REPUBLIC OF TURKEY
ÇUKUROVA UNIVERSITY
INSTITUTE OF SOCIAL SCIENCES
DEPARTMENT OF BUSINESS ADMINISTRATION

RESOURCE CONSUMPTION ACCOUNTING AND ITS APPLICATION IN A HEALTHCARE INSTITUTION

Hasan ÖZYAPICI

PhD THESIS

Adana, 2012

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ABSTRACT

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Hasan ÖZYAPICI

Ph.D. Thesis, Department of Business Administration

Supervisor: Prof. Dr. Veyis Naci TANIŞ

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In the current global environment, businesses must use an efficient cost system in order to develop a competitive advantage. A traditional cost system does not produce accurate information since it considers a volume based allocation procedure. As a result, Activity Based Costing System has been developed. However, this system cannot reveal the unused capacity. In addition, this system cannot be used to make short-run decisions. Thus, a new cost system, Resource Consumption Accounting, has emerged. The Resource Consumption Accounting is a new and detailed system which provides opportunities to managers to make both short- and long-run decisions. This system also shows the unused capacity by using both activity-based and process-based perspectives. Accordingly, this study aimed to reveal the effectiveness of the Resource Consumption Accounting. In this regard, reliable data were obtained to make long-run decisions. The short-run cost data that can be used to improve the competitive advantage were also obtained.

Keywords: Resource Consumption Accounting, Activity Based Costing, Time Driven Activity Based Costing, Unused Capacity

ÖZET

KAYNAK TÜKETİM MUHASEBESİ VE BİR SAĞLIK KURUMUNDA UYGULANMASI

Hasan ÖZYAPICI

Doktora Tezi, İşletme Anabilim Dalı
Danışman: Prof. Dr. Veyis Naci TANIŞ
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İşletmeler günümüz küresel iş dünyasında rekabet avantajı sağlayabilmek için etkili bir maliyet sistemi kullanmalıdırlar. Geleneksel maliyet sistemleri özellikle hacim tabanlı olmalarından dolayı günümüz işletmelerinin ihtiyaçlarını karşılayamamış ve işletmeleri yeni maliyet sistemleri arayışına itmiştir. Buna bağlı olarak Faaliyet Tabanlı Maliyetleme sistemi ortaya çıkmıştır. Bu sistemin atıl kapasiteyi dikkate almaması ve kısa vadeli kararlar için kullanılamaması Kaynak Tüketim Muhasebesi'nin ortaya çıkmasına neden olmuştur. Yeni, detaylı ve geniş kapsamlı bir maliyet sistemi olan Kaynak Tüketim Muhasebesi, yöneticilerin hem kısa hem de uzun vadeli kararlar almasına imkân tanımaktadır. Ayrıca işletmelere hem faaliyetler hem de kaynaklar için bakış açısı kazandırdığından atıl kapasiteyi gözler önüne sermektedir. Bu çalışma ile Kaynak Tüketim Muhasebesi'nin etkinliğinin ortaya çıkarılması amaçlanmıştır. Bu amaçla yapılan çalışmada uzun vadeli kararların alınmasını sağlayacak güvenilir bilgiler elde edilmiştir. Buna ek olarak piyasadaki en düşük fiyatın belirlenmesini sağlayarak rekabet avantajını arttırabilecek kısa vadeli maliyet bilgilerine de ulaşılmıştır.

Anahtar Kelimeler: Kaynak Tüketim Muhasebesi, Faaliyet Tabanlı Maliyetleme, Sürece Dayalı Faaliyet Tabanlı Maliyetleme, Kullanılmayan Kapasite

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LIST OF ABBREVIATIONS

ABC : Activity Based Costing

ABM : Activity Based Management

CAM-I : Consortium for Advanced Manufacturing-International

DABC : Departmental Activity Based Costing

ERP : Enterprise Resource Planning

GPK : Grenzplankostenrechnung (German Costing System)

IMA : Institute of Management Accountants

MRP : Material Requirements Planning

MRPII : Manufacturing Resource Planning

RCA : Resource Consumption Accounting

TCS : Traditional Cost System

TDABC : Time Driven Activity Based Costing

TOC : Theory of Constraints

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CHAPTER I

INTRODUCTION

The success of a company, especially in a highly competitive environment, is closely related to the cost system used in the company. In order to become successful, companies must use efficient and reliable cost systems. This is because a decision making process concerned with a product or service is mainly based on the data obtained by the cost system. Indeed, by using an efficient cost system, the companies can determine costs in an accurate way, which ensures them to make strategic decisions.

Cost systems may be divided into two different categories, namely, Traditional Cost Systems (TCS) and Contemporary Cost Systems. The TCS, such as Job Order Costing, Process Costing, Actual Costing, have been used extensively to compute the cost of products or services. In the past decades, the development of enterprises was generally low and the largest portion of the cost elements of any product or service was based on the direct labour. In this respect, since the TCS use direct labour hour as an overhead cost allocation base in general, they have been used to meet the needs of data about the cost of products or services.

The TCS, which are mainly volume-based, have started to produce inaccurate information for the reason that direct labour costs have declined while the overhead costs have been increasing especially in current advanced business environment (Roztocki, Porter, Thomas, & Needy, 2004, pp. 19-20). Since the inaccurate assignment of costs cause distortions to occur, the Contemporary Cost Systems such as Activity Based Costing System (ABC), Time Driven Activity Based Costing System (TDABC), Theory of Constraints (TOC), have emerged. In spite of their advantages, however, these new systems have some constraints. Indeed, the updating process of the ABC system is difficult. In addition, this system becomes theoretically inadequate since it does not take the possibility of unused capacity into account (Kaplan & Anderson, 2007a, pp. 4-16). On the other hand, companies that have non-homogeneous activities may encounter difficulties to implement

the TDABC system (Barrett, 2005, pp. 35-39). Moreover, this system does not consider the cross allocations of resource costs among resource pools (Tse & Gong, 2009, pp. 41-54). Along with these systems, the usefulness of the TOC is also limited for the reason that it focuses on short-term decisions (MacArthur, 1993, pp. 50-56). In short, although the contemporary cost systems have been developed for providing data that are claimed to be more accurate, they have some peculiar constraints such as time-consuming survey process or difficult updating process.

On the other hand, one of the most important contemporary cost systems minimizing the constraints mentioned above is Resource Consumption Accounting (RCA). This thesis will tend to clarify the RCA, which is claimed as an efficient cost system to be considered by companies, in a detailed way.

1.1. Problem Statement

Companies always exert an effort to operate efficiently by minimizing their limitations. It is important to note that recognizing the limitations may become very difficult for managers since it requires a comprehensive investigation in all aspects, sections or processes of the company.

One of the major limitations of companies is idle capacity. It can be defined as the difference occurred between the resources supplied and the resources used for a variety of reasons such as seasonal or cyclical fluctuations in consumer demands (Polimeni, Fabozzi, & Adelberg, 1991, p. 145).

The TCS, however, has no ability to point out idle capacity because of the predetermined overhead rates used by this system are calculated by dividing estimated or budgeted overhead costs by the estimated total cost driver capacity such as direct labour hours. This practice results in inefficient outcomes since the cost of idle capacity is assigned to products or services. Indeed, the logic of these cost systems, which presumes products consume all resources in proportion to their production volumes, will lead to distorted cost information (Drury, 1992, p. 274). In addition, the ABC system does not

certainly reveal the idle capacity since it assumes employees or any other resources work at full capacity (Kaplan & Anderson, 2007a, pp. 4-7).

Contrary to the TCS or ABC, the RCA system provides valuable information by disclosing the idle capacity, which is the significant issue for companies. Indeed, the determination of idle capacity is very difficult and can only be possible by using an efficient cost system. It is also important to emphasize that the data concerning the idle capacity play a vital role for companies. Hence, when the idle capacities are determined, companies do not spend a lot of time doing unnecessary works. Moreover, they do not allocate the cost of idle capacity to a cost object. It is also important to note that the RCA system overcomes this problem by recognizing the resources used in manufacturing and service processes. In fact, clarifying resources that are used not only makes the idle capacity visible but it also helps managers to find out the right price for the products or services of a company. Accordingly, companies will increase their competitiveness by using the RCA system.

1.2. The Aim of the Study

A cost system is one of the most important issues for a company. Managers cannot make decisions without analyzing the data provided by that cost system. Companies should identify what quantities of resources are used, and what the costs of these resources are. Hence, the idle resources should be revealed. The managers must also understand the results of their activities and processes. The purpose of this study, in this respect, is to implement a cost system, which can respond to these requirements. The service sector will be preferred since it is a dominant sector that can provide help for the improvement of Cyprus. Thus, in order to depict both the importance and applicability of the RCA system, the implementation will be conducted in a healthcare institution that uses traditional cost system. In this regard, this study will analyze key issues given below:

- Whether or not an RCA system can be used in determining the cost of products,
- To identify if there are any significant differences between the results of the RCA and TDABC systems,

- To identify whether or not the RCA system can be applied in a service company.

1.3. The Methodology of the Study

The case study method will be employed in this thesis. The reason of selecting this method is that it provides a wide perspective to researchers on a research topic. Indeed, the case study method presents an explanation to research questions. It may be descriptive by examining the features of current situation of an organization. It may also provide suggestions for the company's problem by pointing out the required research strategies (Baker, 1994, p. 300).

This study will be conducted in a service company. In this regard, a descriptive case study will first be carried out for identifying the current situation of the company. An exploratory case study will then be conducted to reveal the results of the RCA system.

In order to perform this study, books, journals and articles have been analyzed by utilizing both online sources and services of libraries. Furthermore, comprehensive observations and interviews have been performed. In addition, face-to-face interviews have been held with managers and employees to get a detailed perspective related to the company.

1.4. The Plan of the Study

The first chapter includes the research problem, research objective, research methodology, and the plan of the study, respectively. The definitions and structures of the ABC system will be explained in the second chapter. In this chapter, the insufficiencies of the traditional systems will also be discussed. In addition, this chapter will present the detailed information related to the TDABC system. Chapter third will point out a broad perspective on the fundamental characteristics of the RCA system. The data related to the research methodology will be mentioned in the fourth chapter. An implementation of the RCA system in a service company will be given in the fifth chapter. It is important to

emphasize that the TDABC system will first be implemented and then the RCA system will be applied. This chapter will also present the comparison of the results of the RCA system with both the existing cost system and TDABC system, respectively. Finally, the summary remarks, conclusion, limitations of the study and recommendations will be given in the sixth chapter.

CHAPTER II

TIME DRIVEN AND CONVENTIONAL ACTIVITY BASED COSTING SYSTEMS

A rapidly changing business environment forced both service and manufacturing companies to adapt new cost systems. This is due to the fact that the new business environment has changed the structure of cost of a product or service and this is resulted in the inadequacy of the traditional cost systems.

In this part of the study, the limitations of the TCS and the need for new cost system will first be mentioned. Then, the characteristics of the ABC will be analyzed. The benefits of an Activity Based Management (ABM) will also be given. Finally, the structure of the TDABC will be explained.

2.1. Limitations of the TCS and the Need for a New Approach

In the past decades, the importance of overhead costs was low since the organizations, which were producing a narrow range of products, were labour intensive (Williamson, 1996, p. 198). Applying the TCS, seeking answers to the characteristics of the past decades will produce distorted cost data for today's advanced business environment (Gunasekaran & Sarhadi, 1998, pp. 231-242). As a matter of fact, the logic of the TCS, which presumes products consume all resources in proportion to their production volumes, will lead to distorted cost data (Drury, 1992, p. 274).

It can be said that, in fact, the technological changes is the major reason behind the insufficiency of the TCS. Thus, the following section examines the technological changes and its effects on cost in detail.

2.1.1. Technological Changes and Its Effects on Product Cost

Technological changes have led companies to use advanced manufacturing technologies. Advanced manufacturing technologies such as numerical control machines, computer aided design, and computer-aided manufacturing, are considered as a competitive weapon in today's global business world. This is because these technologies decrease throughput time and increase manufacturing flexibility (Tanış, 1996, pp. 4-5).

It is also important to emphasize that the technological changes have resulted in changes in the structure of costs incurred by companies. The effects of technological changes should be taken into account for direct materials, direct labours, and overhead costs, respectively.

As might be expected, new technologies are able to use direct materials efficiently. However, the rate of the direct material in the manufacturing cost of an item did not change. Nevertheless, the cost of inventory, which can be expressed as non-value-added costs, has decreased and the quality of materials has increased (Tanış, 2005, pp. 30-34).

On the other hand, the rate of direct labour has decreased in the proportion of the cost of an item. This is because automatic technologies have been started to use for many activities that were made manually (Chalos & Bader, 1986, pp.106-110). It can also be said that the quality of the labour force, by means of the automation, has increased.

It is important to emphasize that the most effected cost by technological changes is overhead. Technological innovation forced companies to invest in advanced technologies. In this regard, indirect costs such as maintenance and repairing, insurance, and depreciation, have increased. Thus, the rate of overhead cost has risen in the proportion of overall costs (Tanış, 2005, pp. 32-34). Therefore, the TCS can be misleading. In this context, companies need a new cost system using both volume-based and non-volume-based cost drivers.

2.1.2. Shortcomings of the Traditional Cost Systems

In the past decades, organizations were generally labour intensive rather than being capital intensive. Thus, using direct labour as an allocation base did not produce inaccurate results. Indeed, functional-based costing system using plant-wide rates have been used so far. However, since the proportion of indirect costs was relatively low in these decades, the volume-based cost allocation was used without any problems.

As businesses turn out to be increasingly competitive in the age of technology, they are becoming more relevant to find out a new cost system producing an accurate result. This is for the reason that overhead costs have been increasing while the direct labour costs have been decreasing in the proportion of total cost. In this respect, the volume-based cost allocation cannot respond the requirements of companies with respect to the accuracy of costing. Thus, the shortcomings of the TCS, which can be considered as the reasons for adopting new cost systems, can be summarized as follows (Kaplan, 1984, pp. 95-101, Gunasekaran & Singh, 1999, p. 413, Gunasekaran, 1999, p. 120, Van Damme & Van Der Zon, 1999, p. 71, Ismail, 2010, p. 41):

- Traditional costing systems do not provide non-financial information.
- Traditional costing systems are inaccurate product costing system since overhead cost is higher than the labour cost.
- The traditional costing system does not give accurate information about the consumption of different resources and the activities of the organization.
- Accounting methods are based on assumptions of a stable and predictable market, long product life-cycles, large productions runs, and a large portion of direct, variable costs in total product costs. However, markets develop rapidly and are unpredictable. Product life cycles are shortening and there is a decrease in the amount of direct, variable cost. As a result, the information that is acquired with the existing accounting techniques has become less suitable for the support of management decision.
- Traditional cost management system focused on managing cost by means of cost-based budgets, standards and variances, established at the departmental or

unit level. In such a system, many of the volume-sensitive cost drivers are attached to the overhead costs as an economical means of ensuring a proper match between revenues and expenses. This approach tends to over- or underestimates the costs of products/services based on misleading measures, thus resulting in erroneous decisions.

2.2. The Characteristics of the ABC System

Companies, which use distorted cost data, have no chance to compete with their rivals. Therefore, this situation increased the necessity of a new cost system to protect and maintain a competitive advantage. Many companies all around the world have improved their costing accuracy by using the ABC system accordingly (Hansen, Mowen, & Guan, 2009, pp. 85-97).

In the 1980s, some large US manufacturing companies (especially electronics and machinery producing companies) were dissatisfied with the TCS regarding the allocation process of overhead. Thus, during the late 1980s, two professors, Robin Cooper and Robert S. Kaplan, from Harvard Business School, focused on activities and cost drivers of these companies. They indicated their findings by publishing articles. They emphasized that labour resources were replaced by automation so the proportion of overhead cost has increased in the total cost of a product or service. In this regard, companies have understood they should look at a new cost system that would be more accurate. As a result, the ABC system has emerged (Tanış, 2005, pp. 35-36; Weetman, 2010, p. 86).

Before analyzing the ABC system, some basic definitions given below should be known.

2.2.1. Definitions of Some Basic Cost Terms

There is a widespread interest in using new cost systems throughout the business life since organizations are facing fierce competition. Thus, existing and new concepts should first be known. In this regard, some important concepts will be given below:

Resource is any factor that can be used to perform an activity. To illustrate, a surgeon can be considered as a resource in the activity of surgery. Cost, on the other hand, is referred to as the value of resources sacrificed to acquire something, such as products or services (Weetman, 2010, p. 33). It can be measured by taking into account both the amount of item and the unit price of item. For example, if a service company needs 100 breads in a day for customers and if the unit cost of bread is equal to ₺0.5 so the total cost will be equal to ₺50.

Cost Object is anything, such as goods, services, customers, etc., for which a separate cost is determined (Atkinson, Banker, Kaplan, & Young, 2001, pp. 72-73). For example, if a manager of a hospital wants to calculate the cost of a patient, the patient is called a cost object.

Cost Driver can be defined as any factor, change of which will change the total cost of a cost object (Heitger, Ogan, & Matulich, 1992, pp. 9-18). For example, assume that you are going to Mersin from Adana by your car. This trip is considered as a cost object. In addition, the consumption of fuel has a significant impact on the total cost of the cost object. Thus, the consumption of fuel should be calculated by considering the total distance travelled. If the consumption of fuel per kilometre is constant, the total kilometres travelled will change the total cost of the trip. Therefore, in this example, "kilometre travelled" is taken into account as the cost driver.

Some costs affect the cost of a product or service directly, but some others do not. Thus, they are separated into direct and indirect costs. These terms are used in both cost and management accounting. Direct Costs are the costs that are directly identified with a cost object (Wild, & Shaw, 2010, p. 10). These costs can easily be traced to a cost object.

Indirect Costs are those costs that are not directly identified with a cost object (Weetman, 2010, p. 39). It is also important to note that indirect costs cannot be conveniently assigned to a cost object. For example, a production department needs some inputs such as sugar and flour, for producing bread. Moreover, some costs such as

electricity costs for machines or telephone costs for taking an order are incurred to sustain manufacturing process. Accordingly, sugar and flour are direct costs of bread, but electricity, telephone and supervisor costs of the production department become indirect for this cost object (bread).

In the production process, as noted earlier, some costs are directly related to the cost object whereas other costs have indirect relationship with the cost object. Accordingly, direct material, direct labour and factory overhead costs are the components of product or manufacturing costs. Direct Materials are those materials that can be directly identified with the final product and can conveniently be allocated to that product (Drury, 1992, p. 25). Their costs can be defined as Direct Material Costs, which are directly identified with that cost object. In a chair, for example, direct materials are wood and iron bars.

Direct Labour includes all labour forces directly participated in the production process. Accordingly, Direct Labour Costs are the total cost of the workers participated in the production process of goods or services. The cost of a carpenter can be given as an example of direct labour cost for the production of a chair.

Factory Overhead costs are the costs that cannot be allocated easily and directly to the product or service. In this respect, Factory Overhead includes indirect materials, indirect labours and other indirect costs such as electricity and water consumption, rent, and insurance. The cost of glue or nails can be given as examples of factory overhead costs for a chair.

On the other hand, value added and non-value added activities are the other basic concepts in the literature. Value Added Activity is any activity adding value to the products or services that are purchased by the customers. In contrast, Non-Value-Added Activity is any activity that cannot add value to the products or services purchased by the customers. Managers should eliminate the non-value added activities since they consume resources without adding benefits to the products or services (Horngren, Bhimani, Foster, & Datar, 1999, p. 558).

2.2.2. The Mechanism of the ABC System

The TCS distorts the final production cost since it assigns overhead cost either by using a plant-wide rate or departmental rates. Thus, companies using the TCS will be under pressure to sustain growth and increase profitability. The ABC, on the other hand, is a relatively new cost accounting system. This system first assigns overhead costs to activities, and then assigns the cost of activities to a specific cost object. As a result, the ABC is a system providing more accurate cost data by increasing the level of understanding about the overhead cost of an organization (Khataie, Bulgak, & Segovia, 2011, p. 142).

The ABC is a system which assumes that products consume activities, activities consume resources and resources consume cost. This assumption can be drawn as follows:

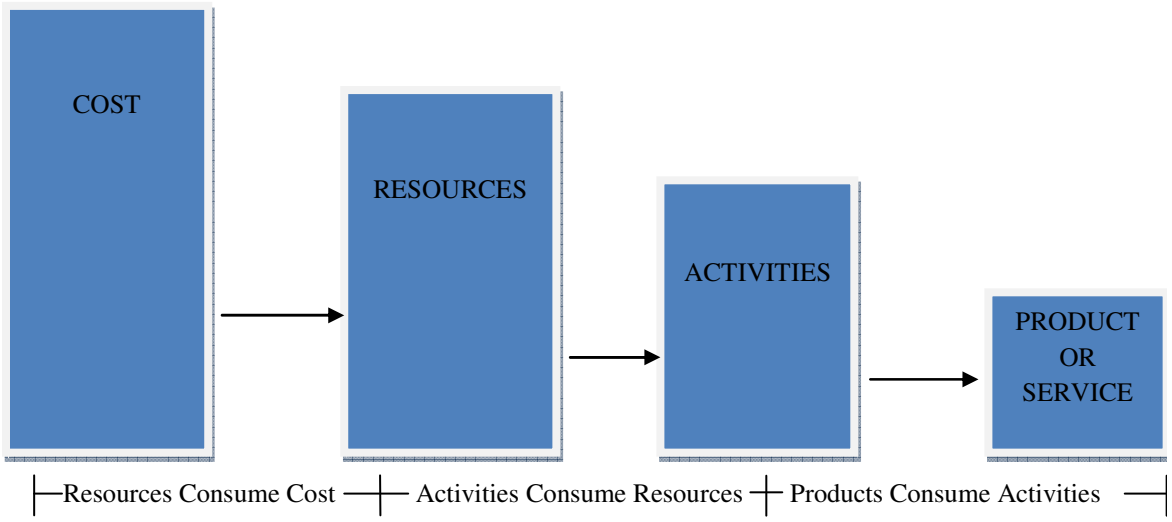


Figure 1. The Structure of Activity Based Costing System

Figure 1 shows the structure of the ABC system. In this regard, the ABC is a two-stage costing system. In the first stage, costs are allocated to the activities based on the resources used. The important point here is that the homogeneous activities are grouped into activity cost pools so as to decrease the number of activities. In the second stage, the costs of activities are allocated to the products or services based on their use of activities

(Gunasekaran, 1999, p. 118). Therefore, the ABC system provides a better understanding of the relationship between processes and cost objects.

The ABC is one of the most flexible systems for both manufacturing and service companies. The system enables managers to have flexibility in achieving the application process. It means that the ABC system can be used as an entire accounting system. However, this system can also be used for a specific department or division. When the ABC system is applied for a specific department, it is called departmental activity based costing (DABC) (Keys & Lefevre, 1995, pp. 27-28).

In the first stage of the DABC, costs are first assigned to the departments with the traditional perspective. In the second stage, the costs of departments are allocated to the cost object by considering the activities that are used. In this stage, cost drivers are used so as to determine the amount of cost to be assigned (Keys & Lefevre, 1995, pp. 27-28).

2.2.3. The Steps of the ABC System

The ABC system has six key steps that can be ordered as follows (Yennie, 1999, pp. 28-31):

- Step One: Identify Activities
- Step Two: Determine How Resources Are Related To Activities
- Step Three: Calculate Activity Costs
- Step Four: Identify Cost Objects
- Step Five: Determine How Activities Are Related To Cost Objects
- Step Six: Calculate Cost Object Costs

In order to increase the understandability of the ABC process, these steps will first be combined into Figure 2. Then, each of them will be explained in detail.

