 ytl, **A7:** 0.157 *41= 6.44 ytl, **A8:** 0.157 *91= 14.29 ytl, **A9:** 0.157 *120= 18.84 ytl

- Water Consumption Costs

4800 ytl per year for overall hospital= 4800/12= 400 ytl per month/20= 20 ytl/month

20 ytl-month /734 patient= 0.027 ytl/ patient

A1: 0.027 ytl/patient*120 patient= 3.24 ytl, **A2:** 0.027*120= 3.24 ytl, **A3:** 1.89 ytl, **A4:** 1.35 ytl, **A5:** 2.889 ytl, **A6:** 0.405 ytl, **A7:** 1.107 ytl, **A8:** 2.457 ytl, **A9:** 3.24 ytl

- Cleaning Costs

5 Cleaners + Cleaning Materials= 60000 per year= 5*860+700 ytl = 5000 ytl per month/20= *250 ytl/month*

250 ytl-month/300m2= 0.83 ytl/m2

A1: 0.83 ytl/m2*28m2= 23.24 ytl, **A2:** 73.04 ytl, **A3:** 6.64 ytl, **A4:** 8.3 ytl , **A5:** 16.6 ytl, **A6:** 83 ytl, **A7:** 16.6 ytl, **A8:** 4.98 ytl, **A9:** 16.6 ytl.

- General Medical Materials and Fuel-Oil Costs

General Medical Materials 240000 ytl per year= 20000 ytl per month + Fuel-Oil Costs 24000 ytl per year= 2000 ytl per month: Total= 22000 ytl per month. This amount represents the 960 patients' cost as a whole cost of the hospital. General Surgery Department has only 120 patients so 120/960=0.125= 22000*0.125= *2750 ytl/month*= 2750 ytl/1376 material= 1.998 ytl/material

A2: 1.998 ytl/material*360 material= 719.28 ytl, **A3:** 699.3 ytl, **A4:** 199.8 ytl, **A5:** 427.57 ytl, **A6:** 299.7 ytl, **A7:** 163.836 ytl, **A9:** 240 ytl

- Accounting Department Costs

48000 ytl per year for overall hospital= 48000/12= 4000 ytl (4*1000) per month. This amount represents the whole cost of the hospital which is composed by 960 patients. On the other hand, General Surgery Department has only 120 patients so 120/960=0.125= 4000*0.125= *500 ytl/month*

500 ytl-month/734 patients= 0.681 ytl/patient

0.681 ytl-patient/*120 patients= 81.72 ytl**: A1**, **A2:** 81.72 ytl, **A3:** 47.67 ytl, **A4:** 34.05 ytl, **A5:** 72.87 ytl, **A6:** 10.215 ytl, **A7:** 27.92 ytl, **A8:** 61.97 ytl, **A9:** 81.72 ytl

*- **Meal Costs***

180000 ytl per year for overall hospital= 180000/12= 15000 ytl per month/20 department= 750 ytl/month: A8

- Laundry Costs

Mağusa Yaşam Hospital pays 30000 ytl as a fixed cost to a laundry company for every year. It equals to 2500 ytl per month. This expense is equally recognized by each department= 2500/ 20= *125 ytl/month*

125 ytl/month /734 patients= 0.17*120=20.4 ytl**: A1**, **A2:** 20.4 ytl, **A3:** 11.9 ytl, **A4:** 8.5 ytl, **A5:** 18.19 ytl, **A6:** 2.55 ytl, **A7:** 6.97 ytl, **A8:** 15.47 ytl, **A9:** 20.4 ytl

- Office Requisites and Miscellaneous Costs

2400 ytl per year for overall hospital= 2400/12= 200 ytl per month. This amount represents the 960 patients' cost. Moreover, General Surgery Department has only 120 patients so 120/960= 0.125= 200*0.125= 2*5 ytl/month*

25 ytl/734 patients= 0.034*120= 4.08 ytl**: A1**, **A2:** 4.08 ytl, **A3:** 2.4 ytl, **A4:** 1.7 ytl, **A5:** 3.64 ytl, **A6:** 0.51 ytl, **A7:** 1.4 ytl, **A8:** 3.1 ytl, **A9:** 4.08 ytl

- Information System Costs

This expense category covers the salary expenses of 2 secretaries and computers' costs. 2*860/20= 86 ytl per month, and the total amount of maintenance, repairing and depreciation is 6000 ytl per year which is equal to 500 ytl per month. 500 ytl-month /20 department= 25 ytl/month= 25 ytl+86 ytl= *111 ytl/month*

111 ytl-month/8 computer= 13.88 ytl/month

A1: 13.88*3=41.64 ytl, **A2:** 13.88 ytl, **A3:** 13.88 ytl, **A4:** 13.88 ytl, **A6:** 13.88 ytl, **A7:** 13.88 ytl

The total cost of the activities can be reclassified in Table 6.7;

Table 6.7
Total Cost of The Activities

	A1	A2	A3	A4	A5	A6	A7	A8	A9	Total
1.Mangement Costs	344	2400				2100				4844
2. Personnel Costs	172		250	1500	300	150	350	172	100	2994
3.Main. and Repair. Costs of Medical Instruments and Materials	12.5	87.5	60	75		200				435
4.Depreciat. Costs of Med. Instr. and Materials	40	125	120	150		800				1235
5. Insurance Costs of Medical Instruments and Materials	20	100	80	80		350				630
6. Building Insurance Costs	14	44	4	5	10	50	10	3	10	150
7. Building Depreciation	18.68	58.70	5.34	6.67	13.34	66.7	13.34	4	13.34	200.11
8. Building Maintenance	4.68	14.7	1.34	1.67	3.34	16.7	3.34	1	3.34	50.11
9. Electricity	186.8	586.96	53.36	66.7	133.4	667	133.4	40	133.4	2000.9

	A1	A2	A3	A4	A5	A6	A7	A8	A9	Total
10. Communication	18.84	18.84	10.99	7.85	16.79	2.355	6.44	14.29	18.84	115.24
11. Water Consumption	3.24	3.24	1.89	1.35	2.889	0.405	1.107	2.457	3.24	19.82
12. Cleaning Costs	23.24	73.04	6.64	8.3	16.6	83	16.6	4.98	16.6	249
13. General Medical Materials and Fuel-Oil C.		719.28	699.3	199.8	427.57	299.7	163.84		240	2749.5
14. Accounting Department Costs	81.72	81.72	47.67	34.05	72.87	10.215	27.92	61.97	81.72	499.86
15. Meal (Meal) Costs								750		750
16. Laundry Costs	20.4	20.4	11.9	8.5	18.19	2.55	6.97	15.47	20.4	124.8
17. Office Requisites and miscallen. Costs	4.08	4.08	2.4	1.7	3.64	0.51	1.4	3.1	4.08	25
18. Information System Costs	41.64	13.88	13.88	13.88		13.88	13.88			111.04
Total:(ytl)	1005.8	4351.3	1368.7	2160.5	1018.6	4813.02	748.2	1072.3	644.9	17183.3