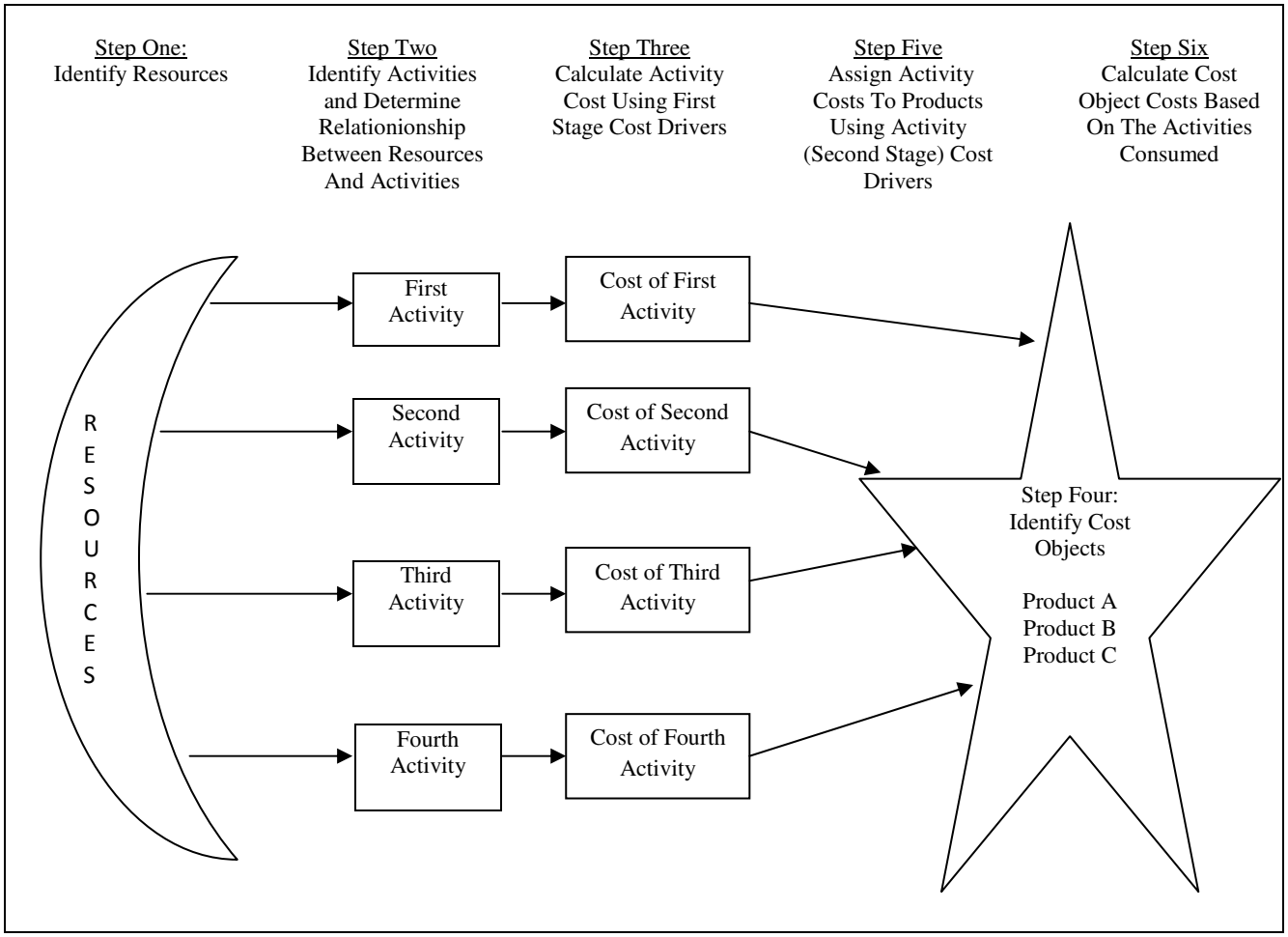


Figure 2. The Steps of Activity-Based Costing

Step One: Identify Activities: It is the most interesting and challenging steps of the ABC since identifying activities that use resources requires understanding of the workflow needed to produce goods and services (Lanen, Anderson, & Maher, 2011, pp. 320-321). In this regard, observations should be done to identify the most important activities. In addition, managers doing this step may also require face-to-face interviews to make a decision with respect to the activities realized in the business. It is also important to emphasize that activities may include several subprocesses. These subprocesses should also be determined.

Step Two: Determine How Resources Are Related To Activities: Once activities have been identified, determining how resources are concerned with the activities is the second major step in the implementation process of the ABC (Yennie, 1999, pp. 28-39).

First stage cost drivers are used to decide how much of the indirect costs are associated with each activity. For example, allocation of plant managers' salaries or rent costs would require first stage cost drivers such as number of employees, or a square meter.

Step Three: Calculate Activity Costs: Once the relationship between resources and activities has been identified, the next major step is to allocate resources to activities by using first stage cost drivers. Thus, the expense categories concerning each activity are identified (Roztocki et al., 2004, p. 20). For example, the expense category "Rent" may be traced to the activity "Surgery" using the square meter, whereas the expense category "Depreciation of Machinery" may be allocated using the machinery time spent by the activity.

Step Four: Identify Cost Objects: As mentioned before, cost object is anything, for which a separate cost is determined. This step can be put into the first position because managers first desire to calculate the cost of any item and then they start to study on the calculation of the cost of that item. Once activities have been determined, several cost objects can then be identified to allocate cost of these activities to the cost objects.

Step Five: Determine How Activities Are Related To Cost Objects: The relationship between activities and cost objects should be identified. This is because some activities are associated with the production of a specific unit, whereas some other activities are associated with the production of batch products. In this regard, the appropriate cost drivers can only be determined by establishing the relationship between activities and cost objects. By doing so, all data that are needed by managers, will be ready to allocate the costs of activities to the products or services.

Step Six: Calculate Cost Object Costs: Once the relationship between activities and cost objects have been identified, the next (also final) step is to trace the cost of activities to the products or services based on the activities consumed.

Second stage cost drivers, which are known as "Activity Drivers", are used to allocate the cost of activities to the products or services. However, Kaplan and Atkinson (1998, pp.

108-110) state that there are three types of activity drivers; Transaction Drivers, Duration Drivers, and Intensity Drivers. These may be explained as follows:

The transaction drivers, such as the number of products packaged, or the number of setups, are concerned with the frequency of the activity performed. These drivers can be used when all products have the same level of demand on the activity. Therefore, it is important to note that the transaction drivers are not accurate. **The duration drivers**, on the other hand, are more accurate than the transaction drivers. This is due to the fact that the duration drivers consider the time needed to perform an activity. It can also be said that the TDABC system uses the duration drivers. However, requiring time estimations for each activity, which can be expensive for managers, is the main limitation of the duration drivers. The last type of activity drivers is the intensity drivers. **The intensity drivers** are the most accurate activity cost drivers. They are directly charge to the resources needed to perform activities. Nevertheless, using intensity drivers is the most difficult task for managers since they require the most time-consuming and expensive studies (Kaplan & Atkinson, 1998, pp. 108-110).

2.2.4. Hierarchy of Activities in the ABC System

The TCS rely on volume-based cost allocation procedure. It can be said that the costs of unit-level activities are calculated correctly by using unit-based cost drivers such as direct labour or machine hours. This is because the unit-level activities are related to the volume of units produced. However, the unit-based cost drivers cannot be used to allocate costs to the other levels of activities. Therefore, the ABC defines four levels of activities (Weygant, Kieso, & Kimmel, 2005, p. 156). The four levels of activities that are known as 'Hierarchy of Activities' are described as follows:

Unit-Level Activity: A unit-level activity is an activity performed for each unit of production. When the number of units produced is increased, the cost of unit level activity is also raised. It means that the cost of unit level activities is changed with the volume of production. Utilities cost of operating equipment, cost of raw materials, and cost of sales

commission can be given as the examples of unit level activity costs (Morse, Davis, & Hartgraves, 2003, pp. 56-57).

Batch-Level Activity: A batch-level activity is an activity performed for each batch of production. The multiple units of the same product that are processed together generate a batch. The cost of batch level activity is called batch level cost. Let us consider the airplane flight; the number of passengers does not affect the cost of the flight crew. This is because the number of units in the batch is irrelevant for batch-level costs. Batch-level costs are only changed with regard to the number of batches (McWatters, Morse, and Zimmerman, 2001, p. 77).

Product-Level Activity: A product-level activity is an activity performed to assist the production of different types of products. With respect to the each different type of product, connections with customers, engineering studies, and purchase and sales management can be given as examples to the product-level activities. The cost of a product-level activity is not affected by the changes of units or batch levels. The major factor that affects the product level activity is the types of products. When the types of products are increased or decreased, the costs of product-level activities are also changed. Accordingly, managers can decrease the costs of product-level activities by minimizing the different types of products (Tanış, 2005, p. 38).

Facility-Level Activity: A facility level activity is an activity performed to sustain the overall manufacturing processes. Examples of the costs of facility-level activities are the rent on the factory building, the depreciation of the factory building, salary of plant manager, insurance, and taxes. It is also important to emphasize that the number or type of products produced do not change the facility-level costs (Jackson, Sawyers, & Jenkins, 2006, p. 105).

2.3. A Comparison of ABC and TCS

Allocating indirect costs to products or services is always a complex issue for companies. In the past decades, companies used the TCS in the determination of costs of the products or services (Tanış, 2005, p. 24). However, the insufficiencies of the TCS resulted in the emergence of the ABC system (Kaplan & Anderson, 2007a, p. 4). There is also no doubt that several differences can be seen between the TCS and ABC systems. These differences can be ordered as follows:

- Traditional systems allocate manufacturing overhead costs either by using a plant-wide rate or departmental rate; either case may distort the final production cost amount. Unrealistic cost estimation may lead to mispricing and compromise the firm's growth and profitability. Activity-Based Costing and Management (ABC/M) is a relatively new cost accounting and management approach that enhances the level of understanding about business operation costs; especially manufacturing overhead costs (Khataie, Bulgak, & Segovia, 2011, p. 142).
- Traditional systems were mainly developed to serve the accountancy function not the needs of the decision makers in the firm. The ABC can be described as a methodology, which enables the financial information in the firm to be used for active decision-making (Hughes, 2005, p. 8).
- Traditional systems focused on managing cost by means of cost-based budgets, standards and variances, established at the departmental or unit level. In such a system, many of the volume-sensitive cost drivers are attached to the overhead costs as an economical means of ensuring a proper match between revenues and expenses. This approach tends to over- or underestimates the costs of products/services based on misleading measures. Recently, organizations need to focus on processes and activities costs, as well as performance measurements for quality attributes such as customer satisfaction, reliability, cycle time, flexibility, and productivity. The ABC is a method that is designed to provide managers with more accurate product/service costs, clearer insights into what causes costs to exist and what

drives costs and more relevant information for strategic decision-making. In other words, the ABC provides a focus on activities not visible through traditional accounting (Ismail, 2010, pp. 41-42).

- While traditional cost behaviour divides costs into variable and fixed categories, the ABC divides these same costs into those that vary with unit-level activities, batch-level activities, and product-level activities and facility-level costs. Recognition that cost may vary with something other than volume can make the ABC a powerful tool for industrial marketers (Lere, 2000, p. 31).

Likewise, Periasamy (2010, p. 514) states the differences between the ABC and TCS clearly. These differences, given in Table 1, present the different viewpoints on these systems that help related parties to understand the superiority of the ABC system:

Table 1
Differences Between ABC and TCS

ABC	TCS
1- It begins with identifying activities and then to producing the products	1- It begins with identifying cost and then to producing the products
2- It mainly focuses on activities performed to produce products	2- It emphasises mainly on ascertainment of costs after they have been incurred
3- Cost Drivers used for identifying the factors that influence the cost of particular activity	3- Cost unit is used for allocation and accumulation of costs
4- Overhead costs are assigned to Cost Centre or Cost Pools	4- Overhead costs are assigned to production departments or service departments
5- Overhead costs are assigned to products using Cost Drivers Rates	5- Overheads allocated on the basis of departmental overhead allocation rate
6- Variable overhead is appropriately identified to individual products	6- Costs may be allocated or assigned either on actual cost incurred or on standard cost basis
7- In ABC many activity based on Cost Pools or Cost Centres are created	7- Overheads are pooled and collected department wise
8- There is no need to allocate and re-distribution of overhead of service departments to production departments	8- The process of allocation and re-distribution of the costs of the service departments to production department is essential to find out total cost of production
9- It assumes that fixed overhead costs vary in proportion to changes in the volume of output.	9- It assumes that fixed overheads do not vary with changes in the volume of output.

Source: Periasamy, P. (2010). A Textbook of Financial, Cost, and Management Accounting, Himalaya Publishing House, Nagpur, p. 514.

2.4. Activity Based Management

Activity-based management (ABM) is referred to as the identification and selection of activities for not only maximizing the value of activities but also minimizing their costs. It means that the ABM is an approach which ensures an efficient and effective management of activities (Morse, Davis, & Hartgraves, 2003, p. 193). This will be resulted in enhanced customer value that helps companies to increase their own profit margins.

The ABM has two different dimensions (Hansen et al., 2009, p. 430); cost dimension and process dimension. These dimensions can be seen in Figure 3. In this regard, the cost dimension reveals the cost information about resources, activities, and products or services (cost objects). The basic aim of the cost dimension is to provide an efficient cost assignment procedure. On the other hand, the process dimension reveals the detailed information about the types and reasons of activities that are performed. It also points out how activities can be performed better. The basic aim of the process dimension is to minimize costs to be allocated to cost objects.

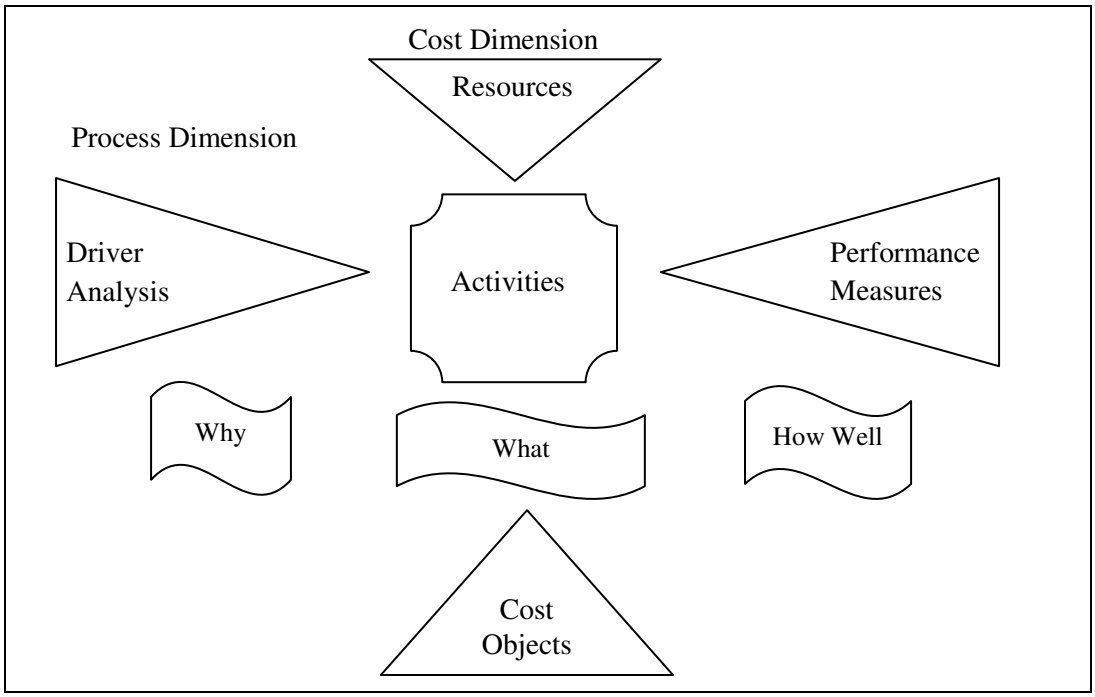


Figure 3. The Two-Dimensional Activity-Based Management Model
Source: Hansen, D. R., Mowen, M. M., & Guan, L., (2009). Cost Management: Accounting and Control, Sixth Edition, South-Western Cengage Learning, USA, p. 430

2.4.1. Cost Driver Analysis

Cost driver is referred to as any cause, change of which will change the total cost of a cost object. It is important to note that, all production cost concerning with a specific product should be considered in the cost identification. It is easy to trace direct material and direct labour costs to the product. However, costs that have indirect characteristics should first be accumulated into cost pool and then allocated to the product or service by using the proper cost drivers.

An analysis of cost drivers should be made so as to highlight non-value-added activities. Cost drivers were traditionally considered for only unit-levels. However, batch level, product level, and facility level should also be considered. This is because an accurate cost allocation can only be realized using the proper cost drivers (Kinney, & Raiborn, 2011, pp. 119-120).

2.4.2. Activity Analysis

The time interval from the beginning of the manufacturing process until the completion of goods or services for sending customers is called throughput time. Throughput time is the sum of the elements given below (Polimeni, 1991, pp. 445-446):

Processing Time: Processing time is the time spent to complete a processing activity of a product or service. Processing time is the actual time spent for working on a product or service.

Inspecting Time: Inspecting time is the time spent to control products or services so as to define the conformance of units to predetermined standards.

Moving Time: Moving time is the time needed to shift products or services from one production process to another and the time spent to send products to inspection stations.

Waiting Time: Waiting time is the amount of time spent for waiting next step that could be processing, moving, or inspecting.

Storage Time: Storage time is the time needed by products to remain in warehouse before delivering to other manufacturing departments or before delivering to customers.

The throughput time is occurred by value added and non-value added activities. When the throughput time is analyzed, it can be said that the processing time should only be considered as value added activity for a product. Other activities can be evaluated as non-value added activities. McWatters, Morse, and Zimmerman (2001, p. 435) and Polimeni (1991, p. 447) state that there are various strategies, such as improving quality, designing factory layout in accordance with the characteristics of a production process, and making collaboration with suppliers to get high quality products on time, to reduce time needed by non-value activities. Thus, following these strategies will help managers to minimize the throughput time of a product. As a result, companies can easily reach their cost reduction goals.

2.4.3. Customer Profitability Analysis

There may be various strategies for companies to operate successfully. Companies can first define the targeted customers within the market in which they will operate. The second strategy for companies is to create value for their customers. After creating value to the targeted customers, performance criteria must be developed to evaluate the performance of the company. Customer satisfaction ratings, number of new customers, and customer profitability can be used in the analysis of customers. In addition, these perspectives also give managers a valuable insight that can be integrated in a decision-making process. For instance, by using the data related to the customer profitability, companies can exert a great deal of effort over the customers that are more profitable.

As a result, customer profitability analysis helps managers to (Blocher, Stout, & Cokins, 2010, p. 146):

- Identify most profitable customers.
- Manage each customer's costs-to-serve.
- Introduce profitable new products and services.
- Discontinue unprofitable products, services, or customers.
- Shift a customer's purchase mix toward higher-margin products and service lines.
- Offer discounts to gain more volume with low costs-to-serve customers.
- Choose types of after-sale services to provide.

2.5. Limitations of the ABC System

Although the ABC provides useful information to managers, it continues to have some problems. These problems can be ordered as follows (McWatters et al., 2001, p. 85; Chen & Wang, 2007, p. 682; Gunasekaran, 1999, pp. 125-126):

- The accuracy of ABC depends on identifying and estimating the costs of the activities as well as the relation between the cost driver to the costs of the activity. If cost driver usage is not proportional to the cost of the activity, inaccurate estimates will occur.
- ABC cannot resolve the problem of what to do with facility-level costs since they are fixed with respect to the number of products.
- ABC is costly to implement since many measurements and observations must be made to implement it.
- The problem of complexity explosion in mass customization has not been well addressed. Additionally, the alleviation of complexity by using indirect cost drivers inevitably sacrifices the accuracy of cost estimate and valuable information about activity efficiency.
- There can be managerial difficulties in dealing with mismatch between formal departments and activities. The use of ABC in targeting labour cost reductions in particular, can lead to its being associated with redundancies and cost cutting. This can result in its adoption being viewed with some

apprehension and lead to difficulties in gathering accurate data about the activities of staff.

In addition, Robert S. Kaplan who is known as the "Father of Activity Based Costing" and Steven R. Anderson also emphasized that there are a large number of disadvantages of the ABC system. These are given as follows (Kaplan & Anderson, 2007a, pp. 5-7):

- 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.

Due to the insufficiencies mentioned above, Kaplan and Anderson have revisited the ABC system. As a result, a new and developed system, TDABC, has emerged.

2.6. Time Driven Activity Based Costing

Many companies have been using the ABC system for a long time. However, the shortcomings of the system have resulted in an increasing need for a new and revised cost system. Therefore, the ABC system has been revised and a new cost system, TDABC, has been obtained.

2.6.1 Introduction to the TDABC System

Notice that the heterogeneity in transactions has led companies to take into account either increasing the number of activities or using the duration drivers (Kaplan & Anderson, 2004, pp. 131-138; Kaplan & Anderson, 2007a, pp. 1-11). However, increasing

the number of activities can enhance the workload of the managers. Therefore, using duration drivers could be a better choice. As a result, the importance of a new approach considering duration drivers has been underlined.

It can also be said that the origins for the TDABC go back to 1996. Steven Anderson, in 1996, founded a consulting company which helps businesses to drive better business decisions. In the spring of 1997, the first TDABC practices were implemented. Afterwards, Robert S. Kaplan joined Acorn's board of directors in 2001. In this respect, Kaplan and Anderson decided to study on the ABC so as to obtain a system that is more accurate. Consequently, the TDABC system has been developed as a new approach (Kaplan & Anderson, 2007a, pp. 1-3). It is also important to emphasize that once the TDABC system has been developed, the specific concepts such as traditional ABC, rate-base ABC or conventional ABC have been started to use for representing the ABC system.

The TDABC system attempts to address the limitations of the conventional ABC. In this regard, by using the TDABC system, companies can increase their competitiveness in the present global business environment. As a result, the fundamentals of the system should be analyzed.

2.6.2 Fundamentals of the TDABC System

Managers should always make a decision with regard to the product mix, the types of products, the relationship with customers and so on to achieve their goals. Profit maximization is one of the most important goals of companies. Thus, managers can obtain accurate cost and profitability information to get high profit using the TDABC system. This is due to the fact that the TDABC is a new approach giving companies an elegant and practical option for performing the profitability analysis of their cost objects (Kaplan & Anderson, 2007b, p. 5).

The TDABC is a new system that is simpler, cheaper, and more accurate than the conventional ABC. Indeed, this system is very simple since it eliminates the need to

interview and survey employees for assigning resource costs to activities (Kaplan & Anderson, 2007b, p. 8).

If a manager wants to identify the unused resource capacity in a company, he or she can use the TDABC system. This is because it highlights the unused capacity. In addition, an analysis of the unused capacity by virtue of the TDABC system will display the non-value added activities. It must also be stressed that this system improves process efficiencies by eliminating the cost of the non-value added activities that can exist anywhere in a company (Stouthuysen, Swiggers, Reheul, & Roodhooft, 2010, p. 84).

2.6.2.1. Simplicity of the TDABC System

Using an accurate cost system is very important for a business to be successful. However, in spite of producing an accurate result, some cost system cannot be used because of its inherent complexity. As a result, cost system should be simple and applicable.

The TDABC system provides a simpler alternative than the conventional ABC since it needs only two parameters. The capacity cost rate for a department is the first parameter needed by the TDABC system. The capacity cost rate is calculated by dividing the cost of capacity supplied by the practical capacity of resources supplied. The second parameter is the capacity usage by each transaction processed in the department (Kaplan & Anderson, 2007a, p. 10). In other words, the time needed to perform an activity and the cost of unit time are the basic parameters of the TDABC system.

It is also important to emphasize that the practical capacity, as generally accepted in the management accounting literature, can be set at 85% or 80% of the theoretical capacity. This is because employees spend approximately 15% or 20% of their time for breaks, training, and communication (Kaplan & Anderson, 2004, p. 133; Pernot, Roodhooft, & Abbeele, 2007, p. 555). As a result, managers must take a look at the practical capacity so as to reach accurate results.

To illustrate this point, let us consider that the TDABC model will be implemented in a hotel. The reservation activity has a practical capacity of 500,000 minutes. Furthermore, the total cost of capacity supplied is ₺1,000,000. If employees need 10 minutes to make reservation for a new customer, the cost that should be allocated to the customer is calculated as follows:

$$\text{Capacity Cost Rate} = \frac{Cost\ of\ Capacity\ Supplied}{Practical\ Capacity\ of\ Resources\ Supplied}$$

$$\text{Capacity Cost Rate} = \frac{₺1{,}000{,}000}{500{,}000\ minutes} = ₺2 \text{ per min}$$

The cost to be allocated to the customer = ₺2 per min * 10 minutes = ₺20

The cost to be allocated to the customer from the reservation activity is ₺20. In addition, the costs of other activities that should be allocated must be calculated so as to find the total cost of the customer.

2.6.2.2. Steps of the TDABC System

Similar to the other systems, the TDABC system has its own peculiar implementation process. Everaert, Bruggeman, Sarens, Anderson, and Levant (2008, p. 175) state that the process of the TDABC covers the following 6 major steps:

- Identify the various resource groups (departments)
- Estimate the total cost of each resource group.
- Estimate the practical capacity of each resource group (e.g. available working hours, excluding vacation, meeting and training hours)
- Calculate the unit cost of each resource group by dividing the total cost of the resource group by the practical capacity
- Determine the time estimation for each event, based upon the time equation for the activity and the characteristics of the event

- Multiply the unit cost of each resource group by the time estimate for the event.

2.6.2.3. Superiority of the TDABC System

As mentioned before, the TDABC system needs only two parameters to be estimated. It is easy to update these parameters. Thus, the TDABC system is more appropriate than the conventional ABC for a condition where the operations and processes are fast changing (Everaert, Bruggeman, & Creus, 2008, p. 150). In fact, implementers can first focus on time equations. Once they calculate the cost of activities, they can write up the time equation. Then, when a change occurs, the implementers can represent these changes by reviewing the data found in the time equation. As a result of this, the TDABC system is a superior system. In addition, the concepts "time equation" and "model updating" always ensure the superiority of the system.

Time Equation: The logic of the TDABC system says that companies may include many activities. In addition, within the activities, there may be several subtasks. Therefore, time equations should be created. Otherwise, the simplicity of the system cannot be sustainable.

Notice that by virtue of time equations, managers can learn activities that lead to higher costs. As a result of this, the TDABC system offers operational insights with respect to the activities and their added values (Demeere, Stouthuysen, & Roodhooft, 2009, p. 301).

An example of the time equation can be given below. Accordingly, Figure 4 points out the time needed for an event k of activity j, with p possible time drivers. It also displays that the cost of an activity is calculated by multiplying the time needed for the activity by the cost per time unit (Everaert & Bruggeman, 2007, p. 17).

$t_{j,k} = \beta_0 + \beta_1 .X_1 + \beta_1 .X_1 + \ldots + \beta_p .X_p$ 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, $\ldots$, X_p = time driver *p*

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

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

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*)

Figure 4. General Time Equation
Source: Everaert, P., & Werner, B., (2007). Time Driven Activity Based Costing: Exploring the Underlying Model, Cost Management, *21*(2), p.18.

To illustrate, the reservation activity of the Hotel Alfa has a practical capacity of 500,000 minutes. The cost of capacity supplied is ₺1,000,000 (the capacity cost rate is equal to ₺2 per minute). If employees need 5 minutes and 10 minutes to make reservation for domestic and foreign customers respectively, the time equation for the reservation activity is created below:

₺2 per min* X1 where,

X1= 5 minutes (if domestic customer) or 10 minutes (if foreign customer)

Model Updating: The second concept that increases the superiority of the TDABC system is "model updating". The TDABC system can easily be updated with the assistance of the time equation. The time equation should be revised when the time needed for an activity has changed or when the cost of unit time has changed. For example, assume that the capacity cost rate remains stable, if the times to record domestic and foreign customers have changed from 5 and 10 minutes to 6 and 12 minutes, respectively, the time equation should be revised as follows:

₺2 per min* X1 where,

X1= 6 minutes (if domestic customer) or 12 minutes (if foreign customer)

As shown in the example, the changes of the capacity cost rate or the time needed by activities can quickly be reflected to the time equation. This is resulted in an efficient and a superior cost system for a managerial perspective.

2.6.3. A Comparison of Time Driven and Conventional Activity Based Costing Systems

There are several differences between the TDABC and the conventional ABC systems. The accuracy of method, the assignment process, and the ability to capture unused capacity are the main areas that are different from each other. These differences can be seen in Table 2. Accordingly, the cost assignment process is made on the basis of time under the TDABC system. In addition, the TDABC system is better than the conventional ABC system since it assigns costs to activities in a suitable way. Finally, the TDABC system points out the unused capacity in comparison with the conventional ABC. In this regard, it can be said that the TDABC system is more beneficial than the conventional ABC system.

Table 2
Comparison of the Methods ABC and TDABC

View Point of Comparison	ABC	TDABC
Character of factors for assign of costs	- Cost drivers - The method works with number of occurrence of factors (for example the number of set up).	- Time drivers - The method works with time of operating period, which resulting from incidence of factors (for example the time needed for set up).
The number of factors for assign of costs	By every activity we can use only one factor.	By every activity the numbers of factors are unbounded. They indwell the relationship between factors and these relationships are respected.
The accuracy of method	The method doesn't capture the specification of activity, which influenced the costs.	The method captures the assign of costs to activities in suitable way. The accuracy is better than by the method ABC.
Extensiveness of system for assign of costs	Every difference in the fulfilment of the activity needed implementation of new separated activity	For every activity we needed only one time equation, which captured all specification and variation of activity.
Time consumption for update of system	System is high elaborateness in actualization of costs rates.	Relatively smaller elaborateness than method ABC, because the costs rates are set up per time unit.
The ability to captured unused capacity	No	Yes

Source: Macurová, P. 2003. Ekonomika logistiky. In Bazala, J. et al. Logistika v praxi. Praktická příručka manažera logistiky. Verlag Dashöfer, Czech Republic. Translated by: Dejnega, O. (2011). Method Time Driven Activity Based Costing – Literature Review, Journal of Applied Economic Sciences, *6*(1-15), pp. 7-15.

On the other hand, some researches have also underlined the differences between these systems. According to Everaert, Bruggeman, and Creus (2008, p. 150), the TDABC system needs only two parameters to be estimated so it is more appropriate than the conventional ABC for a condition where the operations and processes are fast changing. Everaert Bruggeman, Sarens, et al. (2008a, pp. 187-188) also states that the conventional ABC considers only a single cost driver for the activity involving many subtasks. However, the TDABC system includes a separate time driver for each individual subtask. Dalcı, Tanış and Koşan (2010, p. 611) points out that whereas the conventional ABC system allocates the cost of activity cost pools to the cost object using activity driver, the TDABC system considers only the time consumed by the activity. Another important difference is that the TDABC system enables more accurate representation of over/under capacity than the

conventional ABC does since it expresses the capacity in units of time (Stout & Propri, 2011, p. 3). Finally, contrary to the conventional ABC considering theoretical capacity, the TDABC system takes into account the practical capacity that plays an important role in helping managers to get accurate results. Thereupon, it can be said that the TDABC system is a revised model of the conventional ABC. In addition, it creates more powerful and reliable cost system for today's business life.

2.6.4. Benefits and Shortcomings of the TDABC System

The TDABC system has been developed as a revised model in order to minimize the complexity of the conventional ABC system. As a result, this system includes several benefits in comparison with the traditional systems. These benefits can easily be seen when the previous titles of this section are analyzed. Nevertheless, the benefits of the TDABC system can be classified below (Stout & Propri, 2011, pp. 2-3; Kaplan & Anderson, 2007a, p. 18). The TDABC;

- eliminates the need for the time-consuming, subjective, interview-and -survey process to define resource pools. It relies only on simple time estimates that, for example, can be established based on direct observation of processes.
- accurately accounts for the complexities of business transactions by using time equations, which more accurately reflect the time involved in a particular process, thereby removing the need to track multiple activities to account for the different costs associated with a single activity.
- dramatically reduces the processing time required to "churn" through the data by using data feeds from ERP systems.
- is easier to build, maintain and update. Through the use of time equations, assisted by today's ERP systems, managers can easily update capacity cost rates and/or unit-time estimates as operating conditions change.
- enables more accurate representation of over/under capacity by expressing capacity in units of time. Because of the traditional ABC survey approach,

the costs of performing activities tend to be overestimated, thus resulting in less accurate representation of capacity usage.

- 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
- 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.

On the other hand, there are some limitations of the TDABC system. These can be ordered as follows (Gervais, Levant, & Ducrocq, 2010, pp. 3-5; Barrett, 2005, p. 39):

- There seems to be some hesitation between use of standard costs and use of actual costs to determine the unit cost of resource groups.
- The calculation of the cost of idle capacity is not so simple.
- The 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 time driven methodology onto activities in which cycle times vary wildly is inappropriate for those activities.
- There is a problem of measuring time in a time-based model because labour times are difficult to measure.

As a result, a new and comprehensive system, RCA, can be considered by the management accounting researchers. Therefore, the following chapter deeply analyzes this new system.

CHAPTER III

RESOURCE CONSUMPTION ACCOUNTING

Since the TCS could not respond the requirements of today's changing business conditions, the conventional ABC system have been using for a long time. However, as discussed in the previous chapter, the ABC system encounters some difficulties. First of all, the measurement and operational complexities may result in problems for the ABC implementers due to the fact that the ABC system requires estimations of cost of activity pools and cost drivers. After these estimations, costs of products or services have to be calculated by accountants. Therefore, the estimations and calculations lead to high measurement costs, which increase the level of difficulty for managers (Horngren, Datar, & Rajan, 2012, p. 154). Second, high costs of performing interviews and subjectivity of data used especially for time allocations are the other significant issues of the ABC system (Lambino, 2007, p. 75). At the same time, the updating process of the system is difficult. Finally, this system becomes theoretically inadequate when it does not take the possibility of unused capacity into account (Kaplan & Anderson, 2007a, p. 7). Consequently, the TDABC system has emerged.

Although the TDABC system has many advantages, it has two basic shortcomings. The first one is it considers only non-volume-based cost driver. However, using both volume-based and non-volume-based cost drivers may help managers to get accurate results. The second one is that the data obtained by the TDABC system cannot be used to make short-term decisions as it does not separate mixed costs into fixed or variable. As a result, in order to overcome these serious obstacles, Resource Consumption Accounting (RCA) can be considered as a new system.

The RCA is an advanced system since it includes the major benefits of both German Costing and ABC Systems. In addition, it can also be said that the RCA implementers can take the Enterprise Resource Planning (ERP) philosophy into account in the planning and

control process of internal resources of an organization. Therefore, the ERP will first be explained as follows:

3.1. Enterprise Resource Planning

The directing function for the entire organization becomes difficult since they are expanding their own activities. Indeed, businesses usually grow and develop incrementally day-to-day. As a result of this, a new system that integrates internal and external data is needed.

The roots of the ERP system go back to the 1960s. In the 1960s, manufacturers began to use material requirements planning (MRP) to facilitate the flow of information around the manufacturing processes. Then, the MRP has been expanded to cover resources so manufacturing resource planning (MRPII) has obtained. However, in the 1990s, Gartner Group, a consultancy firm, studied on the MRPII to link the internal and interorganizational processes. Thus, the MRPII has been changed as the ERP system (Supramaniam & Kuppusamy, 2009, p. 333; Beheshti, 2006, p. 186).

The ERP is an advanced information technology that integrates separate organizational functions and business processes into a single centralized system (Supramaniam & Kuppusamy, 2009). It can also be said that it is a strategic business solution since it improves the organization's efficiency by providing an advanced and centralized system (Dezdar & Ainin, 2010, p. 449).

The purpose of using the ERP system is to combine the business processes such as inventory, finance, and human resources into one common system to not only simplify the decision making process but also improve its effectiveness (Alshawi, Themistocleous, & Almadani, 2004, p. 454).

When the main characteristics of the ERP are analyzed it can be said that it is a comprehensive system building connections beyond the organizational boundaries. In

addition, it is also a flexible system which responds the needs of the changing conditions (Zeng, Chiang, & Yen, 2003, pp. 115-116).

Beheshti (2006, pp. 186-187) states that the ERP system has many advantages that can be ordered below:

- ERP systems can virtually eliminate the redundancies that occur from the outdated and separate systems.
- If inaccurate data is discovered, it can be corrected once instead of going through each department for every change.
- Different employees can access data simultaneously in ERP systems, whereas in separate legacy systems this is much less likely.
- ERP systems require firms to examine their internal processes in order to increase business efficiency and profitability.
- By improving or reengineering business processes, poor quality and the most costly areas of the operation can be identified and improved or eliminated, thus increasing the value of the processes in the value chain.
- It enables the organization to analyze the value chain as a system, from supplier to firm to customer.

Contrary to the advantages, this system includes some disadvantages that can be given as follows (Alshawi, et al., 2004, p. 455; Gattiker & Goodhue, 2004, p. 9; Morabito, Pace, & Previtali, 2005, p. 591):

- ERP system needs long implementation periods.
- Enterprises are tied to a single ERP vendor who might influence and dictate its prices and technologies. In addition, a bigger disadvantage is losing a vast amount of supplementary benefits that might be provided by the other ERP vendors/products.
- ERP implementations have a high risk of failure and may drift.

- The level of integration in ERP makes for highly complex systems with difficult to understand interrelationships between subsystems.
- An organization may face considerable risks associated with the investments in ERP software.

The efficiency of the company will be improved with the help of the ERP system when a manager takes the critical success factors into consider. In this respect, in order to implement ERP system successfully, top management should support the ERP implementation. Second, user training and involvement should be provided. Third, interdepartmental communication should also be provided (Chung, Skibniewski, Lucas, & Kwak, 2008, p. 374; Ferratt, Ahire, & De, 2006, pp. 459–461; Shah, Bokhari, Hassan, Shah, & Shah, 2011, p. 744). It can also be said that companies with ERP information systems are more likely to adopt German costing system (GPK) since the strong information system is essential for successful implementation of the GPK (Krumwiede & Suessmair, 2008, pp. 41-42). Actually, when SAP, one of the most important information systems that is headquartered in Germany, is analyzed, it can be concluded that it provides a GPK module to help managers to use it easily. Thus, the ERP system will facilitate the application of the GPK in any organization (Cheney, 2005, p. 15). Since the RCA system is established on the basis of the GPK system, the following section will also explain the details of the GPK system.

3.2. A New and Integrated System: Resource Consumption Accounting

Management accounting is concerned with providing both financial and non-financial information to managers, for planning, organizing, staffing, directing, motivating, coordinating, budgeting, controlling, and reporting. Managers use the data obtained by the management accounting for internal purposes since their primary role is to direct and manage the company to improve its effectiveness.

Many management accounting methodologies such as ABC, theory of constraints, and lean accounting, provide valuable insights, but they cannot integrate fundamental principles needed by managers to optimize the company (White, 2009, p. 63). Ernst & Young and the

Institute of Management Accountants (IMA) (2003, pp. 2-5) conducted a survey to display the current situation of the management accounting and concluded that;

- 80 percent of respondents reported that cost management was important to their organization's overall strategic goals. 75 percent believe that the state of the economy has generated greater demand for cost management and cost transparency.
- Despite the need for cost information, several factors are perceived to impair cost visibility. 98 percent of all respondents agree that there is some distortion due to certain factors.
- Nearly 80 percent of all respondents agreed implementing new management accounting initiatives tools is of a low to medium priority. 72 percent of respondents use homegrown systems while 14 percent prefer to use "best of breed" solutions, and another 14 percent ERP modules.

On the other hand, the RCA interest group of the Consortium for Advanced Manufacturing-International (CAM-I) conducted another survey in 2003 and concluded that (Sharman, 2003a, p. 44);

- 80 percent of U.S. organizations still use traditional cost allocation systems.
- Only 23 percent of respondents were satisfied with decision support information.

According to the surveys, it is evident that management accounting is very important for managers. Thus, a new system should be used to respond the requirements of companies. As a result, the RCA system can be considered a new system to be used by managers.

The RCA is a comprehensive, dynamic and fully integrated management accounting system (Van Der Merwe & Keys, 2002, pp. 31-36). The dynamic feature of the system, among other characteristics, makes it suitable for disclosing the root of the problems even in advanced business environment. An analysis of the resources of a product or service is

the way of disclosing the root of the problem. Indeed, by examining the root of the problem, the RCA system is able to provide a quick response to current business environment, which is shaped by the rapid technological developments.

The RCA system is based on both the GPK and ABC systems. Thus, in order to understand the RCA system, its components, GPK and ABC, should first be analyzed. However, since the ABC system was explained in Chapter II, the GPK system will only be analyzed in the following section.

3.2.1. German Costing System

The RCA system is the combination of German and U.S. costing systems. Since the ABC and TDABC (U.S. costing systems) were analyzed in the previous chapter, this section will only explain the German costing system. As a result of this, the definition and fundamentals of the German costing will be highlighted. Then, the differences between German and U.S. costing systems will be mentioned. Finally, the advantages and disadvantages of the German costing will be analyzed.

3.2.1.1. Definition of German Costing System

Managers cannot make a decision without obtaining managerial information. German costing system, in this regard, was developed to provide information that is needed by managers. It is originally known as Grenzplankostenrechnung (GPK). It is also known as "flexible margin cost". Hence, the GPK can be defined as a marginal costing system that supports short-term decision by giving importance to cost centres (Friedl, Küpper, & Pedell, 2005, p. 56).

Managers can easily achieve their goals by using data that are strategically important. Thus, the importance of cost accounting has been understood. In this regard, in 1950s, Hans-Georg Plaut developed a new cost accounting system, GPK, to the managers of each business area. Plaut tried to spread this system in around Germany and German-speaking countries (Austria and Switzerland). Then, Wolfgang Kilger, a cost accounting researcher,

focused on improving the theory of GPK. Afterwards a computing model, contribution margin accounting, was developed by Prof. Dr. Paul Riebel. However, both models have been combined and a modern GPK has been emerged (Sharman, 2003a, p. 31). The characteristics of this system can be learned by analyzing the following section given below.

3.2.1.2. The Fundamentals of German Costing System

As companies grow and become more global, they become more sensitive to the informational needs of managers. Indeed, in order to make companies more robust and competitive, managers need an efficient accounting system that produces reliable data. Thus, the popularity of the GPK system has been increasing across the world due to its success in Germany (Portz & Lere, 2009, p. 48).

The GPK system integrates resources into a large number of cost centres. Fixed and variable costs are separated from each other in those cost centres. Fixed costs are considered indirect and presented separately in contribution margin reports. Only variable costs are assigned to products or services. Thus, managers can strategically make short-term decisions in conjunction with this system (Krumwiede, 2005, pp 29-32; Kloock & Schiller, 1997, pp. 299-308; Krumwiede, Suessmair, & MacDonald, 2007, pp. 2-5).

On the other hand, cost-type accounting, cost centre accounting, product cost accounting, and contribution margin accounting are main features of the GPK system. Cost-type accounting indicates that different cost types such as labour, insurance, and maintenance and repairing, are classified as fixed and variable. Then, only variable costs are allocated to products or services. Fixed costs do not include information for making short-term decision so they are only presented in the profit-and-loss statement. On the other hand, cost centre accounting indicates that companies applying GPK have multiple cost centres. Each cost centre includes one or a few cost drivers. There are two types of cost centres: final and primary. Final cost centres include activities that are related to the manufacturing process. Primary cost centres include activities such as plant management that help manufacturing process. Thus, the GPK allocates primary costs to final costs so as

to provide link easily between costs and cost objects. Then, the final cost centres are allocated to cost objects (Friedl et al., 2005, pp. 57-59).

Product cost accounting emphasizes that only the variable costs of the final cost centres are allocated to cost objects. Thus, it produces results for a short-term period. Contribution margin accounting points out that the profit-and-loss statement is mainly used for internal purposes. This can be done by excluding all fixed costs. This can also be done by separating fixed costs for products types and product groups. Finally, the most detailed analysis can be done by considering any criteria that is very important for managers (Friedl, Hammer, Pedell, & Küpper, 2009, pp. 39-45).

3.2.1.3. U.S. versus German Costing System

German-speaking countries give more emphasis on management accounting and controllership practices than the U.S. does. Indeed, financial accounting and regulatory reporting are more important than the managerial accounting practices for the U.S. (Sharman & Vikas, 2004, p. 28). Thus, there are many differences between these systems.

Notice that approximately 80 percent of American management accountants are unhappy to use current costing methods in today's business conditions. When a variance is occurred, the U.S. costing system analyzes it within a department. However, the GPK looks at each cost centre instead of departments. Thus, it can be said that the cost control is one of the most important benefits of the GPK system (Cheney, 2005, pp. 14-15).

Germany and the U.S. have different cost centre practices. Therefore, the cost centre practices in Germany and the United States can be summarized in Table 3:

Table 3
Cost centre practices in Germany and in the Unites States

	GERMANY	THE UNITED STATES
Definition of a cost centre	Limited so that a single measure can represent cost centre output	Limited such that decisions made by head primarily affect cost
Size of cost centre	Fairly small	Larger
No of cost centres in firm	Large number	Relatively few
Output or activity measures	One measure that represents output of the cost centre as opposed to output of the firm; relates to resources used by centre	Multiple measures are common and often represent something with which costs of the centre vary: relationship between cost and measure may result from resource use or because of statistical association
Classification of costs in a cost centre	Fixed and proportional; proportional costs change in proportion to changes in cost centre output	Fixed and variable; variable costs change directly with some measure, which may or may not be a measure of cost centre output
Primary responsibility of cost centre managers	To control costs such that the proportional costs change in proportion to the changes in cost centre output	To control all costs incurred within the cost centre
Typical number of cost centres controlled by manager	Several	One

Source: Portz, K., & Lere, J. C. (2010). Cost centre practices in Germany and the Unites States: Impact of country differences on managerial accounting practices. *American Journal of Business, 25*(1), p. 48.

When Table 3 is analyzed, it is evident that there are significant differences in many issues such as number of cost centres, classification of costs in a cost centre, and the primary responsibility of cost centre managers.

Other than cost centre differences, many other differences that are resulted from different cultural perspectives exist for these costing systems. For instance, German culture offers low flexibility so there is a uniform management accounting system adopted in Germany. However, U.S. culture offers high flexibility which is resulted in a wide variety of management accounting practices. On the other hand, some strict rules are directing business area in the German culture. Thus, managers need a highly detailed management accounting information to make a decision. In this regard, the German costing practices are more detailed than the U.S. ones. Strict rules in the German costing practices also state that each cost centre should be managed by only one manager. However, in the U.S. costing

practices, two or more managers can manage any cost centre together (MacArthur, 2006, pp. 11-15).

To summarize, the RCA system is the combination of both GPK and ABC systems. Thus, it can be said that the RCA system has the characteristics of both the German and U.S. costing systems. In this regard, the fundamentals, properties, and benefits of this combined system can be clarified in the following sections.

3.2.2. The Fundamentals of the RCA

The RCA can be applied in a complex organization where the reciprocal activities are performed. Because of its comprehensive and integrated characteristics, it can also be said that this system attains the benefits of German and the U.S. costing systems.

As noted above, the RCA combines the principles of the GPK with the ABC system (Gurowka & Lawson, 2007, pp. 21–27). This can be presented as below:

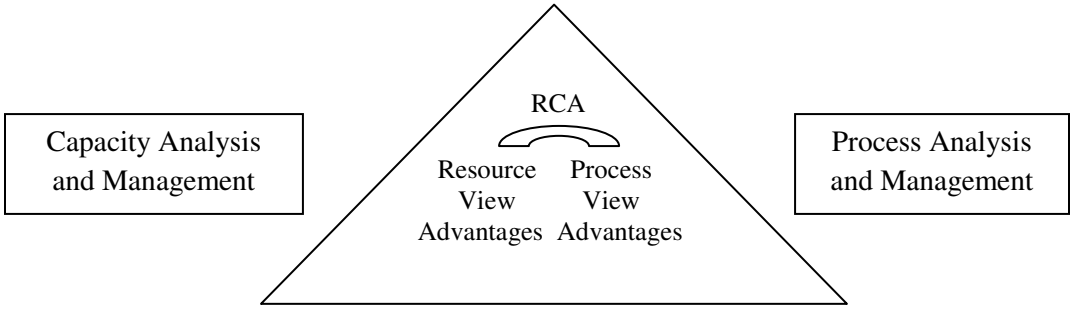


Figure 5. Resource Consumption Accounting
Source: Ahmed, S. A., & Moosa, M. (2011). Application of resource consumption accounting (RCA) in an educational institute. Pakistan Business Review, 12(4), p. 759.

As can be seen from Figure 5, the RCA system acquires the advantages of process view by integrating ABC system. In this regard, the combination of the GPK with the ABC increases the strength of the RCA system. This can also be seen very clearly in Figure 6.

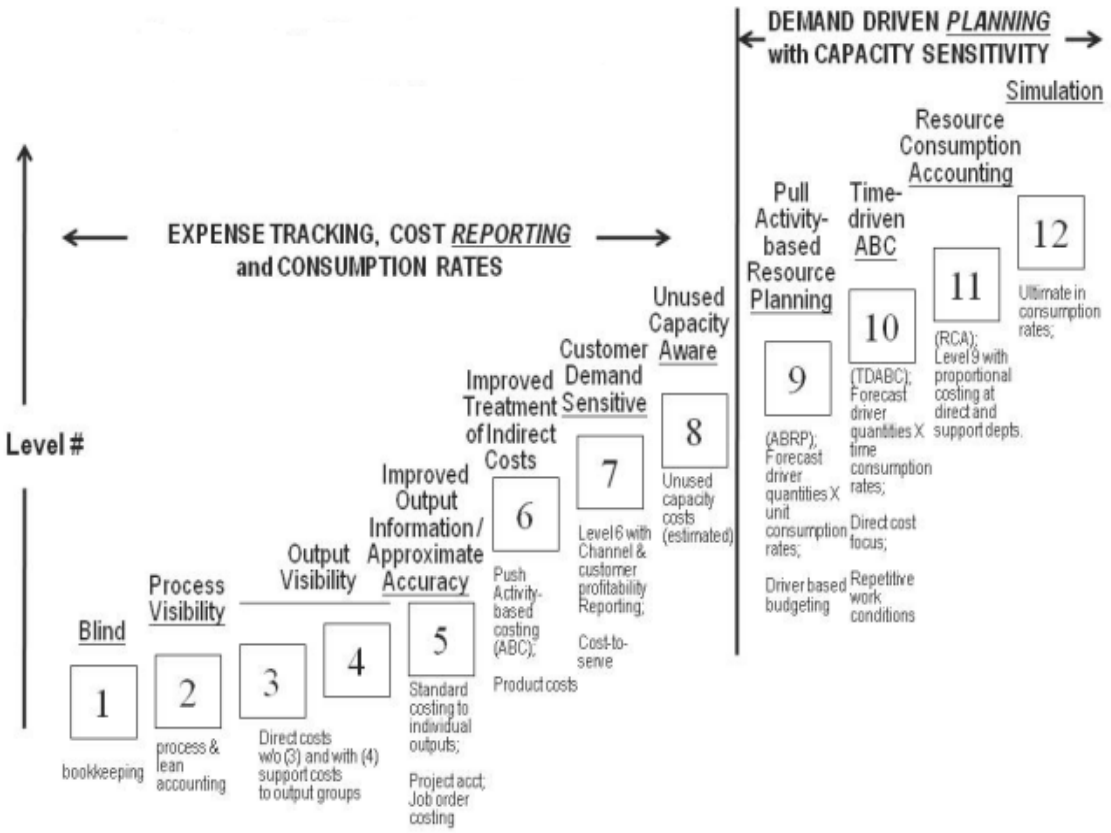


Figure 6. Costing Continuum-Levels of Maturity-
Source: IFAC. (2009). Evaluating the Costing Journey: A costing levels continuum maturity model. p. 19.