6.4.5. Determination of Second Stage Cost Drivers

Cost drivers are tools which establish the relationship among costs, activities, and products or services. First stage cost drivers show the relation between costs and activities. Second stage cost drivers disclose the relation between activities and products or services. Also costs of activities are traced to the open and laparoscopic operation by using second stage cost drivers. Table 6.8 shows the second stage cost drivers of General Surgery Department:

Table 6.8
Second Stage Cost Drivers

A1: Patient Acceptance and Discharging	Number of Patient
A2: Medical Examination	Number of Patient
A3: Lab test.	Number of Test
A4: Ultrasound	Time
A5: Nurse Services before Hospitalization	Number of Utilities
A6: Surgical Operation	Time
A7: Nurse Services after Hospitalization	Number of Utilities
A8: Meal Services	Number of Meal
A 9: Giving Morale and Patient Discharging	Number of Utilities

A1: Patient Acceptance and Discharging:

There are 120 patients per month for General Surgery Department: 1005.8/120= 8.381 ytl/patient

A2: Medical Examination of Patient:

In General Surgery Department, 120 patients require medical examination per month: 4351.3/120= 36.26 ytl/patient

A3: Laboratory tests:

6 tests are necessary for each patients who had open and laparoscopic operations (3 open and 10 close gallbladder operations *6 tests=78 tests). At the same time, each of two other surgical operations requires 5 tests and 105 patients without surgical operations need 140 tests in average (There is an average of 70 patients at risk and doctor needs laboratory results to recognize their real situation: 70*2tests=140 tests). Thus, 228 tests are totally found per month in the General Surgery Department. It can be mathematically represented as follows:

Open Gallbladder Operations: 3 patients*6 tests per patient=	18 tests
Laparoscopic Operations: 10 patients*6 tests per patient =	60 tests
Other Surgical Operations: 2 patients*5 tests per patient=	10 tests
Patients without Surgical Operations: 70 patients (out of 105)*2 tests=	140 tests
1368.7/228= 6 ytl-test Total:	228 tests

A4: Ultrasound Control:

Open and laparoscopic surgery patients require 35 and 30 minutes respectively for ultrasound control. In addition, other surgical patients require 30 minutes. Moreover, out of

70 patients who need laboratory tests, ultrasound control becomes compulsory for 50 high-risk patients after the doctor examines their laboratory results.

Open Operations: 3 patients*35 minutes (open gallbladder operation requires 35 minutes for ultrasound control) = 105 minutes

Laparoscopic Operations: 10 patients*30 minutes = 300 minutes

Patients without Surgical Operations: 50 patients *25 minutes= 1250 min. (Ultrasound control becomes compulsory for 50 high-risk patients after the doctor examines their laboratory results)

Other Surgical Operations: 2 patients*30 minutes = 60 minutes

2160.5ytl/1715min.=1.26 ytl/min Total: 1715 minutes

A5: Nurse Services before Hospitalization:

In general surgery, there are 4, 5 and 4 treatment interferences for each laparoscopic, open and other surgical operation respectively. Additionally, totally 184 treatment interferences are required for the remaining 105 patients.

Open Gallbladder Operations: 3 patients*5 interferences (In this operation, patients require 5 interferences from nurses) = 15 interferences

Patients without Surgical Operations: (105 patients) = 184 interferences

Laparoscopic Operations: 10 patients*4 interferences = 40 interferences

Other Surgical Operations: 2 patients*4 interferences = 8 interferences

1018.6/247= 4.12 ytl/interference Total: 247 interferences

A6: Surgical Operation:

Both laparoscopic and other surgical operations require 90 minutes, whereas open surgical operation needs 120 minutes for each patient.

10 Open Gallbladder Operations *90 minutes= 900 min

+3 Close Gallbladder Operations *120 min= 360 min

+2 Other Surgical Operations *90 min= 180 min

Total= 1440 min= 4813.02/1440=3.34 ytl/min

A7: Nurse Services after Hospitalization:

Each operation patients require 24 treatment interferences for each patient day. At the same time, 105 patients without surgical operations require 52 interferences in average. 26 patients who are at risk stay in hospital and they require nurse services twice a day. As a result, 748 treatment interferences are totally found per month in the general surgery department. The calculation can be given as below:

Open Gallbladder Operations: 3 patients*24 interferences*5 patient days = 360 interferences

Patients without Surgical Operations: (105 patients) = 52 interferences

Laparoscopic Operations: 10 patients*24 interferences*1 patient days = 240 interferences

Other Surgical Operations: 2 patients*24 interferences*2 patient days = 96 interferences Total: 748 interferences

= 748.2/748=1 ytl/interference

A8: Meal Services: 1072.3/315= 3.4 ytl/meal

In general surgery department, operational patients have 29 patient-day and meals are distributed to patients by 3 times for each day. 26 patients out of 105 patients without surgical operations need to stay in hospital for one day and meals are distributed to them by 3 times for each day. Moreover, the remaining 50 patients out of 79 patients (105-26) are utilized from meals (29 patient-day*3 times a day +26 patient days*3+ 50 patients*3). Therefore, 315 meals are totally found per month in the general surgery department.

A9: Giving Morale, Completion of Treatment and Patient Discharging:

Nurses give services 3 times to open surgery patients and twice to laparoscopic surgery patients in a day. Simultaneously, each of two other surgical operations requires services twice a day. Moreover, 105 services are presented to 105 patients (each patient requires service only once a day) by nurses. Hence 135 services are totally found per month; 644.9/135= 4.78 ytl/service.

6.4.6. Allocation of Costs from the Activity Pools to the Products

Open and close gallbladder operations are the main products of general surgery and their costs are shown in Table 6.9.

Table 6.9
Costs of Open and Close Gallbladder Operations in ABC System

Activities	Assigning Ratio	Open Gall Op. Factor	Close Gall Op. Factor	Cost of Open Gall Operation	Cost of Close Gall Operation
A1	8.381 ytl/patient	1 patient	1 patient	8.381	8.381
A2	36.26 ytl/patient	1 patient	1 patient	36.26	36.26
A3	6 ytl/test	6 tests	6 tests	36	36
A4	1.26 ytl/min	35 minutes	30 min	44.1	37.8
A5	4.12ytl/interference	5 inter.	4 inter.	20.06	16.48
A6	3.34 ytl/min.	120 min.	90 min.	400.8	300.6
A7	1 ytl/interference	120 inter.	24 inter.	120	24
A8	3.4 ytl/meal	15 meals	3 meals	51	10.2
A9	4.78 ytl/service	2 services	2 services	9.56	9.56
			Total(ytl):	726.161	479.281

Table 6.10
Traditional Cost System versus Conventional ABC

Traditional Cost System	**Open Gall Operation**	**Close Gall Operation**
Direct	2100	1420
Indirect	1562.2	312.44
Total(ytl)	**3662.2**	**1732.44**
Conventional ABC		
Direct	2100	1420
Indirect	726.161	479.281
Total(ytl)	**2826.161**	**1899.281**

The table above presents the differences between Traditional Cost System and Conventional ABC. According to that, in conventional ABC system, open gallbladder operations should be decreased from 3662.2 ytl to 2826.161 ytl. In contrast, cost of close gallbladder operations should be increased from 1732.44 ytl to 1899.281 ytl.