According to Figure 6, since it obtains the advantages of both GPK and ABC systems, the RCA, which is a mature costing system, is a more advanced system than the ABC and TDABC systems (Cengiz, 2012, p. 218). This idea is also supported by the data given in Figure 7.

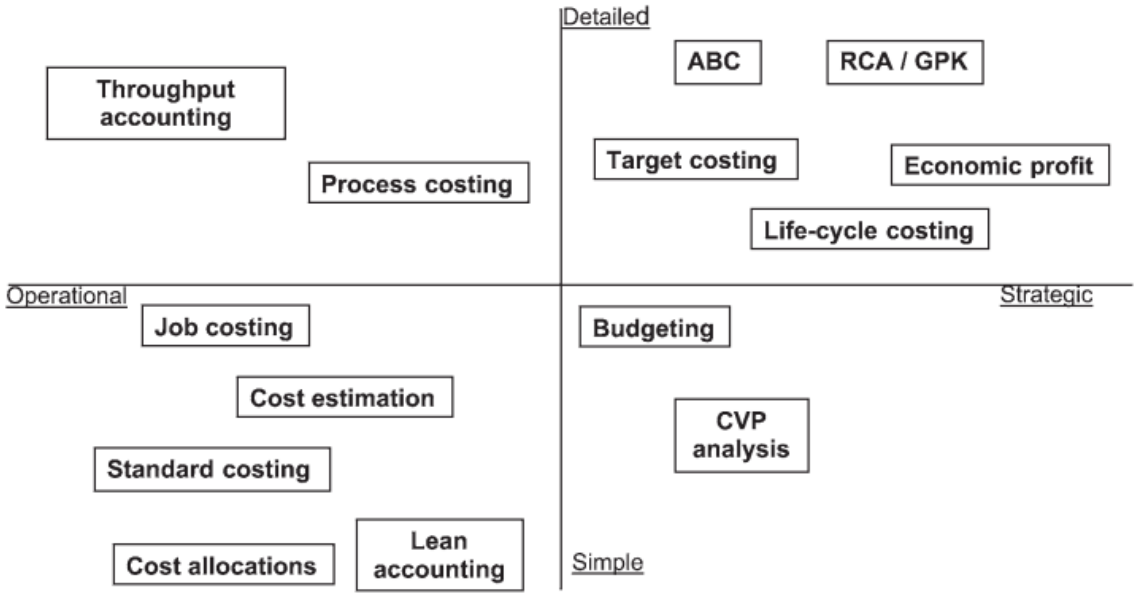


Figure 7. Costing Tool Tradeoff Matrix
Source: Gurowka, J., & Lawson, R. A. (2007). Selecting the right costing tool for your business needs. *Journal of Corporate Accounting & Finance, 18*(3), pp. 21–27.

As shown in Figure 7, the RCA system, like the ABC system, is more detailed than other systems. This is because it gives insights into activities, processes, resources, and types of costs. It is also evident that this system is more strategic than the ABC system. Indeed, the results of the RCA system can be used to make short term strategic and tactical decisions. As a result, it can be said that companies can use the RCA system to improve costing accuracy so as to obtain reliable information for decision making.

The RCA system has three pillars that support the management perspectives (White, 2009, pp. 63-77): Focus on resources and their consumption is the first pillar that provides insights to managers about resources, resource capacities and their consumptions. The second pillar is the quantity-based approach. This approach not only facilitates the management of resource capacities but also points out the causal relationships between resources and cost object. An analysis of the nature of costs with the purpose of determining the resource cost responsiveness is the third pillar of the RCA system

Notice that Clinton and Keys (n.d., as cited in Martin, n.d.) indicate that companies that have already been established can directly use the RCA system. Other than these companies, since it is a comprehensive system including ABC, direct costing, and absorption costing, the RCA system can also be used subjectively as a supporter of the existing cost system. For example, if a company uses step-down method to allocate service department costs to the manufacturing department, those data can be used by the RCA system. In other words, the RCA system can process data, such as dividing costs into fixed and variable, obtained by the step-down method. Thus, it can be said that the flexibility of the RCA system helps companies to easily adopt this system.

On the other hand, when the principle of the RCA is analyzed, it can be said that this system gives a strong emphasis on resources and their interrelationships. Thus, costs are classified into two categories in order to clarify resources consumed: primary and secondary costs (Webber & Clinton, 2004, p. 4). At the same time, the resource consumption by cost objects should be determined based on the quantity. Afterwards, these consumptions should be valued and allocated from cost pools to different cost objects. In this respect, excess/idle capacities become visible. Furthermore, it gives an opportunity to analyze the nature of cost by representing the proportional and fixed cost characteristics in connection with the quantity (Benjamin & Simon, 2003, pp. 20-27).

3.2.3. The Properties of the RCA

In accordance with the RCA system, companies have multiple cost centres. Each cost centre has, in general, one or a few cost drivers so as to identify the relationship between variable costs and the output of the cost centre (Friedl et al., 2005, p. 57).

Costs of a resource pool (cost centre) can be classified as primary or secondary. Primary costs are those that are generated within a particular resource pool. On the other hand, secondary costs are those that are generated within support or other manufacturing resource pool (Webber & Clinton, 2004, p. 4). To illustrate, a machining cost centre is a primary cost centre since it is directly involved with the production of goods. However, a maintenance cost centre is a secondary cost centre since it supports the primary

(machining) cost centre (Grasso, 2005, p. 16). It can also be said that in order to simplify the application of the RCA system, a researcher can first allocate secondary costs to primary cost centres by considering certain allocation bases. As a result of this, before starting the application process, the researcher obtains the primary cost centres which are consumed directly in the production of a product.

With respect to the product cost accounting, only the variable costs of the cost centres are allocated to cost objects (Friedl et al., 2005, p. 58). In other words, the RCA system prepares the marginal cost data to support short term decision making. In addition, an activity basis can be used to promote long term decision making (Grasso, 2005, p. 17). In addition, as noted earlier, the RCA system develops the contribution margin income statement to present the effect of the contribution margin. Thus, it can be said that the RCA system help managers to use profit-and-loss statement for internal purposes.

Notice that an analysis of the properties of any system provides valuable insights to managers. Accordingly, the main properties of the RCA system can be summarized as follows (Krumwiede & Suessmair, 2007, pp. 1-9; Benjamin & Simon, 2003, pp. 20-27; Webber & Clinton, 2004, pp. 1-14):

- The RCA cost assignment is based on a mix of activity-based and direct assignment considering both the resource pool interrelationships and the resource consumption.
- The RCA changes included using replacement cost depreciation to produce internal cost decision-support information.
- The RCA cost assignment excluded fixed costs that could not be casually attributed to either other cost centres or cost objects.
- The RCA changes included the use of theoretical capacity as a basis for cost assignment.
- The RCA separates fixed and variable costs for each resource cost centre. In addition, the distinction between fixed and variable costs is considered while being transferred the costs from support to primary cost centres.
- The RCA identifies the idle capacity so the cost of idle capacity cannot be assigned to products or services.

- The RCA can use both activity- and process-based cost drivers.

As shown above, the RCA considers both activity-based and direct assignment cost allocation procedures. In addition, this system does not use historical cost data since it considers replacement cost depreciation. This system separates fixed and variable costs so as to give managers a chance to make short- and long-term decisions. When the variable costs are only allocated to a cost object, the result will be used for making short-term period. Long-term decisions can only be made when the fixed costs are considered in the allocation procedure. However, the RCA system does not allocate fixed costs which have not casual relationship with the cost object.

There is no obligation with respect to the practical capacity so the RCA system can, in the cost allocation procedure, consider theoretical capacity. Furthermore, since it analyzes resources in a company, it does not allocate unused capacity costs to the cost object. Finally, in order to be appropriate for all occasions, this system uses both volume-based and non-volume-based cost drivers.

3.2.4. The Applicability of the RCA

When the RCA system is analyzed, it can be said that the application of this system can be broken down into six steps (Mackie, 2006, pp. 35-36; Wang, Zhuang, Hao, & Li, 2009, p. 87):

1- Identify resources, resource drivers, activities, and activity drivers: Resources, resource drivers, activities, and activity drivers should first be determined.

2- Create resource pools: In general, companies have many resources. In order to decrease complexity, the resource pools can be created. It is important to emphasize that each resource pool should be homogeneous. In other words, homogeneous resources should be collected into the same resource pool.

3- Identify resource consumption for each resource pool: Once the resources and activities are identified, the resources consumed by the activities should be determined.

4- Distributing the costs of resources to the activities: Once the resource drivers are identified, the resources such as human power, electricity, and equipment should be allocated to the activities on the basis of the resource quantity consumed by the activities.

5- Distributing the costs of activities to the cost object: Once the activity drivers are identified, the cost of activities should be assigned to a cost object on the basis of the activities consumed by the cost object. Grasso (2005, p. 17) also states that, after computing the cost of the cost object, fixed costs can also be allocated on an activity basis to make long term decisions.

6- Cost control and management: By analyzing the results of the RCA system, the difference between actual and standard amounts are obtained. In this regard, the individual or company-wide performance can be checked. Thus, it can be said that the RCA system helps managers to control and manage costs to achieve organizational goals.

Notice that cost managers or any other related parties are always interested in the applicability of the costing systems. Thus, an analysis of the applicability of the RCA system will persuade them to use this system. This is because there are no universally accepted criteria for implementing the RCA system.

Companies can solve their costing problems by using the RCA system. Thus, it can be said that a company which has a problem related to the costing system can take the RCA system into account. Indeed, Clinton and Keys's study (n.d., as cited in Wang et al., 2009) showed that companies having following problems should use the RCA system.

- The resources of enterprise are wasted, but that has not been predicted or the resource demand and use can not be predicted.
- The product manager and service manager often complain that they assume unused productivity cost which they should not assume.

- When those managers who often are responsible for the nature of changing cost make the decision of profit optimization, they encounter the output-side fixed-cost-death-spiral.
- Lacking in sufficient resources or indecisive resources to be used.
- Because the economic confirmations of the fixed, half-fixed and variable costs are not be considered sufficiently, the prediction of future resource consumption is lower than the practice.
- Outsourcing service can not achieve anticipated effect.
- Because lacking in the comparison analysis of the budget and practical consumption, the correct improved measures can not be adopted.

However, since the RCA is a comprehensive system providing strategic decisions, it is also suggested that a company whether having above problems or not can use the RCA system in order to increase its costing efficiency.

3.2.5. The Benefits of the RCA

The RCA is an efficient system, which provides numerous benefits to companies. Webber and Clinton (2004, pp. 1-14) classify these benefits below:

- Properly attributing costs to specific production processes and their outputs resulted in more accurate cost assignment and a better understanding of resource consumption patterns.
- The achievement of more accurate cost assignment provided the ability to conduct resource planning using only relevant costs.
- The use of replacement cost depreciation eliminated the issue of unequal cost assignment for similar products that consumed similar resources and support activities.
- Product costs included only the cost of resources used.
- The amount of excess/idle capacity was made visible to managers based on unconsumed theoretical capacity.

- Cost assignment based only on causality eliminated costs that were previously assigned based on unrelated changes to other products.
- The incentive to nonstrategically lower selling prices to artificially manipulate cost allocation amounts to specific products was eliminated.
- Properly identifying resource consumption based on the innate nature of particular costs enhanced managers' ability to understand resource interrelationships and use the underlying information to support incremental decision making.

As presented above, costs are properly attributed to specific production processes and their outputs by considering both activity-based and direct assignment cost allocation procedures. The RCA system provides reliable data by using the replacement cost depreciation. This system also does not allocate unused capacity costs to a cost object so the product costs included only the cost of resources used. Furthermore, the RCA system allows managers to determine lower selling prices for making short term period by excluding the fixed costs from the cost object (Webber & Clinton, 2004, p. 4). The additional benefits will also be clarified in Section 3.2.7. including the comparative analysis of systems.

3.2.6. Examination of the RCA by examples

In order to examine the RCA system, four different examples will be presented in this section.

Example 1: This example intends to show that the RCA system separates costs into fixed and variable (proportional):

Table 4
Cost Attributes in the RCA

	TCS	RCA		
		Fixed	Variable	Total
Salaries	₺20,000	₺10,000	₺10,000	₺20,000
Electricity	₺6,000	₺1,000	₺5,000	₺6,000
Equipment Depreciation	₺4,000	₺4,000	-	₺4,000
Total	₺30,000	₺15,000	₺15,000	₺30,000

According to Table 4, if the number of units is equal to 5,000, then the cost per unit is found to be ₺3 (₺15,000/5,000 units).

This example shows that, unlike the TCS, the RCA system gives insights into the cost attributes to managers by separating costs into fixed and variable.

Example 2: This example intends to show that the RCA system highlights the concept of "contribution margin" by presenting the contribution format income statement.

TCS		RCA	
Sales:	₺50,000	Sales:	₺50,000
Less: Total Costs	₺30,000	Less: Variable Costs	₺15,000
Net Income	₺20,000	Contribution Margin	₺35,000
		Less: Fixed Costs	₺15,000
		Net Income	₺20,000

A contribution margin income statement is referred to as an income statement in which all variable costs are deducted from sales to obtain contribution margin. Then, fixed costs are deducted from the contribution margin to obtain net income. Highlighting the contribution margin enhances the usefulness of the RCA system. This is because the contribution margin is an amount available to cover fixed costs and to provide net income. It is also important to emphasize that the RCA system enables managers to obtain different contribution margins on different layers.

Example 3: This example intends to emphasize that the RCA system uses both volume-based and non-volume-based cost drivers.

TCS

Shipping Cost: ₺2,000,000 ÷ Number of shipping: 100 = ₺20,000 per ship

RCA

Shipping Cost: ₺2,000,000 ÷ Total hours needed: 2,000 hrs = ₺1,000 per hour

As in the TDABC, the RCA system can use time which is a non-volume-based cost driver as an allocation base. In this regard, it can be said that using both volume based and non-volume-based cost drivers enhances the flexibility of the RCA system.

Example 4: This example is given to emphasize that the RCA system considers the unused capacity.

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 the total variable resource cost is ₺13,000 per month. According to the ABC system, the calculations to be done can be showed as below:

Table 5
Assigning the Total Resource Cost to the Activities in the ABC system

Activities	Time Spent (%)	Assigned cost (₺)	Cost Driver Quantity	Cost Driver Rate (₺ per quantity)
- Passenger Control	30	3,900	2,600	1.5
-Passenger Waiting In The Salon	30	3,900	2,600	1.5
-Taking Passenger On Board	20	2,600	2,600	1
-Taking Passenger Off Board	20	2,600	2,600	1
Total	100	13,000		

Results of Table 5 emphasize that the total resource cost is assigned to activities. This calculation is not true since it does not take the unused capacity into account. Thus, a new costing system can be considered.

The RCA system is a flexible system that can use volume-based or non-volume-based cost drivers. Since the employees, in this example, need different times for each customer, the total time needed by each activity will be considered:

	Total committed times
- Passenger Control	3,200 minutes
- Passenger Waiting in the Salon	3,000 minutes
- Taking Passenger On Board	2,800 minutes
- Taking Passenger Off Board	2,600 minutes
Total:	11,600 minutes

Thus, the cost per minute is found to be ₺1.12 (₺13,000/11,600 minutes). In this regard, the committed cost for each activity is calculated as follows:

	Total committed times	*	Cost per unit	=	Committed cost
- Passenger Control	3,200 minutes	*	₺1.12		₺3,584
- Passenger Waiting in the Salon	3,000 minutes	*	₺1.12		₺3,360
- Taking Passenger On Board	2,800 minutes	*	₺1.12		₺3,136
- Taking Passenger Off Board	2,600 minutes	*	₺1.12		₺2,912

If the actual price (cost) remains stable, the total cost of resources that are actually consumed can be given as below

	Total (Actual) time spent	*	Cost per unit	=	Actual cost
- Passenger Control	3,000 minutes	*	₺1.12		₺3,360
- Passenger Waiting in the Salon	2,900 minutes	*	₺1.12		₺3,248
- Taking Passenger On Board	2,800 minutes	*	₺1.12		₺3,136
- Taking Passenger Off Board	2,400 minutes	*	₺1.12		₺2,688

Thus, the cost of unused capacity can be found as follows:

	Committed cost	-	Actual cost	=	Cost of Unused Capacity
- Passenger Control	₺3,584	-	₺3,360		₺224
- Passenger Waiting in the Salon	₺3,360	-	₺3,248		₺112
- Taking Passenger On Board	₺3,136	-	₺3,136		0
- Taking Passenger Off Board	₺2,912	-	₺2,688		₺224

As shown above, the RCA system does not allocate the unused capacity costs to the activities. Indeed, the RCA, unlike the ABC system, ensures more reliable results since it considers the unused capacity.

It is also important to emphasize that since the TDABC uses, in the first stage, the data obtained by the ABC system, it allocates all costs to the activities. In other words, the TDABC system takes unused capacity into account in the second stage in which costs of activities are allocated to the products or services. Thus, the RCA system, which considers the unused capacity of resources originally, produces different results than the TDABC system.

To summarize, it can be said that managers can use the RCA system to make better decisions which permit to sustainable improvements in resources.

3.2.7. Comparison of the RCA, ABC and TDABC

There are significant differences among the RCA, ABC and TDABC systems. It is important to note that these differences are mainly resulted from the different characteristics of costing practices of Germany and the United States.

German-speaking countries attempt to have a larger number of cost centres than the U.S. does. Each cost centre has only one or two cost drivers. The types of cost drivers may be very different. In fact, volume-based and non-volume-based cost drivers can be used. In addition, German culture offers strict rules that lead to cost classification as fixed and variable (proportional). Thus, the RCA system, which is mainly based on the German costing, produces more detailed information than the ABC and TDABC systems do.

The comparison of an RCA with an ABC system points out the advantages of the RCA. Ahmed and Moosa (2011, pp. 759-760) listed advantages of the RCA over the ABC as follows:

- The RCA model automates gathering, and building the relationship of actual, financial, and operational data into comprehensive, applied business model. The relationships between resources, cost drivers and cost objects are automatically updated in the course of work. In contrast, the ABC model relationships are often discerned through subjective interviews and other time-study snapshots.
- The RCA provides a forward-looking business model. This is in contrast to the activity-based system, which is generally backward looking using historical information without recognition of current and future business changes.
- The RCA focuses on managing resource capacity as the basis for managing attributable costs, with costs driven by quantities of capacity demanded. ABC, using full absorption approach, drives all supplied cost through the business, regardless of the actual quantity of resource demanded by service receiver.
- The RCA recognizes resource interdependencies between the cost centres themselves and retains the transparency of the individual cost elements that make

up the cost centre pool. ABC models are of a step-down nature, (from resource to activity to cost object) without recognizing fully burdened resource costs.

In addition, the difference between the RCA and the ABC systems can also be clarified in Figure 8 as follows:

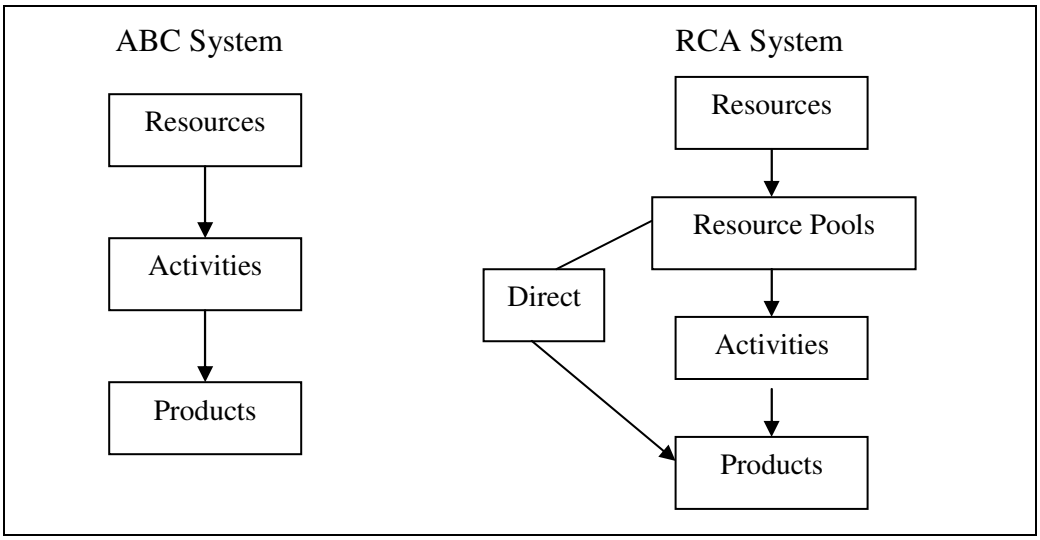


Figure 8. Comparison of RCA and ABC
Sources: Wegmann, G. (2009). The activity-based costing method: Development and applications. *The Icfai University Journal of Accounting Research, 8*(1), p. 14; Labro, E., & Vanhoucke, M. (2008). Diversity in resource consumption patterns and robustness of costing systems to errors. *Management Science, 54*(10), p. 1717.

As shown in Figure 8, the RCA suggests that resources should be collected into resource pools since the first allocation process is always difficult for managers. Accordingly, the large number of resources is decreased by accumulating them into homogenous pools which have a unique allocation basis. In addition, if a manager can establish a relationship between resource pools and products, the direct allocation can be realized without allocating these direct costs to activities.

On the other hand, Tse and Gong (2009, p.45) state that the RCA and TDABC systems are different from each other. First of all, the TDABC system assumes that all resource costs are variable. However, resource costs can be either fixed or variable in the RCA. Second, the RCA considers the cross allocations among resource pools that are not allowed by the TDABC system. The last important difference is that contrary to the TDABC system

recognizing only the activity-based cost allocation, the RCA system allows both activity-based and volume-based cost allocation.

There is no denying the fact that the combination of those systems having different features will offer an efficient costing system for managers. Indeed, managers can exert an effort to convert these differences into benefits. For instance, variances may be determined easily by creating and analyzing several cost centres. Or by separating fixed and variable costs, managers can reach both short- and long-term decisions by integrating those systems.

To sum up, the RCA, which integrates both German and U.S. costing practices, should be considered as an efficient and reliable cost system that can be used by managers in order to obtain accurate results in today's rapidly changing economic environments.

CHAPTER IV

RESEARCH METHODOLOGY

All scientific researches are based on a specific method. Different methods can be used for different scientific fields. To illustrate, while a questionnaire method is being used by social sciences, an experimental method can be preferred by medical sciences. The aim of the research study also determines the method used. Thus, it is important for researchers to be aware of the topic "research methodology" which will be clarified in this chapter.

4.1. Introduction

Scientific researches are conducted in both academic and business areas. These researches play a critical role in a decision making process. Indeed, academicians or managers of businesses make a decision with respect to the result of the research that was conducted. However, without considering an accurate method, the scientific researches may lead to inappropriate results. Hence, determining a proper method should be one of the most critical steps in a scientific research.

As in both medical, and basic and applied sciences, social sciences include a variety of research methods. Due to time and place constraints, this section will only clarify the "case study" method which is employed in this study. In essence, a case study method is one of the most important research methods for managerial accounting. Thus, the following (implementation) chapter will be more easily understood.

In this section, first, research methods in social sciences will be explained generally. Then, the definition and types of case study will be clarified. How a case study can be conducted will also be explained. Finally, after explaining both advantages and disadvantages of the case study research, the reasons for choosing the method will be pointed out.

4.2. Research Methods in Social Sciences

People always exert an effort to identify their surroundings so it can be said that science was born with the help of their curiosity. In the past centuries, people could not explain the reasons of many events. Thus, the unexplained events were considered as problems. Year by year, the endeavours to solve those problems have become more systematic. As a result, the research was emerged.

Research is a systematic inquiry that explains the solution of any problem. It includes both the collection of data and the observation of events again and again from different perspectives. The arrangement of existing knowledge and the possession of new knowledge can be considered as the main functions of the research (Singh, 2006, pp. 2-5).

The term "research" is also referred to as "to search again". During the research process, the researcher must be free of bias. He or she must also be neutral for successful data collection and analysis. It is important to emphasize that data that will be useful in a research process must be relevant, high-quality, timely, and complete (Zikmund, William, Babin, Carr, & Griffin, 2010, pp. 5-19).

Ekmekçi (1999, pp. 1-3) states that there are 12 steps to be considered in conducting a research. These steps can be given as follows:

Focusing on a problem: The first step is to determine a problem that can be resulted from theory or from the personal experiences of the researcher. The researcher will try to find a solution to the problem.