6.5. IMPLEMENTING TIME DRIVEN ACTIVITY BASED COSTING TO THE MAĞUSA YAŞAM HOSPITAL

Activities and their costs are determined in TDABC as well as Conventional ABC system. Afterwards, the cost of these activities are assigned to products by using a cost driver. In contrary to conventional ABC, TDABC system requires only time as a cost driver. For this reason, to allocate activities costs to the services, the required time for these services should be known.

Since the determination of costs is the first stage of conventional ABC, the first phase of this system will be used in this study. In the second stage, time is only considered as a cost driver instead of determining many cost drivers like in conventional ABC system. Therefore, activities and their costs are presented in Table 6.11 and then the calculations of cost of the open and laparoscopic operations will be given:

Table 6.11
Cost of The Activities

Activities	Costs(ytl)
A1: Patient Acceptance and Discharging	1005.8
A2: Medical Examination of Patient	4351.3
A3: Lab test.	1368.7
A4: Ultrasound	2160.5
A5: Nurse Services before Hospitalization	1018.6
A6: Surgical Operation	4813.02
A7: Nurse Services after Hospitalization	748.2
A8: Meal Services	1072.3
A 9: Giving Morale and Patient Discharging	644.9
Total:	17183.3 ytl

6.5.1. Patient Acceptance and Discharging

According to the observations and interviews, the costs of this activity are formed by services of secretaries and ambulance drivers. Related costs with secretaries and ambulance drivers are directly allocated to them and costs which are not directly related are allocated to secretaries and ambulance drivers at a deserved rate.

Cost of Ambulance and Ambulance Drivers: 172 ytl (Management Cost) + 72.5 ytl (Maintenance & Repairing, Insurance and Depreciation Costs of Medical Instruments and Materials)

Costs related with Area (m2), Number of Computer and Number of Patient: Total 417.28 ytl (Building Insurance 14 ytl, Building Depreciation 18.68 ytl, Building Maintenance & Repairing 4.68 ytl, Electricity 186.76 ytl, Communication 18.84 ytl, Water 3.24 ytl, Cleaning 23.24 ytl, Accounting 81.72 ytl, Laundry 20.4 ytl, Office Requisites 4.08 ytl, Information System 41.64 ytl)

The cost of 120 patients is 417.28 ytl. Thus, 149.53 ytl is valid for 43 patients (516 general surgery patient per year= 43 patient per month are carried by ambulance). Thus, the total cost of ambulance and ambulance drivers is=149.53+172+72.5= 394.03 ytl

417.28-149.53= 267.75 ytl+ 344 ytl (Management cost for secretaries). 344+267.75= The total secretary cost is 611.75 ytl.

Cost of ambulance and ambulance drivers: 394.03 ytl

Cost of secretaries: 611.75 ytl

- Subactivity 1: Cost of Secretaries (611.75 ytl)

	Reservation	Information	Exit	Total * times = Total	
Open Gallbladder Operation (3)	5min	5	4	=14min*3	42
Close Gallbladder Operation (10)	5min	5	4	=14min*10	140
Other Surgical Operation (2)	5min	5	4	=14*2	28
Patient without Operation (105)	5min	3	4	=12min*105	1260
					1470 min

A secretary in the hospital works 312 days or 2496 hours or 149760 minutes per year. Secretary spends about 37440 minutes (%25 of her time) for breaks, training and education. The remaining 112320 minutes per year is equal to 9360 minutes per month (According to these information each secretary works 8 hours per day and 26 days per month).

Practical Capacity of Secretaries: 0.40 secretary (8/20 secretary)*9360 minutes = 3744 minutes (8/20 secretary has 3744 minutes as a practical capacity for the activity of Patient Acceptance and Discharging.)

Capacity Cost Rate= 611.75 ytl /3744 min= 0.163 ytl/minute (The cost of one minute is 0.163 ytl)

The calculations display that only about %39.2(1470/3744 = 0.392) of the practical capacity was used by secretaries for productive and useful work. 2274 minutes (3744-1470) are found as an unused capacity in the hospital. However, it should be taken into account that secretaries must be ready to perform their activities. This situation must be considered by managers.

	Total Minutes* Cost of Minute
Open Gallbladder Operation	42min*0.163ytl/min= 6.846 ytl
Laparoscopic Gallbladder Operation	140min*0.163ytl/min= 22.82 ytl
Other Surgical Operation	28min*0.163ytl/min= 4.56 ytl
Patient without Operation	1260min*0.163 ytl/min= 205.38 ytl
	Total= 239.606 ytl

The allocated amount is 239.606 ytl. 372.144 ytl (611.75-239.606) is the cost of unused capacity.

Secretary Cost for Open Gallbladder Operation: 14.163= 2.28 ytl*

Secretary Cost for Close Gallbladder Operation: 14.163= 2.28 ytl*

Secretary Cost for Other Surgical Operation: 14.163= 2.28 ytl*

Secretary Cost for Patient without Operation: 12.163= 1.96 ytl*

- Subactivity 2: Cost of Ambulance and Ambulance Drivers (394.03 ytl)

	Ambulance Services	Minutes	Total.
Open Operation	1	50 min	50
Laparoscopic Operation	1	50	50
Other Surgical Operation	1	50	50
Patient without Operation	40	40	1600
	43		1750 min.

An ambulance driver in the hospital works 312 days or 2496 hours or 149760 minutes per year. Drivers spend about 28080 minutes (%18.15 of their time) for breaks, training and education. The remaining 121680 minutes per year is equal to 10140 minutes per month (According to these information each driver works 8 hours per day and 26 days per month. At the same time, the net working time is 6.5 hours for drivers: 10140min/60min-hour=169 hour-month/ 26days-month= 6.5 hours per day).

Practical Capacity of Ambulance Drivers: 4/20 driver*10140 minutes= 2028 minutes (4/20 ambulance driver has 2028 minutes as a practical capacity for the activity of Patient Acceptance and Discharging)

Capacity Cost Rate= 394.03 ytl /2028 min= 0.194 ytl/minute (The cost of one minute is 0.194 ytl)

The calculations demonstrate that only about %86.3 (1750/2028 = 0.863) of the practical capacity was used by drivers for productive and useful work. 278 minutes (2028-1750= 278 min= unused capacity and 0.194*278= 53.93 ytl cost of idle capacity) are found as an unused capacity in the hospital.