Formulating a purpose statement or research question: Researchers should specify the scope of the research so they must prepare a purpose statement or formulate a research question.

Giving the background and the rationale of the research: General background information is identified to point out the reason of studies on the proposed problem.

Formulating a hypothesis: Researchers always have expectations related to the result of the research. These expectations which will be tested are called hypothesis.

Review the literature: Before starting the research process, the literature should be analyzed in a detailed way so as to create a theoretical framework of the study.

Choosing the research design: The most appropriate research design is selected by considering the purpose of the research study.

Making a detailed plan of the study: Researchers cannot be successful without making a plan. The time schedule for each duty such as literature review, interview, and observation, or supplying the required materials for the research study should be well planned in advance.

Collecting data: Researchers should collect data related to the problem.

Analysing the data: After collecting data, the next step for researchers is to analyze data. This step is needed for generating a conclusion.

Generating conclusion: Generating conclusion can be considered as the last step of the research. After all analyses are made by the researchers, the conclusion will be obtained.

Organizing the collected information: Researchers should organize the collected information with respect to the organizational patterns or specific purposes.

Writing a thesis, a dissertation, or a research article: After completing the research study, it is revised and edited to form the final version of the study in accordance with the purpose of the researcher.

While research is a diligent search for discovering and interpreting new knowledge, a scientific method is a systematic process of techniques used to conduct the research. In this regard, a research done in accordance with the appropriate scientific method will lead to

discovery of fact or information that increases the knowledge of human-beings (World Health Organization, 2001, p. 1).

A variety of scientific methods can be utilized in social sciences. These research methods can be classified under several headings (Tanış, 2005, p. 64). In this respect, social network analysis, random coefficient modelling, advanced measurement techniques, experiments, surveys, histories, and the analysis of archival information can be given as the basic ways of doing social science research (Wensing, 2008, p. 1; Yin, 2003a, p. 1). On the other hand, one of the most important methods that can be used in doing social science research is a "case study". It can be said that selecting the most appropriate method for a specific research is one of the most important tasks of the researcher.

Yin (2003a, p. 1-12) states that these methods are different from each other when the types of research question, the extent of control over behavioural events, and the degree of focus on contemporary events are considered. This condition is presented in Table 6:

Table 6
Research Strategies

Strategy	Form of Research Question	Requires Control of Behavioural Events	Focuses on Contemporary Events
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival Analysis	Who, what, where, how many, how much	No	Yes/No
History	How, why?	No	No
Case Study	How, why?	No	Yes

Source: Yin, R. K. (2003a). Case Study Research: Design and methods. Third Edition, Applied Social Research Methods Series, Volume 5, Sage Publications, United States of America, p. 5.

According to Table 6, it can be said that the research strategy can be determined on the basis of the types of research question, the extent of control over behavioural events, and the degree of focus on contemporary events. An experiment is a research strategy that focuses mainly on "how" and "why" questions for the contemporary events. These events can directly be controlled by the researchers. A survey is also a research strategy that is

used when the researcher tries to find the answers to “who”, “what”, “where”, “how many”, and “how much” questions for the contemporary events. A researcher does not have any control over events in this research strategy. Another research strategy, archival analysis, focuses on “who”, “what”, “where”, “how many”, and “how much” questions for both contemporary and historical events. As in survey, a researcher conducting archival analysis does not have any control over events. A history is used when the historical events are considered. In this research type, a researcher, who does not have any control over events, tries to find the answers to “how” and “why” questions. Finally, a case study is a research strategy where a researcher has little or no control over events. The researcher doing a case study focuses mainly on “how” and “why” questions for the contemporary events (Yin, 2003a, pp. 5-11; Tanış, 2005, pp. 64-65).

4.3. Case Study as a Research Method

Several statements can be given to define the case study. Yin (2003b, p.13), who made one of the broadest definitions, defines a case study as:

“A case study is an empirical inquiry that:
• investigates a contemporary phenomenon within its real life context, especially when
• the boundaries between phenomenon and context are not clearly evident.”

This definition indicates that the replication of phenomena in a laboratory or experimental setting is not needed since the case study investigates a contemporary phenomenon within its real life context (Rowley, 2002, p. 18).

Cepeda & Martin (2005, pp. 852-853) state that there are three reasons that explain the importance of case study as a research strategy. First, the researcher can generate theories from practice by studying in a natural setting. Second, it gives insights to the researcher by answering “how” and “why” questions. Finally, it also shows the potential areas to be developed.

Qi (2009, p. 22) states that the case study, which is a detailed contextual analysis of a limited number of events or conditions, provides a basic knowledge regarding the complex issue or object. Qi also states that, contrary to many methods that represent the world, the case study represents the case.

Several resources such as documents, artefacts, interviews and observations, are used by the case study (Rowley, 2002, p. 17). Thus, it can be said that the case study is a deep study showing many dimensions related to any issue.

4.3.1. Types of Case Study

Once a researcher decided to use a case study method, he or she must then determine the type of case study to be conducted. Ryan, Scapens and Theobald (1992, pp. 114-116) indicate that there are five types of case study:

Descriptive Case Study: A descriptive case study is a method that is conducted to gain knowledge about the existing accounting systems, procedures and techniques used in a business. The descriptive case study method presents the accounting practice by disclosing the gap between accounting theory and practice.

Illustrative Case Study: An illustrative case study is a method that explores how new practices can be applied in a company. It helps researchers by disclosing the outcomes of new and innovative practices. It can also be said that the illustrative case study, which is a descriptive, examines any field to provide knowledge to related parties.

Experimental Case Study: An experimental case study is developed to understand whether new accounting practices can easily be applicable or not. It also indicates the benefits of new practices. In addition, by comparing with the traditional procedures and techniques, both advantages and disadvantages of new practices are disclosed by the experimental case study.

Exploratory Case Study: An exploratory case study is a preliminary investigation that is conducted to make generalizations concerning accounting practices. It discloses the reasons for particular accounting practices. Thus, it helps researchers to create hypothesis related to the reasons of accounting practices.

Explanatory Case Study: An explanatory case study is a method that explores the reasons for accounting practices. The explanatory case study is based on a specific case. Thus, rather than producing generalizations, theory is constructed to explain the specific case only. When the constructed theory does not produce persuasive explanation, it should be modified. Thus, in accordance with the explanatory case study, the researcher will obtain the theory which has better explanation.

The difference between the types of case study is not specific so researchers should first take into account the goals of the study and then prefer the most suitable type of case study that will help them to reach their own goals.

4.3.2. Conducting a Case Study

The conceptual framework, the research cycle, and the developed theory are three main elements of conducting a case study. A conceptual framework is an important tool playing a vital role from initial to final stages of the research process. After obtaining the data from the literature, the conceptual framework is designed. The research cycle consists of making a plan, collecting data, analyzing data that are collected, and reflecting the results that may change the conceptual framework. Finally, the theory is developed in consequence of the interaction between conceptual framework and research cycle (Cepeda & Martin, 2005, pp. 857-861).

Abdul Rahim & Nabi Baksh (2003, pp. 30-32) state that several steps as presented in Figure 9 can be followed during the case study design process.

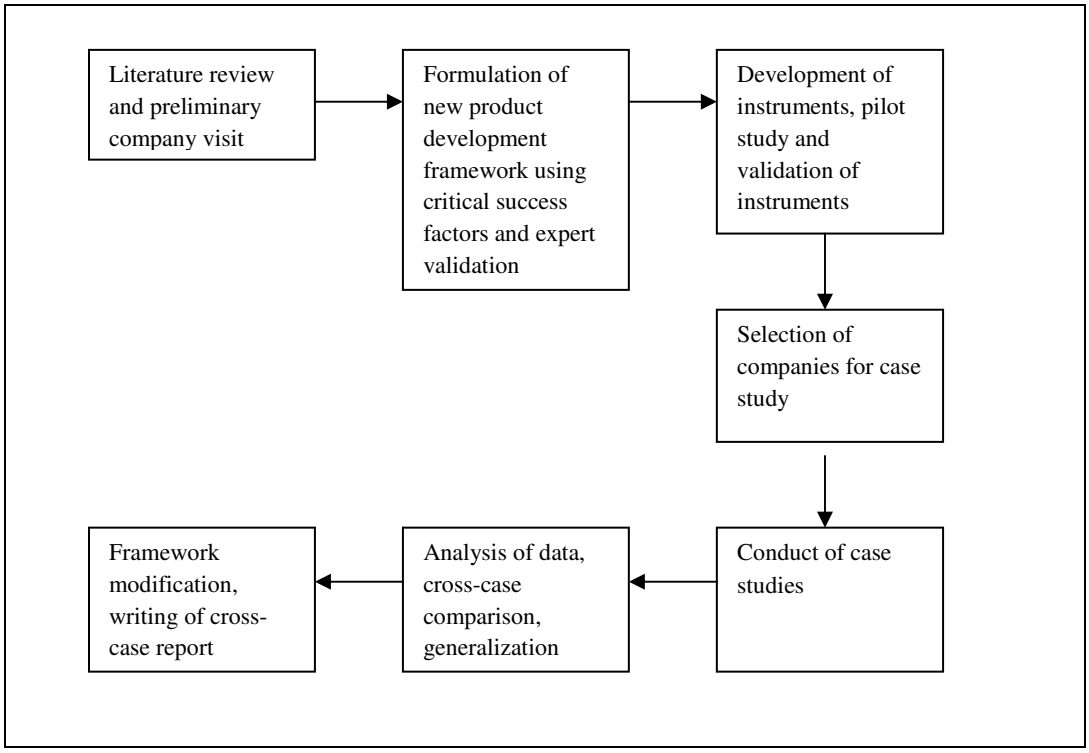


Figure 9. Case Study Design
Source: Abdul Rahim, A. R., & Nabi Baksh, M. S. (2003). Case study method for new product development in engineer-to-order organizations. Work Study, *52*(1), p. 31.

As shown in Figure 9, a researcher follows several steps so as to conduct a case study. The researcher should first review the literature. Creating a framework is the second step to be done by the researcher. Third, the case study instrument should be designed. Fourth, the company where the case study will be implemented should be selected. After the selection of company, an analysis of results should be made. Then, if it is necessary, the framework should be modified. Finally, the flowchart of the case study design should be completed by preparing the case report.

In order to improve the quality of any social research, four tests which are ordered as construct validity, internal validity, external validity, and reliability, are widely used. Construct validity is referred to as reducing subjectivity by creating correct operational measures for the concepts of the study. Internal validity can be defines as establishing a casual relationship for explanatory or casual studies only. External validity indicates the ability of the generalization of findings within a specific domain. The problem concerning the external validity can be evaluated as the major barrier in conducting a case study.

Finally, reliability states that a researcher always obtains same results when he or she follows the same procedures for further studies (Yin, 2003a, pp. 33-39; Rowley, 2002, p. 20).

4.3.3. Criticism of the Case Study

When a case study is criticized, it can first be said that there are many advantages of using the case study. In this respect, it gives a chance to researchers to investigate organizations in a detailed way. Thus, both the order of events and the relationships between events and individuals are understood easily (Zikmund et al., 2010, p. 140). It can also be useful for exploring the existing theory (Saunders, Lewis, & Thornhill, 2007, p. 140). On the other hand, the case study enables the understanding of many concepts. In addition, it helps researchers to reach their research aims by following widespread data collection and analysis procedure (Darke, Shanks, & Broadbent, 1998, p. 287).

The case study, however, has some limitations. First of all, as Singh (2006, p. 157) notes, besides the time consuming and costly characteristics, it will be very difficult to formulate hypotheses. Second, researchers may be biased in directing and analyzing the findings and conclusions (Yin, 2003, p. 10). The last but the most important one is related to the scientific generalization. This is because many people believe that one cannot generalize from a single case. However, this would be incorrect (Flyvbjerg, 2006, pp. 219-225). Indeed, the results of the multiple-case studies conducted under certain circumstances will be similar when these case studies are conducted reliably. Thus, a researcher can utilize from multiple-case studies in order to increase the generalizability of the case study findings.

4.4. The Reasons for Choosing a Case Study as a Research Method

The purpose of this study is to point out both the importance and applicability of the RCA system. Accordingly, the implementation will be realized in a service company that uses traditional cost system. This is because the superiority of the RCA system can easily be revealed by comparing it with the traditional systems. In this regard, this study will

include two steps. In the first step, direct and indirect costs will be determined. In addition, the calculation of the cost of services (gallbladder operations) will be analyzed. In short, the current costing system of the hospital will be investigated. In the second step, the applicability of the RCA system for the hospital will be examined.

It is believed that the method to be followed in this study is a “Case Study” method. This is because it provides a wide perspective to researchers on a research topic. In this regard, a descriptive case study will first be carried out for identifying the current situation of the company. An exploratory case study will then be conducted to reveal the results of the RCA system.

The results obtained by the case study method may not be generalizable to the universe. However, it will provide guidance to other companies having similar circumstances or operating in the same sector. In addition, it will also provide guidance to researchers who can conduct multiple-case studies in order to increase the generalizability of the case study findings with respect to the RCA system.

CHAPTER V

AN APPLICATION OF RESOURCE CONSUMPTION ACCOUNTING SYSTEM IN A HEALTHCARE INSTITUTION

An implementation will be conducted in a healthcare institution to show the applicability and efficiency of the RCA system. Thus, general information about the hospital will first be given. The information related to the gallbladder operations will also be mentioned. Then, the current costing system will be compared to both ABC and TDABC systems. Finally, the implementation of the RCA system will be given. As a result of this, the advantages of the RCA system contrary to the TCS, ABC and TDABC will be clarified.

5.1. General Information about the Hospital

Mağusa Yaşam Hospital is the first well-equipped private hospital in Cyprus. It started to render 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 73 personnel in total; 17 doctors, 19 nurses, 4 ambulance men, 3 radiologists, 4 cafeteria staff, 5 laboratory personnel, 12 customer service representatives, 5 cleaners, 1 gardener, and 3 accountants.

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 3,000 m2 area. As an average, 1,100 patients come to the hospital for different complaints and 72 surgical operations in average are done per month. The General Surgery Department is 300 m2, and it has 132 patients in

average. 22 surgical operations are done per month in the general surgery department. 110 patients out of these 132 patients come to General Surgery Center due to gall complaints. While 18 surgical operations are realized out of 110 patients who have gall problems, there are only 4 surgical operations done out of 22 remaining patients [These data related to the year 2011, are obtained from a comprehensive observations and interviews conducted regularly throughout the year with hospital management]. 3 open and 15 close gallbladder operations are respectively being done out of 22 gallbladder operations which are realized in the general surgery department.

In accordance with the observations and interviews, the 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. Three 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 laparoscopic gallbladder operations (Close Method). Consequently, each of two other different surgical operations requires 2 patient days and 30 patients out of 110 patients without surgical operations, need to stay in hospital for one day. Thus, 62 patient-day are totally found per month in the general surgery department. Additionally, it can be mathematically represented as follows:

Open gallbladder operations:	3 patients * 3 days = 9 patient-day per month
Close gallbladder operations:	15 patients * 1 day = 15 patient-day per month
Other surgical operations:	4 patients * 2 days = 8 patient-day per month
Patients without surgical operations:	30 patients * 1 day = 30 patient-day per month
	Total = 62 patient-day per month

On the other hand, the organization chart of Mağusa Yaşam Hospital is given in Figure 10 as follows:

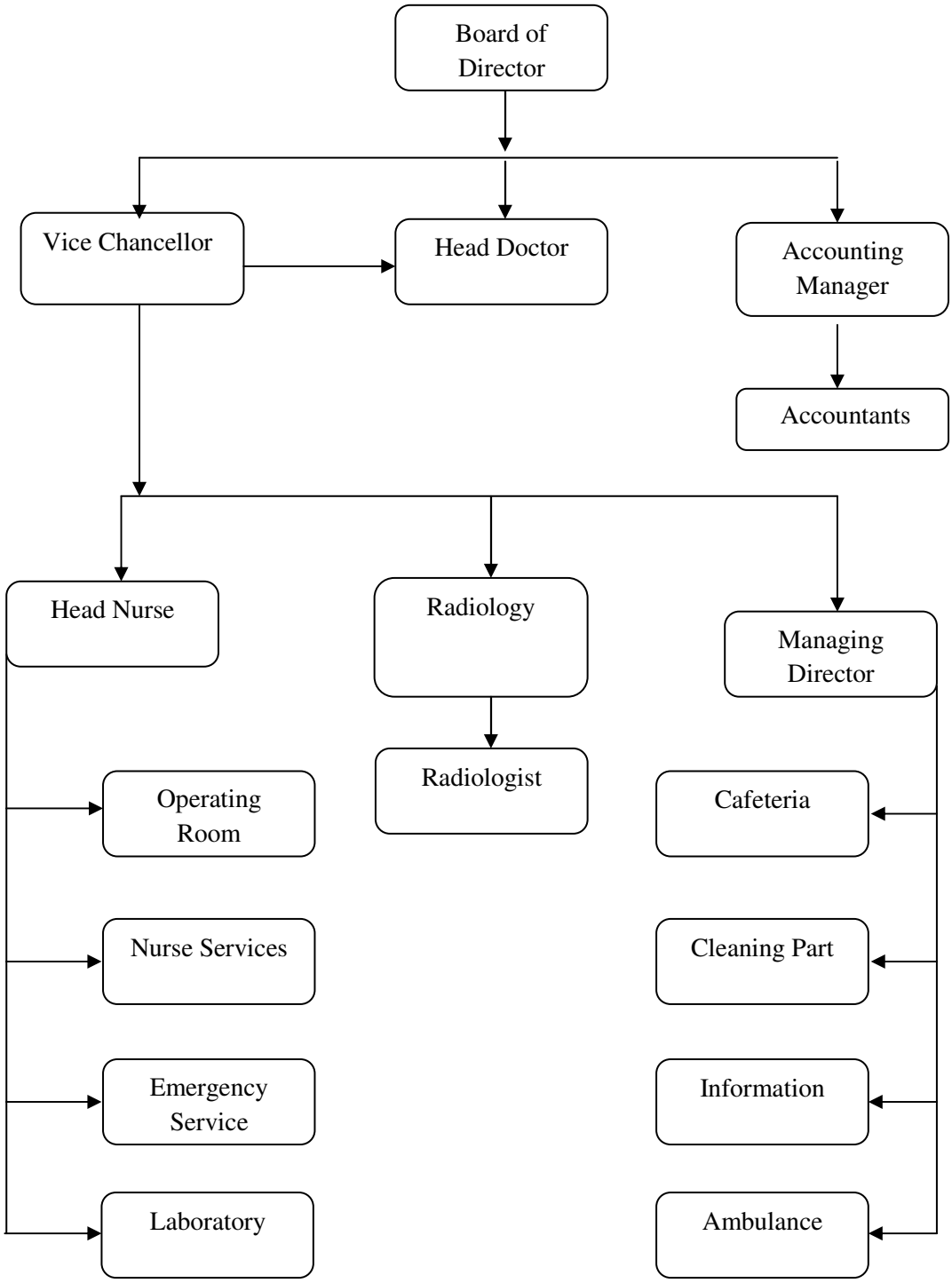


Figure 10. Organization Chart of Mağusa Yaşam Hospital

The organization chart of the hospital indicates that the board of director manages the hospital. In addition, Vice Chancellor and Head Doctor control the organizational activities.

Finally, an accounting manager is responsible from the financial performance of the hospital. Since this study was conducted in the general surgery department, the service flow chart of this department can be given as follows:

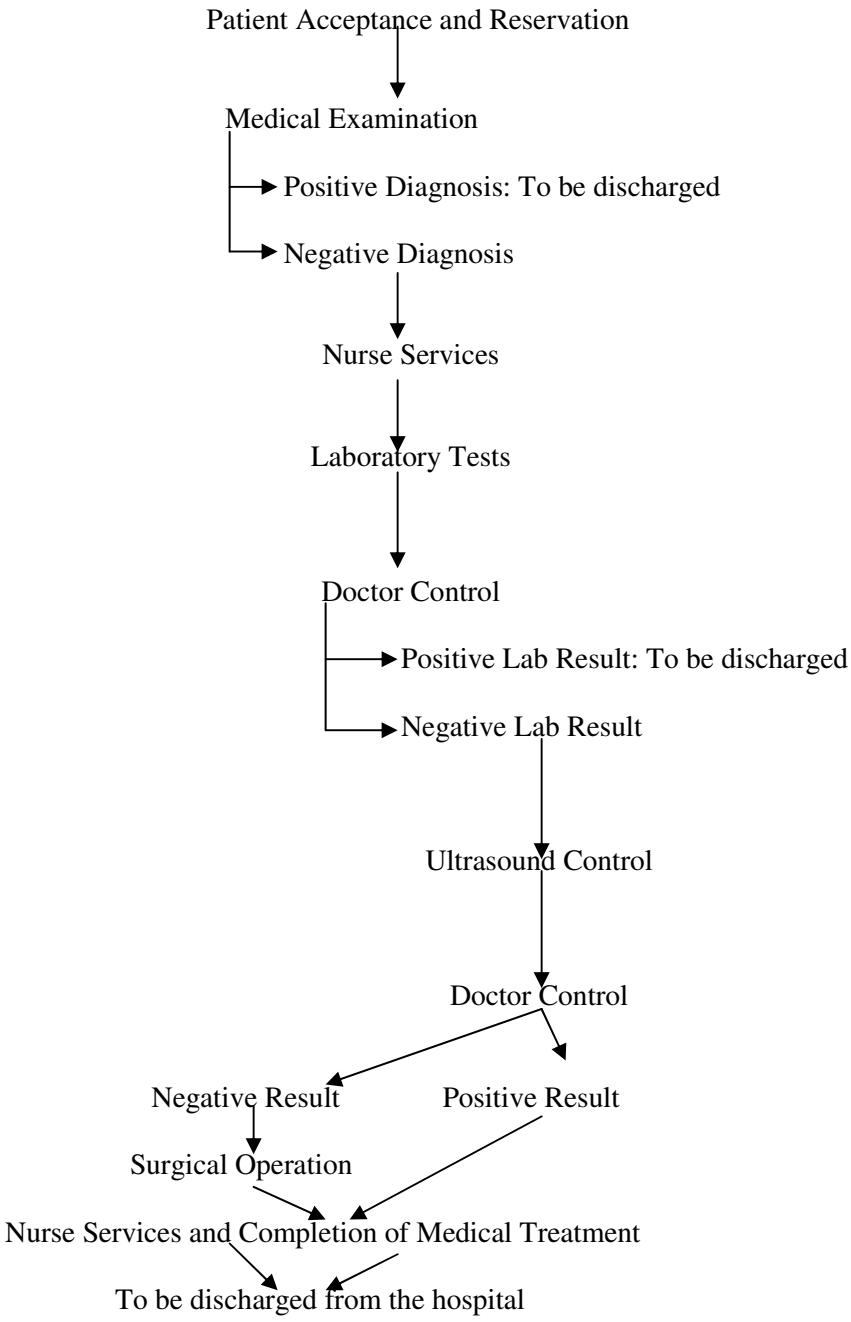


Figure 11. Service Flow Chart of the General Surgery Department

According to Figure 11, the medical examination will be done upon the acceptance of patient. If the diagnosis is positive, the patient will be discharged. However, if the diagnosis

is negative, the patient will be directed to laboratory for doing tests. When the result of the laboratory tests is negative, the patient will be directed to ultrasound control which plays a vital role in a decision making process. In short, it can be said that, after the medical examination process, the results of the ultrasound control and laboratory tests will help surgeon in making a decision with regard to the gallbladder operation.

5.2. 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 Operation: This method requires 120 minutes and patients need 3 days to stay in hospital.

Laparoscopic (Close) Operation: This method requires 90 minutes and patients need 1 day to stay in hospital.

Although the laparoscopic operation is more developed, progressed and cheaper than the open operation, the reasons of the continuity of open operation can be given as follows (Ozyapici, 2008, p. 65):

- 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 the laparoscopic operations.

5.3. The Current Costing System

The open and laparoscopic operations are main cost objects of this study and Mağusa Yaşam Hospital determines their costs by using the traditional system. In this system, direct costs such as doctor costs, nurse and medicine costs, are allocated directly to open and

laparoscopic operations. In addition, overhead costs are assigned to cost objects based on patient-day. In this regard, it can be said that the costs that are transferred to open and laparoscopic operations by hospital managers do not reflect real costs. This is because it relies on an arbitrary allocation of indirect costs that causes over or under applied costs to occur in the hospital. After giving the details of current costing system, the conventional ABC and TDABC systems will be displayed. Finally, the RCA system will be carried out to show the differences between these approaches.

5.3.1. Direct Costs of Open and Laparoscopic Operations

The laparoscopic operation requires 90 minutes and patients need 1 day to stay in the hospital. On the other hand, open operation requires 120 minutes and patients need 3 days to stay in the hospital. In addition, Table 7 displays the direct costs of open and laparoscopic operations as follows:

Table 7
Direct Costs of Open and Laparoscopic Operations

Open Operation (3 times per month)		Laparoscopic Operation (15 times per month)	
Doctor•	₺1,050	Doctor••	₺1,000
Nurse•••	₺90	Nurse•••	₺90
Medicine	₺300	Medicine	₺130
Room	₺360	Room	₺120
Operation Materials	₺350	Operation Materials	₺350
Total Direct Cost:	₺2,150	Total Direct Cost:	₺1,690

• Surgeon ₺450, Assistant Doctor ₺250, Anesthetist ₺350
•• Surgeon ₺400, Assistant Doctor ₺250, Anesthetist ₺350
•••3 nurses*₺30

As shown in Table 7, the total direct costs of open and laparoscopic operations are ₺2,150 and ₺1,690, respectively. Indirect costs should also be added to determine the price of these operations for final customers (patients). The following section will exhibit the indirect costs of the general surgery department.

5.3.2. Indirect Costs of the General Surgery Department

Indirect costs of the general surgery department can be given in Table 8:

Table 8
Indirect Costs of the General Surgery Department

INDIRECT COSTS	
1. Management Costs	10. Communication Costs
2. Personnel Costs	11. Water Consumption Costs
3. Maintenance and Repairing Costs of Medical Instruments and Materials	12. Cleaning Costs
4. Depreciation Costs of Medical Instruments and Materials	13. General Medical Materials and Fuel-Oil Costs
5. Insurance Costs of Medical Instruments and Materials	14. Accounting Department Costs
6. Building Insurance Costs	15. Cafeteria Costs
7. Building Depreciation Costs	16. Laundry Costs
8. Building Maintenance and Repairing Costs	17. Office Requisites and Miscellaneous Costs
9. Electricity Costs	18. Information System Costs

The total amount in Turkish Lira of these cost pools can be calculated below:

1. Management Costs (₺11,500): The management costs can be given as follows:

Surgeon (1 person): The total cost of surgeon is equal to ₺6,000 per month.

Assistant Doctor (1 person): The total cost of assistant doctor is equal ₺4,000 per month.

Anesthetist (1 person): There are 72 surgical operations per month in the hospital and out of this amount, 22 surgical operations take place in the general surgery department. Thus, the general surgery department compensates approximately 30% of the salary of anesthetist. In this regard, the total cost of the anesthetist is equal to ₺1,500 per month.

2. Personnel Costs (₺8,718): The personnel costs can be given as follows:

Customer Service Representatives (10 persons): They give an equal level of service to all branches of hospital so the total cost of the customer service representatives of the general surgery department is equal to ₺1,300/20 departments = ₺650 per month. Notice

that the remaining 2 customer service representatives are giving service to information system so their cost will be included in the information system costs.

Theater Nurses (3 persons): Since 30% of surgeries are done in the general surgery department, the total cost of the theater nurses is equal to 3*₺1,500*30% = ₺1,350 per month.

Nurses (16 persons): There are 332 patient-day for the whole of the hospital. However, the general surgery department has only 62 patient-day per month. Thus, the total cost of the nurses is equal to 16*₺1,500*18.67% = ₺4,481.9 per month.

Gardener (1 person): ₺600/20 departments = ₺30 per month.

Cafeteria Staff (4 persons): There are 332 patient-day for the whole of the hospital. However, the general surgery department has only 62 patient-day per month. Thus, the total cost of the cafeteria staff is equal to 4*₺1,300*18.67% = ₺971.1 per month.

Ambulance Men (4 persons): They give an equal level of service to all branches of hospital so the total cost of the ambulance men is equal to ₺1,300/20 departments = ₺260 per month.

Laboratory Personnel (5 persons): They provide the same level of service to all branches of hospital so the total cost of the laboratory personnel is equal to ₺1,500/20 departments = ₺375 per month.

Radiologists (3 persons): They render service to 550 patients in total and out of this amount, only 55 patients (10 percent of the total) are coming from the department of general surgery. Thus, the total cost of the radiologists is equal to 3*₺2,000*10% = ₺600 per month.

3. Maintenance and Repairing Costs of Medical Instruments and Materials (₺790):
The maintenance and repairing costs can be given as follows:

Cost of Ambulances: In accordance with the observations and interviews, the total ambulance cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺250/20 departments = ₺12.5 per month.

Cost of Laboratory Instruments: In accordance with the observations and interviews, the total laboratory instrument cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺350/20 departments = ₺17.5 per month.

Cost of Surgical Operation Instruments: ₺600 per month.

Cost of General Surgery Medical Control Instruments and Materials: ₺150 per month

General Surgery Ultrasound Cost: In accordance with the observations and interviews, the total ultrasound cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺200/20 departments = ₺10 per month.

4. Depreciation Costs of Medical Instruments and Materials (₺1055): The depreciation costs of medical instruments and materials can be given as follows:

Cost of Laboratory Instruments: In accordance with the observations and interviews, the laboratory instruments are used equally by each department. Thus, the cost to be allocated to the general surgery department is equal to ₺500/20 departments = ₺25 per month.

Cost of Surgical Operation Instruments: ₺800 per month.

Cost of General Surgery Medical Control Instruments and Materials: ₺200 per month.

Cost of Ambulances: In accordance with the observations and interviews, the total ambulance cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺200/20 departments = ₺10 per month.

General Surgery Ultrasound Costs: In accordance with the observations and interviews, the total ultrasound cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺400/20 departments = ₺20 per month.

5. Insurance Costs of Medical Instruments and Materials (₺335.82): The insurance costs of medical instruments and materials can be given as follows:

Cost of Laboratory Instruments: In accordance with the observations and interviews, the laboratory instruments are used equally by each department. Thus, the cost to be allocated to the general surgery department is equal to ₺166.667/20 departments = ₺8.33 per month.

Cost of Surgical Operation Instruments: ₺183.33 per month.

Cost of General Surgery Medical Control Instruments and Materials: ₺125 per month.

Cost of Ambulances: In accordance with the observations and interviews, the total ambulance cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺300/20 departments = ₺15 per month.

General Surgery Ultrasound Costs: In accordance with the observations and interviews, the total ultrasound cost is allocated to all departments equally. Thus, the cost to be allocated to the general surgery department is equal to ₺83.33/20 departments = ₺4.16 per month.

6. Building Insurance Costs (₺150): The total building insurance cost for the whole of the hospital, whose total area is 3,000 m2, is equal to ₺1,500 per month. Since the area of the

general surgery department is 300 m2, ₺150 is calculated as the cost of building insurance cost of the general surgery department.

7. Building Depreciation Costs (₺200): The total building depreciation cost for the whole of the hospital, whose total area is 3,000 m2, is equal to ₺2,000 per month. Since the area of the general surgery department is 300 m2, the cost of building insurance cost of the general surgery department is found to be ₺200.

8. Building Maintenance and Repairing Costs (₺50): The general surgery department covers one-tenth of the hospital's surface so the building insurance cost of the general surgery department is found to be ₺50.

9. Electricity Consumption Costs (₺2,600): The total electricity consumption cost of the general surgery department is ₺2,600 per month.

10. Communication Costs (₺200): The total communication cost of the general surgery department is ₺200 per month.

11. Water Consumption Costs (₺60): The total water consumption cost of the general surgery department is ₺60 per month.

12. Cleaning Costs (₺725): The total cleaning cost (5 Cleaners + Cleaning Materials) for the whole of the hospital, whose total area is 3,000 m2, is equal to ₺7,250 per month. Since the area of the general surgery department is 300 m2, the cleaning cost of the general surgery department is found to be ₺725.

13. General Medical Materials and Fuel-Oil Costs (₺3,240): The total cost of the general medical materials and fuel-oil of the hospital which has 1,100 patients per month is equal to ₺27,000. However, the general surgery department has only 132 patients per month so the general medical materials and fuel-oil cost is found to be ₺27,000*(132/1,100) = ₺3,240 per month.

14. Accounting Department Costs (₺468): The total cost of the accounting department of the hospital which has 1,100 patients per month is equal to ₺3,900. However, the general surgery department has only 132 patients per month so the accounting department cost is found to be ₺3,900*(132/1,100) = ₺468 per month.

15. Cost of Cafeteria (Meal) (₺1,867.5): There are 332 patient-day for the whole of the hospital. However, the general surgery department has only 62 patient-day per month. Thus, the total cost of the meal of the general surgery department is equal to ₺10,000*18.67% = ₺1,867.5 per month.

16. Laundry Costs (₺150): Mağusa Yaşam Hospital pays ₺3,000 as a fixed cost to a laundry company for each month. This expense is equally recognized by each department so the laundry cost of the general surgery department is equal to ₺3,000/20 departments = ₺150 per month.

17. Office Requisites and Miscellaneous Costs (₺36): The total office requisites and miscellaneous cost of the general surgery department is ₺36 per month.

18. Information System Costs (₺155): The information system cost pool includes the costs of both computers and 2 customer service representatives. The costs of customer service representatives and computers are equal to ₺2,600 and ₺500, respectively, for the whole of the hospital. Thus, the information system cost of the general surgery department is equal to ₺3,100/20 departments = ₺155 per month.

In accordance with the calculations given above, the overhead costs of the general surgery department can be summarized in Table 9:

Table 9
Overhead Costs of the General Surgery Department

Indirect Costs	Total (₺ per month)
1. Management Costs	11,500
2. Personnel Costs	8,718
3. Maintenance and Repairing Costs of Medical Instruments and Materials	790
4. Depreciation Costs of Medical Instruments and Materials	1,055
5. Insurance Costs of Medical Instruments and Materials	335.82
6. Building Insurance Costs	150
7. Building Depreciation Costs	200
8. Building Maintenance and Repairing C.	50
9. Electricity Costs	2,600
10. Communication Costs	200
11. Water Consumption Costs	60
12. Cleaning Costs	725
13. General Medical Materials and Fuel-Oil	3,240
14. Accounting Department Costs	468
15. Cafeteria (Meal) Costs	1,867.5
16. Laundry Costs	150
17. Office requisites and Miscellaneous Costs	36
18. Information System Costs	155
Total:	₺32,300.32 per month

The management of the hospital allocates overhead costs to open and laparoscopic operations on the basis of patient-day. As noted earlier, there are 62 patient-day per month for the general surgery department. In this respect, the total overhead cost, ₺32,300.32, is first divided by the total number of patient-day, 62 patient-day, in order to find the cost of one patient-day which will be equal to ₺520.97. Then, that amount will be multiplied by numbers of patient-day needed by open and laparoscopic operations to allocate overhead costs to these operations. Table 10 discloses the costs of open and laparoscopic operations calculated by the current costing system of the hospital.

Table 10
Costs of Open and Laparoscopic Operations in Traditional System

	Open Operation	Laparoscopic Operation
Direct	₺2,150	₺1,690
Indirect	₺1,562.91	₺520.97
Total	**₺3,712.91**	**₺2,210.97**
Sales Price	₺4,250	₺3,250

As shown in Table 10, the cost of the open operation is higher than the laparoscopic operation. This is because the open operation needs a higher patient-day, which is the overhead allocation base, in comparison to the laparoscopic operation. Indeed, a patient having open operation needs 3 patient-day to stay in the hospital whereas only one day is enough for the patients to stay in the hospital having laparoscopic operation.

5.4. Implementing Activity Based Costing To Mağusa Yaşam Hospital

Activities, cost drivers, relations between activities and costs must be determined so as to implement the ABC system. Consequently, activities of the general surgery department of Mağusa Yaşam Hospital will first be presented. Then, first stage cost drivers will be determined to allocate overhead costs to the activities.

5.4.1. Identifying Activities of the General Surgery Department

After comprehensive observations and interviews, nine major activities that are performed in the general surgery department were identified. These activities can be ordered as follows:

Activity (A)1: 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 operation.

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

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

A9: Giving Morale, Completion of Treatment and Patient Discharging: Patient control, instruct to patient, paying attention to patient and discharging.

5.4.2. The Identification of First Stage Cost Drivers

Once the activities have been identified, determining how resources are concerned with the activities is the next step in the ABC system. Thus, the first stage cost drivers and their relationships with the activities are given in Tables 11 and 12, respectively:

Table 11
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 Costs	m2
9. Electricity 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 Costs	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 Costs	Number of Patient
18. Information System Costs	Number of Computer

Table 12

Relationship Between First Stage Cost Drivers and Activities

Activities	No. of Employee	No. of Medical Instruments	m2(General Surgery)	No. of Patient	No. of Medical Materials Used	No. of Meal	No. of Computer
A1: Patient Acceptance and Discharging	10/20 Customer service representative 4/20 Ambulance men	3/20 ambulance	28 m2	132	-		3
A2: Medical Examination of Patient	Surgeon(He spends 60% of his time)	2	88 m2	132	396		1
A3: Laboratory Test	5 Laboratory personnel/20 departments	6/20	8 m2	80	400		1
A4: Ultrasound	3 Radiologists (They spend 10% of their time)	1	10 m2	55	110		1
A5: Nurse Services before Hospitalization	7 Nurses/20 departments	-	20 m2	110	220		
A6: Surgical Operation	Surgeon (40%) Assist. Dr. (80%) Anesthetist (30%) 3 Nurses/20 departments	6	100 m2	22	220		1
A7: Nurse Services after Hospitalization	7 Nurses/20 departments	-	20 m2	66	132		1
A8: Cafeteria (Meal) Services	4 Kitchen personnel/20 departments	-	6 m2	52	-	200	
A 9: Giving Morale and Patient Discharging	2 Nurses/20 departments Gardener/20 departments Assist. Dr. (20%)	-	20 m2	132	132		
Total:			300 m2	781	1,610	200	8

After the relationship between first stage cost drivers and activities are determined, the next step, which will be given in the following section, is to calculate the costs of the activities.

5.4.3. Calculating the Cost of the Activities

The relationship between costs and activities, which is given in Table 13, should first be identified in order to calculate the cost of the activities.

Table 13
Relationship Between Costs and Activities

Costs	A1	A2	A3	A4	A5	A6	A7	A8	A9
1. Management Costs	x	x				x			
2. Personnel Costs	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 Depreciation Costs	x	x	x	x	x	x	x	x	x
8. Building Maintenance and Repairing Costs	x	x	x	x	x	x	x	x	x
9. Electricity Costs	x	x	x	x	x	x	x	x	x

Table 13 (continued)

Costs	A1	A2	A3	A4	A5	A6	A7	A8	A9
10. Communication Costs	x	x	x	x	x	x	x	x	x
11. Water Consumption Costs	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 Costs		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		

Costs are allocated to activities by considering the relationship between them. In this regard, the calculations of costs of the activities can be given below:

1- Allocating Management Costs to Activities

Management costs are allocated to second, sixth, and ninth activities as follows:

A2

Cost of Surgeon: ₺6,000*0.60 = ₺3,600 (Surgeon spends 60% of his time for this activity)

A6

Cost of Surgeon: ₺6,000*0.40 = ₺2,400 (Surgeon spends 40% of his time for this activity)
Cost of Assistant Doctor: ₺4,000*0.80 = ₺3,200 (Assistant Doctor spends 80% of his time for this activity)
Cost of Anesthetist: ₺1,500

A9

Cost of Assistant Doctor: ₺4,000*0.20 = ₺800 (Assistant Doctor spends 20% of his time for this activity)

2- Allocating Personnel Costs to Activities

Personnel costs are allocated to first, third, fourth, fifth, sixth, seventh, eighth and ninth activities as follows:

A1

Cost of Customer Service Representatives: ₺650
Cost of Ambulance Men: ₺260

A3

Cost of Laboratory Personnel: ₺375

A4

Cost of Radiologists: ₺600

A5

Cost of Nurses: ₺1,960.83

A6

Cost of Theater Nurses: ₺1,350

A7

Cost of Nurses: ₺1,960.83

A8

Cost of Kitchen Personnel: ₺971.1

A9

Cost of Nurses: ₺560.24
Cost of Gardener: ₺30

3- Allocating Maintenance and Repairing Costs of Medical Instruments and Materials to Activities

Maintenance and Repairing Costs of Medical Instruments and Materials are allocated to first, second, third, fourth, and sixth activities as follows:

A1

Ambulance Costs: ₺12.5

A2

Cost of General Surgery Medical Control Instruments and Materials: ₺150

A3

Cost of Laboratory Instruments: ₺17.5

A4

General Surgery Ultrasound Costs: ₺10

A6

Costs of Surgical Operation Instruments: ₺600

4- Allocating Depreciation Costs of Medical Instruments and Materials to Activities

Depreciation Costs of Medical Instruments and Materials are allocated to first, second, third, fourth, and sixth activities as follows:

A1

Ambulance Costs: ₺10

A2

Cost of General Surgery Medical Control Instruments and Materials: ₺200

A3

Cost of Laboratory Instruments: ₺25

A4

General Surgery Ultrasound Costs: ₺20

A6

Costs of Surgical Operation Instruments: ₺800

5- Allocating Insurance Costs of Medical Instruments and Materials to Activities

Insurance Costs of Medical Instruments and Materials are allocated to first, second, third, fourth, and sixth activities as follows:

A1

Ambulance Costs: ₺15

A2

Cost of General Surgery Medical Control Instruments and Materials: ₺125

A3

Cost of Laboratory Instruments: ₺8.33

A4

General Surgery Ultrasound Costs: ₺4.16

A6

Costs of Surgical Operation Instruments: ₺183.33

6- Allocating Building Insurance Costs to Activities

Building Insurance Costs are allocated to all activities. The total area of the hospital is 3,000 m2. However, the area of general surgery department is only 300 m2. Thus, the total building insurance cost is first divided by ten, and then the area needed by each activity is multiplied by the cost per square meter. This can be shown below:

Building insurance cost for overall hospital is equal to ₺1,500. Thus, the building insurance cost of the general surgery department becomes ₺150. In this regard, the cost per square meter is found to be ₺0.5 (₺150/300 m2).

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

7- Allocating Building Depreciation Costs to Activities

Building Depreciation Costs are allocated to all activities. It is important to note that the cost per square meter is found to be ₺0.667 (₺200/300 m2). In this respect, the calculations can be given below:

A1
28 m2*₺0.667 per m2 = ₺18.68
A2
88 m2*₺0.667 per m2 = ₺58.7
A3
8 m2*₺0.667 per m2 = ₺5.34
A4
10 m2*₺0.667 per m2 = ₺6.67
A5
20 m2*₺0.667 per m2 = ₺13.34
A6
100 m2*₺0.667 per m2 = ₺66.7
A7
20 m2*₺0.667 per m2 = ₺13.34
A8
6 m2*₺0.667 per m2 = ₺4
A9
20 m2*₺0.667 per m2 = ₺13.34

8- Allocating Building Maintenance and Repairing Costs to Activities

Building Maintenance and Repairing Costs are allocated to all activities. It is important to note that the cost per square meter is found to be ₺0.167 (₺50/300 m2). In this respect, the calculations can be given as follows:

A1
28 m2*₺0.167 per m2 = ₺4.68
A2
88 m2*₺0.167 per m2 = ₺14.7
A3
8 m2*₺0.167 per m2 = ₺1.34
A4
10 m2*₺0.167 per m2 = ₺1.67
A5
20 m2*₺0.167 per m2 = ₺3.34
A6
100 m2*₺0.167 per m2 = ₺16.7
A7
20 m2*₺0.167 per m2 = ₺3.34
A8
6 m2*₺0.167 per m2 = ₺1
A9
20 m2*₺0.167 per m2 = ₺3.34

9- Allocating Electricity Costs to Activities

Electricity Costs are allocated to all activities. Notice that the cost per square meter is found to be ₺8.667 (₺2,600/300 m2). In this respect, the calculations can be given as follows:

A1
28 m2*₺8.667 per m2 = ₺242.67
A2
88 m2*₺8.667 per m2 = ₺762.69
A3
8 m2*₺8.867 per m2 = ₺69.34
A4
10 m2*₺8.667 per m2 = ₺86.67
A5
20 m2*₺8.667 per m2 = ₺173.34
A6
100 m2*₺8.667 per m2 = ₺866.7
A7
20 m2*₺8.667 per m2 = ₺173.34
A8
6 m2*₺8.667 per m2 = ₺52.001
A9
20 m2*₺8.667 per m2 = ₺173.34

10- Allocating Communication Costs to Activities

Communication Costs are allocated to activities on the basis of number of patients. The cost per patient is found to be ₺0.256 (₺200/781 patients). In this regard, the calculations can be shown as follows:

A1
132 patients*₺0.256 per patient = ₺33.79
A2
132 patients*₺0.256 per patient = ₺33.79
A3
80 patients*₺0.256 per patient = ₺20.48
A6
22*₺0.256 per patient = ₺5.63
A7
66*₺0.256 per patient = ₺16.89
A8
52*₺0.256 per patient = ₺13.31

A4
55 patients*₺0.256 per patient = ₺14.08
A5
110 patients*₺0.256 per patient = ₺28.16
A9
132*₺0.256 per patient = ₺33.79

11- Allocating Water Consumption Costs to Activities

Water Consumption Costs are allocated to activities on the basis of number of patients. The cost per patient is found to be ₺0.077 (₺60/781 patients). In this regard, the calculations can be shown as follows:

A1
132 patients*₺0.077 per patient = ₺10.16
A2
132 patients*₺0.077 per patient = ₺10.16
A3
80 patients*₺0.077 per patient = ₺6.16
A4
55 patients*₺0.077 per patient = ₺4.24
A5
110 patients*₺0.077 per patient = ₺8.47
A6
22*₺0.077 per patient = ₺1.69
A7
66*₺0.077 per patient = ₺5.08
A8
52*₺0.077 per patient = ₺4.004
A9
132*₺0.077 per patient = ₺10.16

12- Allocating Cleaning Costs to Activities

Cleaning Costs are allocated to all activities. It is important to note that the cost per square meter is found to be ₺2.42 (₺725/300 m2). In this respect, the calculations can be given as follows:

A1
28 m2*₺2.42 per m2= ₺67.76
A2
88 m2*₺2.42 per m2= ₺212.96
A3
8 m2*₺2.42 per m2= ₺19.36
A4
10 m2*₺2.42 per m2= ₺24.2
A5
20 m2*₺2.42 per m2= ₺48.4
A6
100 m2*₺2.42 per m2= ₺242
A7
20 m2*₺2.42 per m2= ₺48.4
A8
6 m2*₺2.42 per m2= ₺14.52
A9
20 m2*₺2.42 per m2= ₺48.4

13- Allocating General Medical Materials and Fuel-Oil Costs to Activities

General Medical Materials and Fuel-Oil Costs are allocated to all activities. It is important to note that the cost per number of medical materials used is found to be ₺2.012 (₺3,240/1,610 medical materials used). In this respect, the calculations can be given as follows:

A1
₺0
A2
396 materials*₺2.012 per material = ₺796.75
A3
400 materials*₺2.012 per material = ₺804.8
A4
110 materials*₺2.012 per material = ₺221.32
A5
220 materials*₺2.012 per material = ₺442.64
A6
220 materials*₺2.012 per material = ₺442.64
A7
132 materials*₺2.012 per material = ₺265.58
A8
₺0
A9
132 materials*₺2.012 per material = ₺265.58

14- Allocating Accounting Department Costs to Activities

Accounting Department Costs are allocated to activities on the basis of number of patients. In this regard, the cost per patient is found to be ₺0.599 (₺468/781 patients). All calculations can also be shown as follows:

A1
132 patients*₺0.599 per patient = ₺79.068
A2
132 patients*₺0.599 per patient = ₺79.068
A3
80 patients*₺0.599 per patient = ₺47.92
A4
55 patients*₺0.599 per patient = ₺32.945
A5
110 patients*₺0.599 per patient = ₺65.89
A6
22*₺0.599 per patient = ₺13.178
A7
66*₺0.599 per patient = ₺39.534
A8
52*₺0.599 per patient = ₺31.148
A9
132*₺0.599 per patient = ₺79.068

15- Allocating Meal Costs to Activities

A total of ₺1,867.5 meal cost is allocated to the fifteenth activity only.