Total Minutes * Unit Cost

Open Operation	50* 0.194= 9.7
Laparoscopic Operation	50* 0.194= 9.7
Other Surgical Operation	50* 0.194= 9.7
Patient without Operation	1600* 0.194= 310.4

339.5 ytl (allocated cost)

Cost of Open Gallbladder Operation= 9.7+2.28= 11.98 ytl

Cost of Laparoscopic (Close) Gallbladder Operation= 9.7+2.28= 11.98 ytl

Cost of Other Surgical Operation= 9.7+2.28= 11.98 ytl

Cost of Patient without Operation= (1600/105)*.194=2.96+2= 4.96 ytl

As mentioned before, activities are separated into many subactivities and this situation increases the complexity for managers. In this condition, time equations can be created for each main activity to decrease complexity. "Patient Acceptance and Discharging" is the first activity of this study and it has two subactivities which cause difficulties and complications in cost calculation. Consequently, time equations are needed to simplify cost calculation and cost updating process. According to that, the time equation of first activity can be presented as below:

Time Equation for both Open and Close Gallbladder Operation:

$$\mathbf{14*X_1+50*X_2}$$

14 min*0.163 ytl/min+ 50 min*0.194 ytl/min= 11.98 ytl

X_1 = Secretary Cost= 0.163

X_2 = Ambulance Driver Cost= 0.194

To illustrate its simplicity, when the required time for secretaries to perform works has changed from 14 minutes to 20 minutes, managers can easily reach new result by using time equation as follows: 20 min*0.163 ytl/min+ 50 min*0.194 ytl/min= 12.96 ytl

6.5.2. Medical Examination of Patient

Doctor and Assistant Doctor spend 60 percent of their time for this activity. Doctors work 312 days or 149760 minutes per year. They spend about 37440 minutes (%25 of their time) for breaks, training and education. The remaining 112320 minutes per year is equal to 9360 minutes per month (According to these data, each doctor works theoretically 8 hours per day and 26 days per month. In practical; 9360 min/60 min-hour=156 hour-month/ 26 day-month= it translates into an average of approximately 6 hours per day).

Practical Capacity of Doctors: 9360 min.*%60= 5616 minutes

Doctor and Assistant Doctor have 1500 ytl and 900 ytl management costs respectively. These costs are directly allocated them and remaining costs (4351.3-1500-900= 1951.3 ytl) are equally divided between them.

- Subactivity 1: Assistant Doctor (900+975.65=1875.65 ytl): 1875.65/5616= 0.334 ytl/min=Capacity Cost Rate

	Number of Patient	Min.	Total Min	*	Unit Cost	= Total
Open Operation	3*	30min=	90	*	0.334	= 30.06
Laparoscopic Operation	10*	25min=	250		0.334	= 83.5
Other Surgical Operation	2*	25min=	50		0.334	= 16.7
Patient without Operation	105*	20min=	2100		0.334	= 701.4
			2490 min			831.66 ytl

(5616 min -2490= 3126 min unused capacity*0.334= 1044 ytl cost of idle capacity or 1875.65-831.66= 1044 ytl cost of idle capacity)

1 Open Operation: 0.334*30= 10.02 ytl

1 Laparoscopic Operation: 0.334*25= 8.35 ytl

1 Other Surgical Operation: 0.334*25= 8.35 ytl

1 Patient without Operation: 0.334*20= 6.68 ytl

- Subactivity 2: Doctor (1500+975.65=2475.65 ytl)

	Number of Patient	Min.	Total Min	* Unit Cost	= Total
Open Operation	3*	25 min=	75	* 0.441	= 33.075
Close Operation	10*	20 min=	200	0.441	= 88.2
Other Surgical Operation	2*	20 min=	40	0.441	= 17.64
Patient without Operation	105*	15 min=	1575	0.441	= 694.575
			1890 min		833.49 ytl

(2475.65 min -833.49 = 3726 min. unused capacity*0.441= 1639.44 ytl= cost of idle capacity)

Capacity Cost Rate: 2475.65/5616= 0.441 ytl/min

1 Open Operation	0.441*25=	11.025 ytl
1 Laparoscopic Operation	0.441*20=	8.82 ytl
1 Other Surgical Operation	0.441*20=	8.82 ytl
1 Patient without Operation	0.441*15=	6.615 ytl

Total Values:

1 Open Gallbladder Operation: 10.02+ 11.025= 21.045 ytl

1 Close Gallbladder Operation: 8.35+ 8.82= 17.17 ytl

1 Other Surgical Operation: 8.35+ 8.82= 17.17 ytl

1 Patient without Operation: 6.68+ 6.615= 13.295 ytl

Time Equation for Open Gallbladder Operation: $30*X_1+25*X_2$

30 min*0.334 ytl/min+ 25 min*0.441 ytl/min= 21.045 ytl

X_1 = Assistant Cost=0.334 ytl/min X_2 = Doctor (Surgeon) Cost= 0.441 ytl/min

Time Equation for Close Gallbladder Operation: $25*X_1+20*X_2$

25 min*0.334 ytl/min+ 20 min*0.441 ytl/min= 17.17 ytl

X_1 = Assistant Cost=0.334 ytl/min X_2 = Doctor (Surgeon) Cost= 0.441 ytl/min

6.5.3. Laboratory test

In the Mağusa Yaşam Hospital, 6 tests are necessary for each patient who had open and close gallbladder operations. At the same time, each of two other surgical operations requires 5 tests. Moreover, 105 patients without surgical operations need 140 unit tests in average (About 70 patients become critical and doctor needs laboratory results to recognize their real situation: 70*2 tests=140 tests). Thus, four patient groups in general surgery department require 228 tests totally per month. The amount of required tests for each group can be presented as follows:

Open Operations: 3 patients*6 tests per patient=	18 tests
Laparoscopic Operations: 10 patients*6 tests per patient =	60 tests
Other Surgical Operations: 2 patients*5 tests per patient=	10 tests
Patients without Surgical Operation: 70 patients*2 tests=	140 tests
	Total: 228 tests

In the hospital, each laboratory employee works 312 days or 2496 hours or 149760 minutes per year. Lab. personnel spend about 22464 minutes (%15 of their time) for breaks,

training and education. The remaining 127296 minutes per year is equal to 10608 minutes per month (According to these information each lab. personnel works 8 hours per day and 26 days per month. At the same time, the net working time is 6.8 hours for lab. personnel: 10608min/60min-hour=176.8 hour-month/ 26days-month= 6.8 hours per day).

Practical Capacity of Laboratory Personnel: 5/20 Lab. personnel *10608 minutes= 2652 minutes

Capacity Cost Rate= 1368.7 ytl /2652 min= 0.516 ytl/minute

The calculations demonstrate that only about % 94.19 (Laboratory personnel spend about 2498 minutes for the patients of the general surgery department: 2498/2652 = 0.9419) of the practical capacity was used by laboratory personnel for productive and useful work. 154 minutes (2652-2498 =154 min unused capacity *0.516=79.5 ytl cost of unused capacity) are found as an unused capacity in the hospital.

	Patient/month * Number of Tests	
Open Operations	3*6tests*16min/test=288 min*0.516 =	148.61
Laparoscopic Operations	10*6tests*16min/test=960min*0.516 =	495.36
Other surgical Operations	2*5test*13min/test= 130min*0.516 =	67.08
Patients without Surgical Op.	140 test *8min/test=1120min*0.516 =	577.92
	2498 min	1288.97 ytl

1 Open Gallbladder Operation: 1*6 tests*16 min/test*0.516 ytl/min= 49.54 ytl

1 Laparoscopic Operation: 1*6 tests*16 min/test*0.516 ytl/min= 49.54 ytl

1 Other Surgical Operation: 1*5 tests*13 min/test*0.516 ytl/min= 33.54 ytl

1 Patient without Surgical Operation: 1*1.33 tests (140tests/105patient)* 8 min/test*0.516 ytl/min= 5.504 ytl

6.5.4. Ultrasound Control:

Open and close gallbladder operation patients require 35 and 30 minutes, respectively, for ultrasound control. In addition, other surgical operation patients require 30 minutes. Furthermore, ultrasound control becomes compulsory for 50 high-risk patients out of 70 patients who are required to do laboratory tests.

Open Operations:	3 patients*35 minutes =	105 minutes
Laparoscopic Operations:	10 patients*30 required minutes =	300 minutes
Patients without Surgical Operations:	50 patients *25 minutes =	1250 minutes
Other Surgical Operations:	2 patients*30 required minutes =	60 minutes
	Total:	1715 minutes

Radiologists work 312 days and 149760 minutes per year. Each radiologist spends about 29952 minutes (%20 of their time) for breaks, training and education. The remaining 119808 minutes per year is equal to 9984 minutes per month (According to these information each radiologist works 8 hours per day and 26 days per month. At the same time, the net working time is 6.5 hours for them: 9984min/60min-hour=166.4 hour-month/ 26days-month= 6.4 hours per day).

Practical Capacity of Radiologists: 3/4 radiologist *9984 minutes= 7488 minutes per month

Capacity Cost Rate= 2160.5 ytl /7488 min= 0.289 ytl/minute (7488-1715= 5773 minutes idle capacity*0.289= 1668.397 ytl cost of idle capacity)

Open Operations: 3 patients*35 min. = 105 minutes*0.289= 30.35 ytl

Laparoscopic Operations: 10 patients*30 min. = 300 minutes*0.289= 86.7 ytl

Patients without Surgical Op.: 50 patients *25 min. = 1250*0.289= 361.25 ytl

Other Surgical Op.: 2 patients*30 min. = 60 minutes*0.289= 17.34

1 Open Gallbladder Operation: 35 minutes*0.289 ytl/min= 10.115 ytl

1 Laparoscopic Operation: 30 minutes*0.289 ytl/min= 8.67 ytl

1 Patient without Surgical Operation: (1250/105)=14.28min*0.289ytl/min= 4.13ytl

1 Other Surgical Operation: 30 minutes*0.289= 8.67 ytl

6.5.5. Nurse Services before Hospitalization

In general surgery, there are 4, 5 and 4 treatment interferences for each laparoscopic, open and other surgical operation respectively. Moreover, totally 184 interferences are required for the remaining 105 patients.

Open Operations: 3 patients*5 interferences (In this operation, patients require 5 interferences from nurses) = 15 interferences

Patients without Surgical Operations: (105 patients) = 184 interferences

Laparoscopic Operations: 10 patients*4 interferences = 40 interferences

Other Surgical Operations: 2 patients*4 interferences = 8 interferences

Total: 247 interferences

Each nurse in the hospital works 312 days or 149760 minutes per year. A nurse spends about 22464 minutes (%15 of their time) for breaks, training and education. The remaining 127296 minutes per year is equal to 10608 minutes per month (According to these data, each nurse works 8 hours per day and 26 days per month. Thus, the net working time is 6.5 hours for nurses: 10608 min/60 min-hour=176.8 hour-month/ 26 days-month= 6.8 hours per day).

Practical Capacity of Nurses: 6/20 nurses *10608 minutes= 3182.4 minutes per month

Capacity Cost Rate= 1018.6ytl /3182.4 min= 0.32ytl/minute

Open Gallbladder Operations: 15 interferences*15 min = 225*0.32=72ytl

Patients without Surgical Op.: 184 interferences*12 min = 2208*.32=706.56

Close Gallbladder Operations: 40 interferences*15 min = 600*.32= 192

Other Surgical Operations: 8 interferences*15 min = 120*.32=38.4

Total: 1008.96 ytl

1 Open Gallbladder Operation: 5 interferences*15 min*0.32= 24 ytl

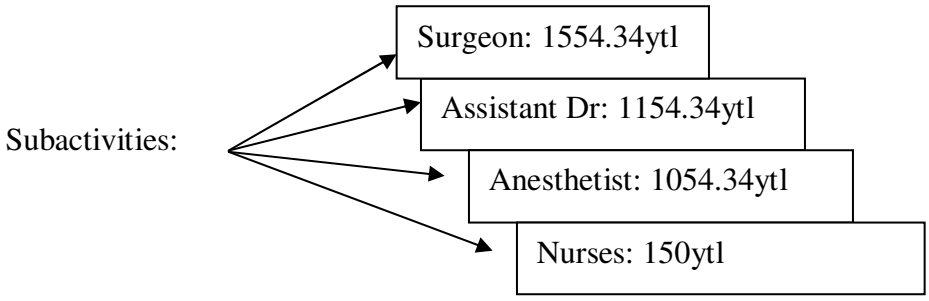
1 Close Gallbladder Operation: 4 interferences*15 min*.32= 19.2 ytl

1 Other Surgical Operation: 4 interferences*15 min*.32=19.2 ytl

1 Patient without Surgical Operation: (2208/105) = 21.03*.32=6.73 ytl

6.5.6. Surgical Operation

Both laparoscopic and other surgical operations require 90 minutes, whereas open surgical operation needs 120 minutes. There are four subactivities in this main activity:



-Subactivity 1: Surgeon (Doctor) (1554.34 ytl)

[The cost of subactivities: Doctor 2500*%40=1000, Assistant Doctor %40*1500= 600, Anesthetist 500, 3 Nurses 3/20*1000= 150 ytl. Totally it equals to 3150 ytl. 4813.02-3150=1663.02 remaining cost is equally divided between doctors (1663.02 / 3= 554.34 ytl) and added to their costs.]

Doctor and assistant doctor spend 40 percent of their time for this activity. They work 149760 minutes per year. They spend about 37440 minutes (%25 of their time) for breaks, training and education. The remaining 112320 minutes per year is equal to 9360 minutes per month.