16- Allocating Laundry Costs to Activities

Laundry Costs are allocated to activities on the basis of number of patients. In this regard, the cost per patient is found to be ₺0.192 (₺150/781 patients). All calculations can also be shown as follows:

A1
132 patients*₺0.192 per patient = ₺25.344
A2
132 patients*₺0.192 per patient = ₺25.344
A3
80 patients*₺0.192 per patient = ₺15.36
A4
55 patients*₺0.192 per patient = ₺10.56
A5
110 patients*₺0.192 per patient = ₺21.12
A6
22*₺0.192 per patient = ₺4.224
A7
66*₺0.192 per patient = ₺12.67
A8
52*₺0.192 per patient = ₺9.98
A9
132*₺0.192 per patient = ₺25.344

17- Allocating Office Requisites and Miscellaneous Costs to Activities

Office Requisites and Miscellaneous Costs are allocated to activities on the basis of number of patients. In this regard, the cost per patient is found to be ₺0.046 (₺36/781 patients). All calculations can also be shown as follows:

A1
132 patients*₺0.046 per patient = ₺6.072
A2
132 patients*₺0.046 per patient = ₺6.072
A3
80 patients*₺0.046 per patient = ₺3.68
A4
55 patients*₺0.046 per patient = ₺2.53
A5
110 patients*₺0.046 per patient = ₺5.06
A6
22*₺0.046 per patient = ₺1.01
A7
66*₺0.046 per patient = ₺3.036
A8
52*₺0.046 per patient = ₺2.39
A9
132*₺0.046 per patient = ₺6.072

18- Allocating Information System Costs to Activities

Information System Costs are allocated to activities on the basis of number of computers. In this regard, the cost per computer is found to be ₺19.375 (₺155/8 computers). All calculations can also be shown as follows:

A1
3 computers*₺19.375 per computer = ₺58.125

A2
1 computer*₺19.375 per computer = ₺19.375

A3
1 computer*₺19.375 per computer = ₺19.375

A4
1 computer*₺19.375 per computer = ₺19.375

A5
₺0

A6
1 computer*₺19.375 per computer = ₺19.375

A7
1 computer*₺19.375 per computer = ₺19.375

A8
₺0

A9
₺0

The total cost of the activities can be collected into Table 14 as follows;

Table 14
Total Cost of The Activities

	A1	A2	A3	A4	A5	A6	A7	A8	A9	Total(₺)
1.Management Costs	-	3,600	-	-	-	7,100	-	-	800	11,500
2. Personnel Costs	910		375	600	1,960.8	1,350	1,960.8	971.1	590.24	8,718
3.Main. and Repair. Costs of Medical Instruments and Materials	12.5	150	17.5	10	-	600	-	-	-	790
4.Depreciation Costs of Med. Instr. and Materials	10	200	25	20	-	800	-	-	-	1,055
5. Insurance Costs of Medical Instruments and Materials	15	125	8.33	4.16	-	183.33	-	-	-	335.82
6. Building Insurance Costs	14	44	4	5	10	50	10	3	10	150
7. Building Depreciation	18.68	58.7	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	242.67	762.69	69.34	86.67	173.34	866.7	173.34	52.001	173.34	2,600.091
10. Communication	33.79	33.79	20.48	14.08	28.16	5.63	16.89	13.31	33.79	199.92

Table 14 (continued)

	A1	A2	A3	A4	A5	A6	A7	A8	A9	Total(₺)
11. Water Consumption	10.16	10.16	6.16	4.24	8.47	1.69	5.08	4.004	10.16	60.124
12. Cleaning Costs	67.76	212.96	19.36	24.2	48.4	242	48.4	14.52	48.4	726
13. General Medical Materials and Fuel-Oil Costs	-	796.75	804.8	221.32	442.64	442.64	265.58	-	265.58	3,239.31
14. Accounting Department Costs	79.068	79.068	47.92	32.945	65.89	13.178	39.534	31.148	79.068	467.819
15. Meal Costs	-	-	-	-	-	-	-	1,867.5	-	1,867.5
16. Laundry Costs	25.344	25.344	15.36	10.56	21.12	4.224	12.67	9.98	25.344	149.95
17. Office Requisites and miscellaneous Costs	6.072	6.072	3.68	2.53	5.06	1.01	3.036	2.39	6.072	35.92
18. Information System Costs	58.125	19.375	19.375	19.375	-	19.375	19.375	-	-	155
Total:(₺)	1,507.85	6,138.61	1442.99	1,063.42	2,780.59	11,763.18	2,571.42	2,973.95	2,058.67	32,300.68

The total costs of the activities are presented at the last row of Table 14. The next step to be done is to determine the second stage cost drivers.

5.4.4. The Identification of Second Stage Cost Drivers

As noted earlier, the first stage cost drivers disclose the relationship between costs and activities. However, the second stage cost drivers show the relationship between activities and cost objects (products or services). In this regard, the second stage cost drivers can be given below:

Table 15
Second Stage Cost Drivers

Activities	Cost of Activities	Second Stage Cost Drivers
A1: Patient Acceptance and Discharging	₺1,507.85	Number of Patient
A2: Medical Examination	₺6,138.609	Number of Patient
A3: Laboratory Test	₺1,442.99	Number of Test
A4: Ultrasound Control	₺1,063.42	Time
A5: Nurse Services before Hospitalization	₺2,780.59	Number of Interferences
A6: Surgical Operation	₺11,763.18	Time
A7: Nurse Services after Hospitalization	₺2,571.42	Number of Interferences
A8: Cafeteria Services	₺2,973.95	Number of Meal
A 9: Giving Morale and Patient Discharging	₺2,058.674	Number of Interferences

The second stage cost drivers given in Table 15 are used to assign costs of activities to both open and laparoscopic operations.

5.4.5. Trace Activity Costs to Cost Objects

The open and laparoscopic operations, as mentioned before, are the cost objects of this study. By using the second stage cost drivers presented in Table 15, the costs of activities

are allocated to these operations. Thus, as presented below, it is needed to compute costs per cost drivers:

A1: Patient Acceptance and Discharging (₺1,507.85)

There are 132 patients per month for the general surgery department so the cost of this activity is divided by the number of patients to find cost per patient: ₺1,507.85/132 patients= ₺11.42 per patient.

A2: Medical Examination of Patient (₺6,138.609)

There are 132 patients that require medical examination per month in the general surgery department. Thus, the medical examination cost per patient is calculated as: ₺6,138.609/132 patients= ₺46.5 per patient.

A3: Laboratory Tests (₺1,442.99)

Each patient who has had gallbladder surgery needs 6 tests. At the same time, each of four other surgical operations needs 6 tests and 110 patients without surgical operations require 232 tests in average (There is an average of 58 patients at risk and doctor needs laboratory results to recognize their real situation: 58*4 tests = 232 tests). Thus, 364 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: 15 patients*6 tests per patient =	90 tests
Other Surgical Operations: 4 patients*6 tests per patient =	24 tests
Patients without Surgical Operations: 58 patients*4 tests =	232 tests
Total:	364 tests

so the cost per test is calculated as: ₺1,442.99/364 tests = ₺3.96 per test.

A4: Ultrasound Control (₺1,063.42)

The open and laparoscopic surgery patients require 35 and 30 minutes respectively for the ultrasound control. In addition, other surgical patients require 30 minutes. Moreover, out of 58 patients who need laboratory tests, ultrasound control becomes compulsory for 33 high-risk patients after the doctor examines their laboratory results. These patients need 25 minutes only for ultrasound control.

Open Operations: 3 patients*35 minutes =	105 minutes
Laparoscopic Operations: 15 patients*30 minutes =	450 minutes
Other Surgical Operations: 4 patients*30 minutes =	120 minutes
Patients without Surgical Operations: 33 patients *25 minutes =	825 minutes
Total:	1,500 minutes

so the cost per minute is calculated as: ₺1,063.42/1500 minutes = ₺0.709 per minute.

A5: Nurse Services before Hospitalization (₺2,780.59)

In the general surgery department, there are 4, 5 and 4 interferences for each laparoscopic, open and other surgical operation, respectively. In addition, totally 176 interferences are required for the remaining 110 patients.

Open Operations: 3 patients*5 interferences =	15 interferences
Laparoscopic Operations: 15 patients*4 interferences =	60 interferences
Other Surgical Operations: 4 patients*4 interferences =	16 interferences
Patients without Surgical Operations: 88 patients*2 interferences =	176 interferences
Total:	267 interferences

so the cost per interference is calculated as: ₺2,780.59/267 interferences = ₺10.42 per interference.

A6: Surgical Operation (₺11,763.18)

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

Open Operations: 3 patients*120 minutes =	360 minutes
Laparoscopic Operations: 15 patients*90 minutes =	1,350 minutes
Other Surgical Operations: 4 patients*90 minutes =	360 minutes
Total:	2,070 minutes

so the cost per minute is calculated as: ₺11,763.18/2,070 minutes = ₺5.68 per minute.

A7: Nurse Services after Hospitalization (₺2,571.42)

Each patient who has had operation requires 24 interferences. At the same time, 110 patients without surgical operations require approximately 90 interferences. As a result, 856 interferences are totally found per month in the general surgery department. The calculation can be given as follows:

Open Operations: 3 patients*24 interferences*3 patient-day =	216 interferences
Laparoscopic Operation: 15 patients*24 interferences*1 patient-day =	360 interferences
Other Surgical Operations: 4 patients*24 interferences*2 patient-day =	192 interferences
Patients without Surgical Operations: 30 patients*12 interferences =	360 interferences
Total:	1,128 interferences

so the cost per interference is calculated as: ₺2,571.42/1,128 interferences = ₺2.28 per interference.

A8: Meal Services (₺2,973.95)

In the general surgery department, meals are distributed to patients who have had gallbladder surgery 3 times each day. 30 patients out of 110 patients without surgical operations need to stay in the hospital for one day and meals are distributed to them 3 times each day. Moreover, an additional 14 meals are prepared for unexpected patients who can come suddenly to the hospital. This can be summarized below:

Open Operations: 3 patients*3 times a day*3 patient-day =	27 meals
Laparoscopic Operation: 15 patients*3 times a day*1 patient-day =	45 meals
Other Surgical Operations: 4 patients*3 times a day*2 patient-day =	24 meals
Patients without Surgical Operations: 30 patients*3 times a day*1 patient-day =	90 meals
A confidence interval (for unexpected patients)	14 meals
Total:	200 meals

so the cost per meal is calculated as: ₺2,973.95/200 meals = ₺14.87 per meal.

A9: Giving Morale, Completion of Treatment and Patient Discharging (₺2,058.674)

Nurses render services 3 times to open surgery patients and twice to laparoscopic surgery patients in a day. Simultaneously, each patient who has had other surgical operations requires services twice a day. Moreover, 110 services are rendered to the remaining 110 patients (each patient requires service only once a day) by nurses. An assistant doctor renders also services 3 times to open surgery patients and twice to laparoscopic surgery patients in a day. In addition, each of two other surgical operations requires services twice a day. Moreover, 110 services are rendered to the remaining 110 patients. This can be summarized as follows:

Nurse Services	
Open Operations: 3 patients*3 interferences =	9 interferences
Laparoscopic Operations: 15 patients*2 interferences =	30 interferences
Other Surgical Operations: 4 patients*2 interferences =	8 interferences
Patients without Surgical Operations: 110 patients*1 interference =	110 interferences
Services of Assistant Doctor	
Open Operations: 3 patients*2 interferences =	6 interferences
Laparoscopic Operations: 15 patients*2 interferences =	30 interferences
Other Surgical Operations: 4 patients*2 interferences =	8 interferences
Patients without Surgical Operations: 110 patients*1 interference =	110 interferences
Total:	311 interferences

so the cost per interference is calculated as: ₺2,058.674/311 interferences = ₺6.62 per interference.

Activity rates that are calculated above will be used to allocate overhead costs to the cost objects. Thus, these rates and the final costs of open and laparoscopic operations can be given in Table 16:

Table 16
Costs of Open and Laparoscopic Gallbladder Operations in the ABC System

Activities	Assigning Ratio	Open Operation Factor	Laparoscopic Operation Factor	Cost of Open Operation	Cost of Laparoscopic Operation
A1	₺11.42 per patient	1 patient	1 patient	11.42	11.42
A2	₺46.5 per patient	1 patient	1 patient	46.5	46.5
A3	₺3.96 per test	6 tests	6 tests	23.76	23.76
A4	₺0.709 per minute	35 minutes	30 minutes	24.815	21.27
A5	₺10.42 per interference	5 interferences	4 interferences	52.1	41.68
A6	₺5.68 per minute	120 minutes	90 minutes	681.6	511.2
A7	₺2.28 per interference	72 interferences	24 interferences	164.16	54.72
A8	₺14.87 per meal	9 meals	3 meals	133.83	44.61
A9	₺6.62 per interference	5 interferences	4 interferences	33.1	26.48
			Total (₺):	1,071.285	781.64

Table 16 indicates that the costs to be allocated to open and laparoscopic operations are ₺1,071.285 and ₺781.64, respectively. In this regard, it can be said that the results of the TCS and Conventional ABC systems given in Table 17 are different from each other.

Table 17
TCS versus Conventional ABC

Traditional Cost System	**Open Gallbladder Operation**	**Laparoscopic Gallbladder Operation**
Direct	₺2,150	₺1,690
Indirect	₺1,562.91	₺520.97
Total	**₺3,712.91**	**₺2,210.97**
Conventional ABC		
Direct	₺2,150	₺1,690
Indirect	₺1,071.285	₺781.64
Total	**₺3,221.285**	**₺2,471.64**

When Table 17 is analyzed, it is evident that the costs assigned to laparoscopic operation, contrary to the existing traditional system, will be higher in the ABC system. In addition, the ABC system assigns lower costs to open operation than the TCS system. In other words, the ABC system states that open gallbladder operation should be decreased from ₺3,712.91 to ₺3,221.285. In contrast, the cost of laparoscopic gallbladder operation should be increased from ₺2,210.97 to ₺2,471.64

5.5. Implementing Time Driven Activity Based Costing To Mağusa Yaşam Hospital

The TDABC system determines activities and their costs as in the conventional ABC system. In contrary to the conventional ABC, the TDABC system uses time only as a cost driver to allocate activity costs to products. It is important to emphasize that the first stage of the conventional ABC system will be used in this study. In other words, activities costs found in the conventional ABC system will be used at the preliminary stages of the TDABC systems. This is because both systems have the same logic in the allocation of overhead costs to activities. In this regard, the calculations of costs of the open and laparoscopic operations can be given as follows:

5.5.1. Patient Acceptance and Discharging (₺1,507.85)

In accordance with the observations and interviews, the costs of this activity are occurred by the services of customer representatives and ambulance men. Thus, the costs of customer representatives and ambulance men should first be determined. In this respect, their direct costs can easily be identified. However, costs that are not directly related to them should be determined and added to their direct costs by considering a proper allocation basis.

Cost of Ambulance and Ambulance Men: In addition to the services of ambulance men, the costs of ambulances should be considered in this cost pool. The calculations needed to find the cost of ambulance & ambulance men are given below:

Direct Costs of Ambulance&Ambulance Men (₺297.5): ₺260 (Personnel Cost) + ₺12.5 (Maintenance and Repairing Cost) + ₺10 (Depreciation Cost) + ₺15 (Insurance Cost)

Indirect Costs of Ambulance&Ambulance Men (₺179.51): ₺14 (Building Insurance Cost) + ₺18.68 (Building Depreciation Cost) + ₺4.68 (Building Maintenance & Repairing Cost) + ₺242.67 (Electricity Cost) + ₺10.16 (Water Cost) + ₺67.76 (Cleaning Cost) + ₺79.068 (Accounting Department Cost) + ₺25.344 (Laundry Cost) + ₺6.072 (Office Requisites and Miscellaneous Cost) + ₺58.125 (Information System Cost)

The total indirect cost for 132 patients is ₺526.559. However, when 45 patients, who are carried by ambulance, are considered, it can be said that ₺179.51 is found to be the indirect cost of ambulance & ambulance men. Thus, the total cost of Ambulance&Ambulance Men is equal to ₺477.01

Cost of Customer Service Representatives: The calculations needed to find the cost of customer service representatives are given below:

Direct Costs of Customer Service Representatives (₺683.79): ₺650 (Personnel Cost) + ₺33.79 (Communication Cost)

Indirect Costs of Customer Service Representatives (₺347.049): ₺526.559 (Total indirect cost of the first activity) - ₺179.51 (Cost allocated to the ambulance&ambulance men cost pool)

After calculating the costs of the subprocesses, the next step is to allocate their costs to the open and laparoscopic operations. This can be done as follows:

Subprocess 1: Ambulance and Ambulance Men (₺477.01)

First of all, the time needed by the ambulance men can be given as follows:

	Ambulance Services	Minutes	Total (min)
Open Operation:	1	45	45
Laparoscopic Operation:	1	45	45
Other Surgical Operation:	1	45	45
Patient without Operation:	42	40	1,680
	45		1,815 min

The ambulance men in the hospital work 312 days or 149,760 minutes per year. Each of them spends about 28,080 minutes (18.75% of their time) for breaks, training and education. The remaining 121,680 minutes per year is equal to 10,140 minutes per month. In this regard, the practical capacity of the ambulance men and their capacity cost rates can be given as follows:

Practical Capacity of the Ambulance Men: 4/20 ambulance men*10,140 minutes= 2,028 minutes (4 ambulance men giving service equally to 20 departments have 2,028 minutes as a practical capacity for the activity of Patient Acceptance and Discharging)

Capacity Cost Rate: ₺477.01/2028 min= ₺0.235 per minute (The cost of one minute is ₺0.235)

The calculations demonstrate that only about 89.5% (1,815 min/2,028 min = 0.895) of the practical capacity was used by the ambulance men for productive and useful work. However, 213 minutes (2,028 min – 1,815 min = 213 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity of this subprocess is equal to ₺50.055 (₺0.235*213 min = ₺50.055).

Finally, the costs allocated to open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	45	*	0.235	=	10.575
Laparoscopic Operation	45	*	0.235	=	10.575
Other Surgical Operation	45	*	0.235	=	10.575
Patient without Operation	40	*	0.235	=	9.4

Accordingly, the cost to be allocated to open or laparoscopic operations is equal to ₺10.575.

Subprocess 2: Customer Service Representatives (₺1,030.84)

First of all, the time needed by the customer service representatives can be given as follows:

	Reservation (min)	Information (min)	Exit (min)		Total (min)	*No. of	Patient = Total
Open Operation	5	4	4	=	13	* 3	39 min
Close Operation	5	4	4	=	13	* 15	195 min
Other Operation	5	4	4	=	13	* 4	52 min
Patient without Operation	5	3	4	=	12	* 110	1,320 min
							1,606 min

Customer service representatives in the hospital work 8 hours per day and 26 days per month. Each of them spends about 29,952 minutes (20% of her time) for breaks, training and education. The remaining 119,808 minutes per year is equal to 9,984 minutes per month. In this regard, the practical capacity of the customer service representatives and their capacity cost rates can be given as follows:

Practical Capacity of Customer Service Representatives: 10/20 Customer service representatives*9,984 minutes= 4,992 minutes (10 customer service representatives giving service equally to 20 departments have 4,992 minutes as a practical capacity for the activity of Patient Acceptance and Discharging)

Capacity Cost Rate: ₺1,030.84/4,992 min= ₺0.206 per minute (The cost of one minute is ₺0.206)

The calculations display that only about %32.1 (1,606 min/4,992 min = 0.321) of the practical capacity was used by the customer service representatives for productive and useful work. However, 3,386 minutes (4,992 min – 1,606 min = 3,386 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity of this subprocess is equal to ₺697.516 (₺0.206*3,386 min = ₺50.055). Nevertheless, there should be always minimum one employee staying in the business during a shift to meet the needs of patients coming to the hospital. Thus, this situation must be considered by managers during the unused capacity analysis process of the customer service representatives.

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	13	*	0.206	=	2.678
Laparoscopic Operation	13	*	0.206	=	2.678
Other Surgical Operation	13	*	0.206	=	2.678
Patient without Operation	12	*	0.206	=	2.472

Accordingly, the cost to be allocated to the open or laparoscopic operations is equal to ₺2.678

As noted earlier, activities can be separated into many subprocesses. This will increase the complexity of decision making process for managers. In this respect, 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 subprocesses that are resulted in difficulties and complications in the cost calculation process. Therefore, time equations are needed to simplify cost calculation and cost updating processes. According to that, the time equation of first activity can be presented as follows:

Time Equation for both Open and Close Gallbladder Operation: $13*X_1 + 45*X_2$

13 min*₺0.206 + 45 min*₺0.235 = ₺13.253

X_1 = Customer Service Representative Cost= ₺0.206

X_2 = Ambulance Men Cost= ₺0.235

To illustrate its simplicity, when the time needed by customer service representatives to perform works has changed from 13 minutes to 10 minutes, managers can easily reach new result by using the time equation as follows: 10 min*₺0.206 + 45 min*₺0.235 = ₺12.635

5.5.2. Medical Examination of Patient (₺6,138.609)

In accordance with the observations and interviews, surgeon working 312 days or 149,760 minutes per year spends about 29,952 minutes for breaks, training and education. The remaining 119,808 minutes per year is equal to 9,984 minutes per month. In this regard, the practical capacity and the capacity cost rate of the surgeon can be given as follows:

Practical Capacity of the Surgeon: 0.60 Surgeon*9,984 minutes= 5,990.4 minutes (Surgeon spending 60% of his time for this activity has 5,990.4 minutes as a practical capacity for the activity of Medical Examination of Patient)

Capacity Cost Rate: ₺6,138.609/5,990.4 min= ₺1.025 per minute (The cost of one minute is ₺1.025)

On the other hand, the time needed by the surgeon can be given as follows:

	Total Minutes	*	No. of Patient	=	Total (min)
Open Operation	25	*	3	=	75
Laparoscopic Operation	20	*	15	=	300
Other Surgical Operation	20	*	4	=	80
Patient without Operation	15	*	110	=	1,650
					2,105 min

The calculations demonstrate that only about 35.1% (2,105 min/5,990.4 min = 0.351) of the practical capacity was used by the surgeon for productive and useful work. However, 3,885.4 minutes (5,990.4 min – 2,105 min = 213 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺3,982.535 (₺1.025*3,885.4 min = ₺3,982.535).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	= Total(₺)
Open Operation	25	*	1.025	= 25.625
Laparoscopic Operation	20	*	1.025	= 20.5
Other Surgical Operation	20	*	1.025	= 20.5
Patient without Operation	15	*	1.025	= 15.375

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺25.625 and ₺20.5, respectively.

5.5.3. Laboratory Tests (₺1,442.99)

In accordance with the observations and interviews, the laboratory personnel working 312 days or 149,760 minutes per year spend about 14,976 minutes for breaks, training and education. The remaining 134,784 minutes per year is equal to 11,232 minutes per month. In this regard, the practical capacity and the capacity cost rate of the laboratory personnel can be given as follows:

Practical Capacity of the Laboratory Personnel: 5/20 Laboratory Personnel*11,232 minutes = 2,808 minutes (5 laboratory personnel giving service equally to 20 departments have 2,808 minutes as a practical capacity for the activity of Laboratory Test).

Capacity Cost Rate: ₺1,442.99/2,808 min= ₺0.514 per minute (The cost of one minute is ₺0.514)

On the other hand, the time needed by the laboratory personnel can be given as follows:

	No. of Patient	*	No. of Test	*	The time needed by the test=	Total
Open Operations	3	*	6	*	9 min per test =	162 min
Laparoscopic Operations	15	*	6	*	9 min per test =	810 min
Other surgical Operations	4	*	6	*	9 min per test =	216 min
Patients without any Operation	58	*	4	*	6.5 min per test =	1,508 min
						2,696 min

The calculations demonstrate that only about 96% (2,696 min/2,808 min = 0.96) of the practical capacity was used by the laboratory personnel for productive and useful work.

However, 112 minutes (2,808 min – 2,696 min = 112 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺57.568 (₺0.514*112 min = ₺57.568).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	* Unit Cost(₺) =	Total(₺)
Open Operation	6 tests*9 min per test	* 0.514 =	27.756
Laparoscopic Operation	6 tests*9 min per test	* 0.514 =	27.756
Other Surgical Operation	6 tests*9 min per test	* 0.514 =	27.756
Patient without Operation	6 tests*6.5 min per test	* 0.514 =	13.364

Accordingly, the cost to be allocated to the open or laparoscopic operations is equal to ₺27.756

5.5.4. Ultrasound Control (₺1,063.42)

In accordance with the observations and interviews, the radiologists working 312 days or 149,760 minutes per year spend about 22,464 minutes for breaks, training and education. The remaining 127,296 minutes per year is equal to 10,608 minutes per month. In this regard, the practical capacity and the capacity cost rate of the radiologists can be given as follows:

Practical Capacity of the Radiologists: 0.10 Radiologist*10,608 minutes = 1,060.8 minutes (Radiologists spending 10% of his time for this activity has 1,060.8 minutes as a practical capacity for the activity of Ultrasound Control).

Capacity Cost Rate: ₺1,063.42/1,060.8 min= ₺1.002 per minute (The cost of one minute is ₺1.002)

On the other hand, the time needed by the radiologists can be given as follows:

	No. of Patient	*	The time needed by the control	=	Total
Open Operations	3	*	26 min per test	=	78 min
Laparoscopic Operations	15	*	21 min per test	=	315 min
Other surgical Operations	4	*	21 min per test	=	84 min
Patients without any Operation	33	*	16 min per test	=	528 min
					1,005 min

The calculations demonstrate that only about 95% (1,005 min/1,060.8 min = 0.95) of the practical capacity was used by the radiologists for productive and useful work. However, 55.8 minutes (1,060.8 min – 1,005 min = 55.8 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺55.91 (₺1.002*55.8 min = ₺57.568).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	26	*	1.002	=	26.052
Laparoscopic Operation	21	*	1.002	=	21.042
Other Surgical Operation	21	*	1.002	=	21.042
Patient without Operation	16	*	1.002	=	16.032

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺26.052 and ₺21.042, respectively.