Practical Capacity of Doctors (Doctor and Assistant Doctor): 9360 min.*%40 = 3744 minutes

Capacity Cost Rate= 1554.34ytl /3744min= 0.415 ytl/min

Open Operations	3*120min=	360 min*0.415	=	149.4 ytl
Laparoscopic Operations	10*90=	900 min*0.415	=	373.5
Other Surgical Operation	2*90=	180 min*0.415	=	74.7
		1440 min		Total: 597.6 ytl

1 Open Operation: 120*0.415= 49.8 ytl

1 Laparoscopic Operation: 90*0.415= 37.35 ytl

1 Other Surgical Operation: 90*.415=37.35 ytl

-Subactivity 2: Assistant Doctor (1154.34 ytl)

Capacity Cost Rate= 1154.34 ytl /3744 min (practical capacity) =0.308 ytl/min

Open Operations	3*120 min=360 min*0.308 ytl/min =		110.88 ytl
Laparoscopic Operations	10*90=900 min*.308 =		277.2
Other surgical Operations	2*90=180 min* .308 =		55.44
	1440 min		443.52 ytl

1 Open Operation: 120*0.308= 36.96 ytl

1 Laparoscopic Operation: 90*0.308= 27.72 ytl

1 Other Surgical Operation: 90*0.308= 27.72 ytl

-Subactivity 3: Anesthetist (1054.34 ytl)

On average, an anesthetist works 312 days or 149760 minutes per year. Anesthetist spends about 37440 minutes (%25 of her time) for breaks, training and education. The

remaining 112320 minutes per year is equal to 9360 minutes per month. Anesthetist spends only about 25 percent of his time for this activity;

Practical Capacity of An. Doctor: 9360*%25= 2340 min

Capacity Cost Rate = 1054.34 ytl /2340= 0.4506 ytl/min

Open Operations= 3*80 min*0.4506 = 108.144 ytl

Laparoscopic Operations= 10*60*0.4506 = 270.36

Other Surgical Operations= 2*50*0.4506 = 45.06

1 Open Operation=	**80 min*0.4506=**	**36.05 ytl**
1 Laparoscopic Operation=	**60*0.4506=**	**27.036 ytl**
1 Other Surgical Operation=	50*0.4506=	27.036 ytl

-Subactivity 4: Nurses (150 ytl)

A nurse works an average of 149760 minutes per year. Nurses spend about 18750 minutes (%12.5 of her time) for breaks, training and education. The remaining 131040 minutes per year is equal to 10920 minutes per month.

Practical Capacity of Nurses: 10920*3/20= 1638 min

Capacity Cost Rate = 150 ytl /1638= 0.0916 ytl/min

Open Operations	3*130 min	*0.0916=	35.72 ytl
Laparoscopic Operations	10*100	*0.0916=	91.6
Other Surgical Operations	2*100	*0.0916=	18.32
	1590 min		145.65 ytl

1 Open Operation= 130*0.0916 = 11.91 ytl

1 Laparoscopic Operation= 100*0.0916 = 9.16 ytl

1 Other Surgical Operation=100*0.0916 = 9.16 ytl

Total: 1 Open Operation: 134.716 ytl

1 Laparoscopic Operation: 101.266 ytl

Time Equation for Open Gallbladder Operation:

$$\mathbf{120*X_1 + 120*X_2 + 80*X_3 + 130*X_4}$$

120 min*0.415 ytl/min+ 120*0.308+ 80*0.4506+ 130*0.0916= 134.716 ytl

X_1 = Doctor (Surgeon) Cost =0.415 ytl/min

X_2 = Assistant Cost = 0.308 ytl/min

X_3 = Anesthetist Cost= 0.4506 ytl/min

X_4 = Cost of Nurse= 0.0916 ytl/min

Time Equation for Laparoscopic Gallbladder Operation:

$$\mathbf{90*X_1 + 90*X_2 + 60*X_3 + 100*X_4}$$

90*0.415+ 90*0.308+ 60*0.4506+ 100*0.0916= 101.266 ytl

X_1 = Doctor (Surgeon) Cost =0.415 ytl/min

X_2 = Assistant Cost = 0.308 ytl/min

X_3 = Anesthetist Cost= 0.4506 ytl/min

X_4 = Cost of Nurse= 0.0916 ytl/min

6.5.7. Nurse Services after Hospitalization

Each patient who had operation needs 24 treatment interferences per patient day. At the same time, 105 patients without surgical operations require an average of 148 interferences. Thus, 748 treatment interferences are totally found per month in the general surgery department. The calculation can be given as below:

Open Operations: 3 patients*24 interferences*5 patient days = 360 interferences

Patients without Surgical Operations: (26 patients are hospitalized and they require nurse services twice a day) = 52 interferences

Laparoscopic Operations: 10 patients*24 inter.*1 patient days = 240 interferences

Other Surgical Operations: 2 patients*24 inter.*2 patient days = 96 interferences

Total: 748 interferences

A nurse works an average of approximately 149760 minutes per year. Nurses spend about 18750 minutes (%12.5 of her time) for breaks, training and education. The remaining 131040 minutes per year is equal to 10920 minutes per month.

Practical Capacity of Nurses: 10920*7/20= 3822 min

Capacity Cost Rate = 748.2 ytl/3822min= 0.196 ytl/min

Open Operations: 360 interferences*5 min= 1800*0.196 = 352.8 ytl

Close Operations: 240 interferences*5 min= 1200*0.196 = 235.2

Other Surgical Operations: 96 interferences*5 min= 480*0.196 = 94.08

Patients without Surgical Operations: 52 interferences*4 min=208*0.196 = 40.77

Total: 748 interferences 3688min

1 Open Operation=	**0.196*120*5=**	**117.6 ytl**
1 Laparoscopic Operation=	**0.196*24*5=**	**23.52 ytl**
1 Other Surgical Operation=	0.196*24*5=	23.52 ytl
1 Patient without Surgical Operation=	52/105=0.5*0.196*4=	0.39 ytl

6.5.8. Meal Services

In general surgery department, operational patients have 29 patient-day and meals are distributed to the patients by 3 times for each day. 26 patients, out of 105 patients without surgical operations, need to stay in hospital for one day and meals are distributed to them by 3 times for each day. Moreover, 50 patients out of the remaining patients (105-26=79 patients) are utilized from meals (29 patient-day*3 times a day +26 patient days*3+ 50 patients*3). Therefore 315 meals are totally found per month in the general surgery department and the required times for distributing and collecting them to patients are given as below:

		To get ready	distribute	collect	total min.	total
Open Operations	3*5*3=45	4min	1min	3min	8min	(45*8)*0.505=181.8
Laparoscopic Operations	10*1*3=30	4min	1min	2min	7min	210* .505 =106.05
Other Operations	2*2*3=12	4min	1min	2min	7min	84* .505 =42.42
105 Patients without Op.	76*3=228	4min	1min	1min	6min	1368* .505 =691
						2022 min

Kitchen personnel work 312 days or 149760 minutes per year. They spend about 22464 minutes (%15 of their time) for breaks, training and education. The remaining 127296 minutes per year is equal to 10608 minutes per month (According to these data each personnel works 8 hours per day and 26 days per month. At the same time, the net working time is 6.8 hours for them: 10608min/60min-hour=176.8 hour-month/ 26days-month= 6.8 hours per day).

Practical Capacity of Kitchen Personnel: 4/20 personnel *10608 minutes= 2121.6 minutes per month

Capacity Cost Rate= 1072.3/2121.6 min =0.505 ytl/min (2121.6-2022 min=99.6 min*0.505 ytl/min=50.3 ytl cost of idle capacity)

1 Open Operation 0.505*3*5day*8min	**= 60.6 ytl**
1 Close Operation 0.505*3*1day*7min	**= 10.605 ytl**
1 Other Operation 0.505*3*2days*7min	= 21.21ytl
105 Patient without Operation 0.505*6min*2.17	= 6.58 ytl

6.5.9. Giving Morale, Completion of Treatment and Discharging

Nurses give services 3 times to open surgery patients and twice to laparoscopic surgery patients in a day. Simultaneously, each of two other surgical operations requires services twice a day. Moreover, 105 services are presented to 105 patients (each patient needs service only once a day) by nurses. Hence, 135 services are totally found per month.

Each nurse in the hospital works 312 days or 149760 minutes per year. Nurses spend about 18720 minutes (%12.5 of their time) for breaks, training and education. The remaining 131040 minutes per year is equal to 10920 minutes per month (According to these data, each nurse works 8 hours per day and 26 days per month. Thus, the net working time is 7 hours for them: 10920min/60min-hour=182 hour-month/ 26days-month= 7 hours per day).

Practical capacity of nurses for general surgery department is 10920 min*2/20 nurses= 1092 min

Capacity Cost Rate= 644.9 ytl /1092 min=0.591 ytl/min

Open Operations:	3 patients*2 services*14 min/servcice	*0.591 ytl/min = 49.644ytl
Laparoscopic Operations:	10*2=20*12 min	*0.591 ytl/min = 141.84
Other Surgical Operations:	2*2=4*10 min	*0.591 ytl/min = 23.64
105 Patient without Surgical Operations*6min:	630 min	*0.591 ytl/min = 372.3
	994 min	

1 Open Operation: 2 services*14 min/service*0.591 ytl/min = 16.55 ytl

1 Laparoscopic Operation: 2 services*12 min/service*0.591 ytl/min = 14.18 ytl

1 Other Surgical Operation: 2 services*10 min*0.591 ytl/min = 11.82 ytl

1 Patient without Surgical Operation: 6 min *0.591 ytl/min = 3.546 ytl

Table 6.12
Calculation of The Results of TDABC System

Activities	Assigning Ratio	Open Gallbladder Operation Factor	Laparoscopic or Close Gallbladder Operation Factor	Cost of Open Operation	Cost of Close Operation
A1	Secretary: 0.163ytl/min Amb.driver:0.194ytl/min	=14min =50min	=14min =50min	**11.98ytl** (.163*14 +50*.194)	**11.98ytl**
A2	Ass.Doctor:0.334ytl/min Surgeon : 0.441ytl/min	=30min =25min	=25min =20min	**21.045**	**17.17**
A3	0.516ytl/min	96min	96min	**49.54**	**49.54**
A4	0.289ytl/min	35min	30min	**10.115**	**8.67**
A5	0.32ytl/min	5times*15min/time	4times*15min/time	**24**	**19.2**
A6	Surgeon:0.415ytl/min Ass. Dr: 0.308ytl/min Anesthetist:0.4506ytl/min Nurse:0.0916ytl/min	=120min =120min =80min =130min	=90min =90min =60min =100min	**134.716**	**101.266**
A7	0.196ytl/min	120times*5min/time	24times*5min/time	**117.6**	**23.52**
A8	0.505ytl/min	3times/day* 5day*8min/time	3times/day*1day *7min/time	**60.6**	**10.65**
A9	Nurse: 0.591ytl/min	=2times*14min/time	=2times*12min/time	**16.55**	**14.18**
			Total(ytl):	**446.15**	**256.18**

6.6. COMPARISON OF THE RESULTS OBTAINED BY CONVENTIONAL COST SYSTEMS AND TDABC

Table 6.13
The Results of Traditional Cost System

	Open Gallbladder Operation	Laparoscopic Operation
Direct	2170 ytl	1490 ytl
Indirect	1562.2 ytl	312.44 ytl
Total:	**3662.2 ytl**	**1732.44 ytl**

Table 6.14
The Results of Conventional ABC System

	Open Gallbladder Operation	Laparoscopic Operation
Direct	2170 ytl	1490 ytl
Indirect	726.161 ytl	479.281 ytl
Total:	**2826.161 ytl**	**1899.281 ytl**

Table 6.15
The Results of TDABC System

	Open Gallbladder Operation	Laparoscopic Operation
Direct	2170 ytl	1490 ytl
Indirect	**446.15 ytl**	**256.18 ytl**
Total:	**2616.15 ytl**	**1746.18 ytl**

The above tables present the ultimate results. These results clearly show significant differences between TDABC and conventional systems. Therefore, the following paragraphs include the analysis of results obtained by these systems.

While traditional systems do not consider the criterions such as realized process or the required time for each process, they consider only patient-day in the allocation of costs to the services (open and close gallbladder operation). For example, whereas the time should be consider at ultrasound control, the cost distributions are done according to the patient-day. Consequently, costs are added more and more to the services. The open and close gallbladder operations are main cost objects in this application.

In ABC system, cost allocations are done to open and close gallbladder operations on the basis of their demand for each activity. According to this, one can be deduced that cost of open gallbladder operations should be less than traditional cost systems. On the other hand, cost of close gallbladder operations should be more than traditional cost systems.

According to the TDABC system, just like ABC system, more costs are traced for open gallbladder operation and fewer costs are traced for close gallbladder operation. Thus, it states that open gallbladder operation needs more cost than close gallbladder operation. When the results of TDABC and traditional cost system are criticized with each other, it reveals that more cost should be allocated for close gallbladder operation, whereas less cost should be allocated for open gallbladder operation.

When TDABC and Conventional ABC systems are compared with each other, it can be seen that TDABC system assigns lower costs to cost objects than conventional ABC. This situation, which justifies its superior advantage contrary to conventional ABC, is realized since TDABC system recognizes unused capacity by identifying practical capacity for each activity.

PART 7: CONCLUSION

7.1. SUMMARY, CONCLUSION AND RECOMMENDATIONS

High competition, changing conditions and complex structures are the main issues of today's business environment and they force companies to increase their productivity and arrange their product costs in a more accurate way in order to survive.

Cost systems are the basic elements which are used by companies for taking right and accurate decisions in the right time. A good cost system not only increases productivity but also ensures high competitiveness for companies.

Traditional cost systems were constructed in the past decades. Inadequate technological developments, narrow range of products and low overhead costs are the main characteristics of this era. Thus, traditional cost systems do not meet today's changing business requirements so they cause cost distortions.

Activity Based Costing System has risen as an alternative model for Traditional Cost Systems. ABC system is a more efficient cost system than TCS and it offers new and correct outcomes for managers. On the other hand, these outcomes are not sufficient since they ignore practical and unused capacities. In addition to this, high implementation and maintaining costs and time-consuming properties of the ABC has increased the necessity of a new system whose superiority is confirmed by the practice for business success. Accordingly, Time Driven Activity Based Costing System has emerged to overcome these problems and to form more convenient cost system for businesses

As mentioned before, the aim of this thesis is to underline the importance and productivity of TDABC system and to exhibit how it can be applied. Accordingly, its efficiency and reliability can be emphasized by the view of following questions:

- What is TDABC system and what are the advantages of this system?
- How can TDABC system be applied in the hospital?
- Does TDABC system produce different and more accurate results than Conventional Cost Systems?

An implementation was realized in General Surgery Department of Mağusa Yaşam Hospital which is located in Cyprus. Open and Laparoscopic(Close) Gallbladder Surgeries are the main cost objects of this department and Mağusa Yaşam Hospital determine their costs by using traditional cost system. In this system, direct costs, such as doctor, room and medicine costs, are allocated directly to open and laparoscopic systems. Moreover, overhead costs are assigned to cost objects based on patient-day. This system is not efficient because the costs which are transferred to open and laparoscopic operations by hospital managers do not reflect real costs.

The arbitrary and incorrect nature of overhead allocations encourages TDABC implementation in this hospital. According to implementation, it can be deduced that TDABC system is easily applicable in Mağusa Yaşam Hospital. In this system, durations needed for each activity and the costs of these durations are determined in a more realistic manner. Consequently, costs are assigned to open and close gallbladder operations at required rate in a more detailed and right way. Additionally, it is a simple, quick, inexpensive and powerful model and it ensures enhances in cost system by producing reliable and accurate results which are given below:

Table 7.1
Differences Among The Results Of Cost Systems

	Open Gallbladder Operation	Laparoscopic Operation
Traditional Cost System	**3662.2 ytl**	**1732.44 ytl**
Conventional ABC System	**2826.161 ytl**	**1899.281 ytl**
Difference	-836.039	166.841
Change (%)	(%22.83)	%9.63
Conventional ABC System	**2826.161 ytl**	**1899.281 ytl**
TDABC System	**2616.15 ytl**	**1746.18 ytl**
Difference	-210.011	-153.101
Change (%)	(%7.43)	(%8.06)
Traditional Cost System	**3662.2 ytl**	**1732.44 ytl**
TDABC System	**2616.15 ytl**	**1746.18 ytl**
Difference	-1046.05	13.741
Change (%)	(%28.56)	%0.79

The table above summarizes the differences among the cost systems. According to the table, one can easily understand that ABC gives better results compared with traditional system. This advantage is that the determination of activities is being done well and it considers the consumption of these activities by cost objects. In ABC system, open gallbladder operations should be 22.83 percent less than traditional cost system. In contrast, cost of close gallbladder operations should be 9.63 percent more than traditional cost system.

TDABC, on the other hand, is a system which provides more accurate results by improving ABC. Thus, TDABC is the most suitable and effective system that can be used nowadays for many applications. The main feature of TDABC system is that the time is considered as a single and exclusive cost driver. Moreover, practical capacity, not theoretical, is determined. For this reason, more reliable and more efficient results are obtained by this system. Furthermore, assigned costs to the cost object always become less than the conventional systems for the reason that practical capacity, in general, is lower than normal capacity due to breaks, training and meetings.

When TDABC and Conventional ABC systems are criticized with each other, it demonstrates that TDABC system assigns lower costs for both open and close gallbladder operations. Open and close gallbladder operations should be less than conventional ABC by 7.43 and 8.06 percent respectively. This situation is realized due to the fact that TDABC system recognizes unused capacity by identifying practical capacity for each activity.

At the same time, when the results of TDABC and TCS are compared with each other, it reveals that close gallbladder operation requires 0.79 percent more cost allocation and open operation requires 28.56 percent less cost allocation in TDABC system. When absolute values are considered, it is concluded that open gallbladder operations should be decreased from 3662.2 ytl to 2616.15 ytl. In contrast, cost of close gallbladder operations should be increased from 1732.44 ytl to 1746.18 ytl.

As a result, TDABC gives a chance to managers about the determination of whether the idle capacities are available or not in the hospital. The idle capacities should carefully be determined in the hospital that the application took place and the hospital managers should make decisions with respect to these idle capacities. Thus, this is one of the superior parts of TDABC system. On the view of TDABC system, the following fundamental recommendations should be considered by Mağusa Yaşam Hospital in order to increase the efficiency of cost system:

- Applying TDABC system can be given as the best recommendation for Mağusa Yaşam Hospital. By using TDABC, Mağusa Yaşam Hospital will have an easy, fast, inexpensive and more accurate system.

- Mağusa Yaşam Hospital should increase the efficiency of data which are used in the preliminary phases of TDABC system. In order to obtain efficient results, all types of data must be reorganized and analyzed by managers.

- Mağusa Yaşam Hospital should create a team to perform TDABC system. Furthermore, the seminars, conferences and orientation programs should be designed to teach managers and employees about the characteristics and fundamentals of TDABC model.

- Data about the costs can be easily analyzed and quickly updated by TDABC system. Time equation can be formed for each main activity and it gives an opportunity to managers to easily direct and manage the costs.

- Current cost system of Mağusa Yaşam Hospital does not provide an accurate cost system since it does not consider the training, breaks and meetings. TDABC system enables managers to determine practical capacity. Thus, it ensures cost control and efficiency for the services of the hospital.

- Not only does TDABC system provide practical capacity, but it also discloses unused capacity. Therefore, it assists managers to identify areas of potential development. Managers should make decisions with respect to practical and unused capacity. Furthermore, they can reorganize the labor force according to the unused capacity to gain more efficiency in the hospital.

- TDABC system enables managers to improve their efficiency by producing more reliable, accurate and valuable results. Thus, pricing decisions must be reconsidered by managers. Moreover, this system should be implemented throughout the hospital as an entire accounting system for the overall success of Mağusa Yaşam Hospital.

7.2. IMPLICATIONS FOR FURTHER RESEARCH

In this study, superiority and applicability of TDABC system is revealed by comparing with traditional system of the hospital. In addition to this, a future study could be realized in manufacturing sector. Furthermore, other areas of service sector such as banking sector, transportation sector could be considered. Finally, many accounting topics such as Balanced Scorecard, Enterprise Resource Planning could also be analyzed as a complementary of TDABC system to form a mechanism which might produce highly valuable and reliable results.

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