5.5.5. Nurse Services before Hospitalization (₺2,780.59)

In accordance with the observations and interviews, nurses working 312 days or 149,760 minutes per year spend about 22,464 minutes for breaks, training and education. The remaining 127,296 minutes per year is equal to 10,608 minutes per month. In this regard, the practical capacity and the capacity cost rate of the nurses can be given as follows:

Practical Capacity of the Nurses: 7/20 Nurse*10,608 minutes = 3,712.8 minutes (7 nurses giving service equally to 20 departments have 3,712.8 minutes as a practical capacity for the activity of Nurse Services before Hospitalization).

Capacity Cost Rate: ₺2,780.59/3,712.8 min = ₺0.75 per minute (The cost of one minute is ₺0.75)

On the other hand, the time needed by the nurses can be given as follows:

	No. of Patient	*	No. of Interference	*	The time needed =	Total
Open Operations	3	*	5	*	15 min =	225 min
Laparoscopic Operations	15	*	4	*	15 min =	900 min
Other surgical Operations	4	*	4	*	15 min =	240 min
Patients without any Operation	88	*	2	*	12 min =	2,112 min
						3,477 min

The calculations demonstrate that only about 94% (3,477 min/3,712.8 min = 0.94) of the practical capacity was used by the nurses for productive and useful work. However, 235.8 minutes (3,712.8 min – 3,477 min = 235.8 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺176.85 (₺0.75*235.8 min = ₺176.85).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes * Unit Cost(₺) =	Total(₺)
Open Operation	5 interferences*15 min*0.75 =	56.25
Laparoscopic Operation	4 interferences*15 min*0.75 =	45
Other Surgical Operation	4 interferences*15 min*0.75 =	45
Patient without Operation	4 interferences*6.5 min*0.75 =	19.5

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺56.25 and ₺45, respectively.

5.5.6. Surgical Operation (₺11,763.18)

In accordance with the observations and interviews, the costs of this activity are occurred by the services of a surgeon, an assistant doctor, an anesthetist, and theater nurses. Thus, their costs should first be determined. In this respect, their direct costs were first identified. Then, costs that are not directly related to them were quartered and added to

their direct costs. Thus, the amount to be added to their direct costs can be calculated below:

₺11,763.18 (Surgical Operation) - ₺2,400 (Cost of Surgeon) - ₺3,200 (Cost of Assistant Doctor) - ₺1,500 (Cost of Anesthetist) - ₺1,350 (Cost of Theater Nurses) = ₺3,313.18

Since this activity includes four different types of labor, the amount can be divided by four, so ₺828.29 (₺3,313.18/4) is found to be an indirect cost that will be added to direct costs of the surgeon, assistant doctor, anesthetist, and theater nurses.

After calculating the indirect cost to be added to direct costs of the surgeon, assistant doctor, anesthetist, and theater nurses, the next step is to allocate their total costs to the open and laparoscopic operations. This can be done as follows:

Subprocess 1: The Surgeon (₺3,228.29)

In accordance with the observations and interviews, the surgeon working 312 days or 149,760 minutes per year spends about 29,952 minutes for breaks, training and education. The remaining 119,808 minutes per year is equal to 9,984 minutes per month. In this regard, the practical capacity and the capacity cost rate of the surgeon can be given as follows:

Practical Capacity of the Surgeon: 0.40 Surgeon*9,984 minutes= 3,993.6 minutes (Surgeon spending 40% of his time for this activity has 3,993.6 minutes as a practical capacity for the activity of Surgical Operation)

Capacity Cost Rate: ₺3,228.29/3,993.6 min= ₺0.808 per minute (The cost of one minute is ₺0.808)

On the other hand, the time needed by the surgeon can be given as follows:

	No. of Patient *	The time needed by the surgery =	Total
Open Operations	3 *	120 min =	360 min
Laparoscopic Operations	15 *	90 min =	1,350 min
Other surgical Operations	4 *	90 min =	360 min
			2,070 min

The calculations demonstrate that only about 52% (2,070 min/3,993.6 min = 0.52) of the practical capacity was used by the surgeon for productive and useful work. However, 1,923.6 minutes (3,993.6 min – 2,070 min = 1,923.6 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺1,554.27 (₺0.808 *1,923.6 min = ₺1,554.27).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	120	*	0.808	=	96.96
Laparoscopic Operation	90	*	0.808	=	72.72
Other Surgical Operation	90	*	0.808	=	72.72

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺96.96 and ₺72.72, respectively.

Subprocess 2: The Assistant Doctor (₺4,028.29)

In accordance with the observations and interviews, the assistant doctor working 312 days or 149,760 minutes per year spends about 29,952 minutes for breaks, training and education. The remaining 119,808 minutes per year is equal to 9,984 minutes per month. In this regard, the practical capacity and the capacity cost rate of the assistant doctor can be given as follows:

Practical Capacity of the Assistant Doctor: 0.80 Assistant Doctor*9,984 minutes= 7,987.2 minutes (Assistant doctor spending 80% of his time for this activity has 7,987.2 minutes as a practical capacity for the activity of Surgical Operation)

Capacity Cost Rate: ₺4,028.29/7,987.2 min= ₺0.504 per minute (The cost of one minute is ₺0.504)

On the other hand, the time needed by the assistant doctor can be given as follows:

	No. of Patient *	The time needed by the surgery =	Total
Open Operations	3 *	125 min =	375 min
Laparoscopic Operations	15 *	95 min =	1,425 min
Other surgical Operations	4 *	95 min =	380 min
			2,180 min

The calculations demonstrate that only about 27.3% (2,180 min/7,987.2 min = 0.273) of the practical capacity was used by the assistant doctor for productive and useful work. However, 5,807.2 minutes (7,987.2 min – 2,180 min = 5,807.2 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺2,926.8 (₺0.504 *5,807.2 min = ₺2,926.8).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	125	*	0.504	=	63
Laparoscopic Operation	95	*	0.504	=	47.88
Other Surgical Operation	95	*	0.504	=	47.88

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺63 and ₺47.88, respectively.

Subprocess 3: The Anesthetist (₺2,328.29)

In accordance with the observations and interviews, the anesthetist working 312 days or 149,760 minutes per year spends about 22,464 minutes for breaks, training and education. The remaining 127,296 minutes per year is equal to 10,608 minutes per month. In this regard, the practical capacity and the capacity cost rate of the anesthetist can be given as follows:

Practical Capacity of the Anesthetist: 0.30 Anesthetist*10,608 minutes = 3,182.4 minutes (Anesthetist spending 30% of his time for this activity has 3,182.4 minutes as a practical capacity).

Capacity Cost Rate: ₺2,328.29/3,182.4 min= ₺0.73 per minute (The cost of one minute is ₺0.73)

On the other hand, the time needed by the anesthetist can be given as follows:

	No. of Patient *	The time needed by the surgery =	Total
Open Operations	3 *	120 min =	360 min
Laparoscopic Operations	15 *	90 min =	1,350 min
Other surgical Operations	4 *	90 min =	360 min
			2,070 min

The calculations demonstrate that only about 65% (2,070 min/3,182.4 min = 0.65) of the practical capacity was used by the anesthetist for productive and useful work. However, 1,112.4 minutes (3,182.4 min – 2,070 min = 1,112.4 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺812.052 (₺0.73 *1,112.4 min = ₺812.052).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	120	*	0.73	=	87.6
Laparoscopic Operation	90	*	0.73	=	65.7
Other Surgical Operation	90	*	0.73	=	65.7

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺87.6 and ₺65.7, respectively.

Subprocess 4: Theater Nurses (₺2,178.29)

In accordance with the observations and interviews, theater nurses working 312 days or 149,760 minutes per year spend about 29,952 minutes for breaks, training and education. The remaining 119,808 minutes per year is equal to 9,984 minutes per month. Thus, it can be said that the practical capacity of the theater nurses is 9,984 minutes. In addition, the capacity cost rate of the theater nurses can also be given as follows:

Capacity Cost Rate: ₺2,178.29/9,984 min= ₺0.22 per minute (The cost of one minute is ₺0.22)

On the other hand, the time needed by the theater nurses can be given as follows:

	No. of Patient *	The time needed by the surgery =	Total
Open Operations	3 *	135 min =	405 min
Laparoscopic Operations	15 *	105 min =	1,575 min
Other surgical Operations	4 *	105 min =	420 min
			2,400 min

The calculations demonstrate that only about 24% (2,400 min/9,984 min = 0.24) of the practical capacity was used by the theater nurses for productive and useful work. However, 7,584 minutes (9,984 min – 2,400 min = 7,584 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺1,668.48 (₺0.22*7,584 min = ₺1,668.48).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	135	*	0.22	=	29.7
Laparoscopic Operation	105	*	0.22	=	23.1
Other Surgical Operation	105	*	0.22	=	23.1

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺29.7 and ₺23.1, respectively.

Since the time equation simplifies cost calculation and cost updating processes, the time equation of this activity can be presented as follows:

Time Equation for Open Gallbladder Operation:

$$\mathbf{120*X_1 + 125*X_2 + 120*X_3 + 135*X_4}$$

120 min*₺0.808 + 125 min*₺0.504 + 120 min*₺0.73 + 135 min*₺0.22 = ₺277.26

X_1 = Surgeon Cost = ₺0.808 per minute

X_2 = Assistant Cost = ₺0.504 per minute

X_3 = Anesthetist Cost = ₺0.73 per minute

X_4 = Cost of Nurse = ₺0.22 per minute

Time Equation for Laparoscopic Gallbladder Operation:
$90*X_1 + 95*X_2 + 90*X_3 + 105*X_4$

90 min*₺0.808 + 95 min*₺0.504 + 90 min*₺0.73 + 105 min*₺0.22 = ₺209.4

X_1 = Surgeon Cost = ₺0.808 per minute

X_2 = Assistant Cost = ₺0.504 per minute

X_3 = Anesthetist Cost = ₺0.73 per minute

X_4 = Cost of Nurse = ₺0.22 per minute

5.5.7. Nurse Services after Hospitalization (₺2,571.42)

In accordance with the observations and interviews, the nurses working 312 days or 149,760 minutes per year spend about 22,464 minutes for breaks, training and education. The remaining 127,296 minutes per year is equal to 10,608 minutes per month. In this regard, the practical capacity and the capacity cost rate of the nurses can be given as follows:

Practical Capacity of the Nurses: 7/20 Nurse*10,608 minutes = 3,712.8 minutes (7 nurses giving service equally to 20 departments have 3,712.8 minutes as a practical capacity for the activity of Nurse Services after Hospitalization).

Capacity Cost Rate: ₺2,571.42/3,712.8 min = ₺0.692 per minute (The cost of one minute is ₺0.692)

On the other hand, the time needed by the nurses can be given as follows:

	No. of Patient	*Patient-day*	No of Interference	* Time =	Total
Open Operations	3 *	3 *	24 *	4 min =	864 min
Laparoscopic Operations	15 *	1 *	24 *	3 min =	1,080 min
Other surgical Operations	4 *	2 *	24 *	3 min =	576 min
Patients without any Operation	30 *	1 *	12 *	3 min =	1,080 min
					3,600 min

The calculations demonstrate that only about 97% (3,600 min/3,712.8 min = 0.97) of the practical capacity was used by the nurses for productive and useful work. However, 112.8 minutes (3,712.8 min – 3,600 min = 112.8 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺78.06 (₺0.692*112.8 min = ₺78.06).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes * Unit Cost(₺) =	Total(₺)
Open Operation	72 interferences*4 min* 0.692 =	199.296
Laparoscopic Operation	24 interferences*3 min* 0.692 =	49.824
Other Surgical Operation	48 interferences*3 min* 0.692 =	99.648
Patient without Operation	12 interferences*3 min* 0.692 =	24.912

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺199.296 and ₺49.824, respectively.

5.5.8. The Meal Services (₺2,973.95)

In accordance with the observations and interviews, the practical capacity and the capacity cost rate of the cafeteria staff can be given as follows:

Practical Capacity of the Cafeteria Staff: Cafeteria staff working 312 days or 149,760 minutes per year spend about 22,464 minutes (approximately 15% of their time) for breaks, training and education. The remaining 127,296 minutes per year is equal to 10,608 minutes per month. It should also be said that all cafeteria staff render service to 20 departments. Thus, the total practical capacity of the cafeteria staff is equal to 4/20 cafeteria staff*10,608 minutes = 2,121.6 minutes

Capacity Cost Rate: ₺2,973.95/2,121.6 min = ₺1.40 per minute (The cost of one minute is ₺1.40)

On the other hand, the time needed by the staff can be given as follows:

	No. of Patient	*Patient-day	*Meal	*(To Get Ready + Distribute+Collect) =	Total(min)
Open Operations	3	* 3	*	3 * (5 min + 1 min + 3 min) =	243 min
Laparoscopic Operations	15	* 1	*	3 * (5 min + 1 min + 2 min) =	360 min
Other surgical Operations	4	* 2	*	3 * (5 min + 1 min + 2 min) =	192 min
Patients without any Operation	30	* 1	*	3 * (5 min + 1 min + 2 min) =	720 min
Unexpected patients	14	* -	*	1 * (5 min)	70 min
					1,585 min

The calculations demonstrate that only about 75% (1,585 min/2,121.6 min = 0.75) of the practical capacity was used by the staff for productive and useful work. However, 536.6 minutes (2,121.6 min – 1,585 min = 536.6 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺751.24 (₺1.40*536.6 min = ₺751.24).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes * Unit Cost(₺)	= Total(₺)
Open Operation	9 meals*9 min*1.40 =	113.4
Laparoscopic Operation	3 meals*8 min*1.40 =	33.6
Other Surgical Operation	6 meals*8 min*1.40 =	67.2
Patient without Operation	3 meals*8 min*1.40 =	33.6

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺113.4 and ₺33.6, respectively.

5.5.9. Giving Morale, Completion of Treatment and Patient Discharging (₺2,058.674)

In accordance with the observations and interviews, the costs of this activity are occurred by the services of assistant doctor, and nurses. Thus, their costs should first be determined. In this respect, their direct costs were first identified. Then, costs that are not

directly related to them were equally added to their direct costs. Thus, the amount to be added to their direct costs can be showed below:

₺2,058.674 (Cost of this activity) - ₺800 (Cost of Assistant Doctor) - ₺560.24 (Cost of Nurses) = ₺698.434

Since this activity includes two different types of labor, the amount can be divided by two, so ₺349.217 (₺698.434/2) is found to be an indirect cost that will be added to direct costs of the assistant doctor, and nurses.

After calculating the indirect cost to be added to direct costs of the assistant doctor, and nurses, the next step is to allocate their total costs to the open and laparoscopic operations. This can be done as follows:

Subprocess 1: The Assistant Doctor (₺800+₺349.217 = ₺1,149.217)

In accordance with the observations and interviews, the practical capacity and the capacity cost rate of the assistant doctor can be given as follows:

Practical Capacity of the Assistant Doctor: Assistant doctor working 26 days or 12,480 minutes per month spends about 20% of his time for breaks, training and education. It is also important to emphasize that the assistant doctor spends 80% and 20% of his time for second and ninth activities, respectively. Thus, the practical capacity of the assistant doctor for this activity will be equal to 1,996.8 minutes (12,480 min per month*0.80*0.20).

Capacity Cost Rate: ₺1,149.217/1,996.8 min= ₺0.575 per minute (The cost of one minute is ₺0.575)

On the other hand, the time needed by the assistant doctor can be given as follows:

	No. of Patient *	No of Interference *	Time =	Total
Open Operations	3 *	2 *	7 min =	42 min
Laparoscopic Operations	15 *	2 *	6 min =	180 min
Other surgical Operations	4 *	2 *	6 min =	48 min
Patients without any Operation	110 *	1 *	5 min =	550 min
				820 min

The calculations demonstrate that only about 41% (820 min/1,996.8 min = 0.41) of the practical capacity was used by the assistant doctor for productive and useful work. However, 1,176.8 minutes (1,996.8 min – 820 min = 1,176.8 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺676.66 (₺0.575 *1,176.8 min = ₺676.66).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	14	*	0.575	=	8.05
Laparoscopic Operation	12	*	0.575	=	6.9
Other Surgical Operation	12	*	0.575	=	6.9
Patients without any Operation	5	*	0.575	=	2.875

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺8.05 and ₺6.9, respectively.

Subprocess 2: The Nurses (₺560.24+₺349.217 = ₺909.457)

In accordance with the observations and interviews, the practical capacity and the capacity cost rate of the nurses can be given as follows:

Practical Capacity of the Nurses: Nurses working 26 days or 12,480 minutes per month spend about 15% of their time for breaks, training and education. It is also important to emphasize that they (two nurses) give an equal level of service to all branches. Thus, the practical capacity of the nurses for this activity will be equal to 1,060.8 minutes (12,480 min per month*0.85*2/20).

Capacity Cost Rate: ₺909.457/1,060.8 min = ₺0.86 per minute (The cost of one minute is ₺0.86)

On the other hand, the time needed by the nurses can be given as follows:

	No. of Patient	*	No of Interference	*	Time =	Total
Open Operations	3	*	3	*	12 min =	108 min
Laparoscopic Operations	15	*	2	*	10 min =	300 min
Other surgical Operations	4	*	2	*	10 min =	80 min
Patients without any Operation	110	*	1	*	5 min =	550 min
						1,038 min

The calculations demonstrate that only about 98% (1,038 min/1,060.8 min = 0.24) of the practical capacity was used by the theater nurses for productive and useful work. However, 22.8 minutes (1,060.8 min – 1,038 min = 22.8 min) are found to be an unused capacity in the hospital. It can also be said that the cost of unused capacity is equal to ₺19.608 (₺0.86*22 min = ₺19.608).

Finally, the costs allocated to the open and laparoscopic operations can be shown below:

	Total Minutes	*	Unit Cost(₺)	=	Total(₺)
Open Operation	36	*	0.86	=	30.96
Laparoscopic Operation	20	*	0.86	=	17.2
Other Surgical Operation	20	*	0.86	=	17.2
Patients without any Operation	5	*	0.86	=	4.3

Accordingly, the costs to be allocated to the open or laparoscopic operations are equal to ₺30.96 and ₺17.2, respectively.

Since the time equation simplifies cost calculation and cost updating processes, the time equation of this activity can be presented as follows:

Time Equation for Open Gallbladder Operation:

$$\mathbf{14*X_1 + 36*X_2}$$

14 min*₺0.575 + 36 min*₺0.86 = ₺39.01

X_1 = Assistant Cost = ₺0.575 per minute

X_2 = Cost of Nurse = ₺0.86 per minute

Time Equation for Laparoscopic Gallbladder Operation:

$$\mathbf{12*X_1 + 20*X_2}$$

12 min*₺0.575 + 20 min*₺0.86 = ₺24.1

X_1 = Assistant Cost = ₺0.575 per minute

X_2 = Cost of Nurse = ₺0.86 per minute

Finally, the results of the TDABC system can be summarized in Table 18:

Table 18

Costs of the Open and Close Gallbladder Operations in the TDABC System

Activities	Assigning Ratio	Open Gallbladder Operation Factor	Laparoscopic Gallbladder Operation Factor	Cost of Open Operation	Cost of Laparoscopic Operation
A1	Ambulance men: ₺0.235 per min Customer Service Representative: ₺0.206 per min	45 min 13 min	45 min 13 min	₺13.253 (0.235*45 +0.206*13)	₺13.253
A2	Surgeon: ₺1.025 per min	25 min	20 min	₺25.625	₺20.5
A3	Laboratory personnel: ₺0.514 per min	6 tests*9 min per test	6 tests*9 min per test	₺27.756	₺27.756
A4	Radiologist: ₺1.002 per min	26 min	21 min	₺26.052	₺21.042
A5	Nurse: ₺0.75	5 interferences *15 min per interference	4 interferences *15 min per interference	₺56.25	₺45
A6	Surgeon: ₺0.808 per min Assistant Doctor: ₺0.504 per min Anesthetist: ₺0.73 per min Theater Nurse: ₺0.22 per min	120 min 125 min 120 min 135 min	90 min 95 min 90 min 105 min	₺277.26	₺209.4
A7	Nurse: ₺0.692 per min	72 interferences *4 min per interference	24 interferences *3 min per interference	₺199.296	₺49.824
A8	Cafeteria Staff ₺1.40 per min	9 meals*9 min	3 meals*8 min	₺113.4	₺33.6
A9	Assistant Doctor: ₺0.575 per min Nurse: ₺0.86	2 interferences *7 min per interference 3 interferences *12 min per interference	2 interferences *6 min per interference 2 interferences *10 min per interference	₺39.01	₺24.1
			Total:	₺777.902	₺444.475

Table 18 indicates that the costs to be allocated to the open and laparoscopic operations are ₺777.902 and ₺444.475, respectively. In this regard, it can be said that the results of the TCS and TDABC systems given in Table 19 are different from each other.

Table 19
TCS versus TDABC

Traditional Cost System	**Open Gallbladder Operation**	**Laparoscopic Gallbladder Operation**
Direct	₺2,150	₺1,690
Indirect	₺1,562.91	₺520.97
Total	**₺3,712.91**	**₺2,210.97**
TDABC		
Direct	₺2,150	₺1,690
Indirect	₺777.902	₺444.475
Total	**₺2,927.902**	**₺2,134.475**

Before analyzing Table 19, it can be emphasized that since the author of this study conducted a study (Ozyapici, 2008) related to the TDABC system in the same hospital in 2008, the results of this study can be compared to the study done in 2008. Accordingly, the costs of the open and laparoscopic operations were ₺2,616.15 and ₺1,746.18, respectively. Thus, it can be said that the costs of operations have increased over a four-year period. In addition, in order to eliminate the impact of inflation, it can be said that the open operation were 49.82 percent higher than the laparoscopic operation in the results of the TDABC conducted in 2008. Likewise, the results of the current study indicate that the open operation is 37.17 percent higher than the laparoscopic operation.

When Table 19 is analyzed, it is evident that the costs assigned to the open and laparoscopic operations will be lower in the TDABC system. This is because it does not allocate the unused capacity costs to cost objects. In this regard, the TDABC system states that the open and laparoscopic gallbladder operations should be decreased from ₺3,712.91 and ₺2,210.97 to ₺2,927.902 and ₺2,134.475, respectively. Since a detailed comparison of the results will be given in Section 5.7, the application of the RCA system can now be given.

5.6. Implementing Resource Consumption Accounting To Mağusa Yaşam Hospital

The implementation of the RCA system will be explained in this section. In this study, resources will first be collected into resource pools. Second, fixed and variable costs for each resource pool will be separated. Third, the consumption of resources by the activities will be identified. Fourth, the allocations of both variable resource costs to activities and activities costs to products will be given for making short term strategic decisions. Fifth, the allocations of total resource costs to activities and then products will also be given for making long term decisions.

5.6.1. Integrating Resources into Resource Pools

As noted before, the general surgery department has 18 different types of costs. These costs can be integrated into cost (resource) pools below:

Table 20
Resource Pools

Indirect Costs	Total(₺ per month)	Cost Pool
1. Management Costs	**11,500**	**MANAGEMENT COST POOL**
2. Personnel Costs	**8,718**	
3. Maintenance and Repairing Costs of Medical Instruments and Materials	790	MEDICAL INSTRUMENT COST POOL
4. Depreciation Costs of Medical Instruments and Materials	1,055	
5. Insurance Costs of Medical Instruments and Materials	335.82	
6. Building Insurance Costs	**150**	**BUILDING COST POOL**
7. Building Depreciation Costs	**200**	
8. Building Maintenance and Repairing Costs	**50**	
9. Electricity Costs	**2,600**	
10. Cleaning Costs	**725**	
11. Water Consumption Costs	60	DAILY COST POOL
12. Communication Costs	200	
13. Laundry Costs	150	
14. Accounting Department Costs	468	
15. Office requisites and Miscellaneous Costs	36	
16. General Medical Materials and Fuel-Oil Costs	**3,240**	**GENERAL MEDICAL MATERIAL COST POOL**
17. Cafeteria (Meal) Costs	1867.5	CAFETERIA COST POOL
18. Information System Costs	**155**	**INFORMATION SYSTEM COST POOL**

As shown in Table 20, different types of costs are integrated into primary cost pools. Then, these cost pools will be separated into fixed and variable. There is an important point here is that each cost in the cost pools should also be separated into fixed and variable. Otherwise, their unused capacities cannot be determined. Thus, a distinction between fixed and variable costs can be given in the next section below.

5.6.2. Separating Resource Pools into Fixed and Variable

In order to separate costs, first, the relationships between costs and cost objects were identified. Then, face to face interviews were performed. As a result, the resource pools and each cost found in these pools are separated into fixed and variable as follows:

1- Management Cost Pool

Surgeon (Fixed: ₺2,000 per month, Variable: ₺4,000 per month): The cost of the surgeon, up to 100 patients, is equal to ₺2,000. In addition, from the patients of 101 to 200, the surgeon will get an additional charge of ₺40 per person.

Assistant Doctor (Fixed: ₺1,500 per month, Variable: ₺2,500 per month): The cost of the assistant doctor, up to 100 patients, is equal to ₺1,500. In addition, from the patients of 101 to 200, the assistant doctor will get an additional charge of ₺25 per person.

Anesthetist (Fixed: ₺1,500 per month): The total cost of the anesthetist is fixed.

Customer Service Representatives (Fixed: ₺650 per month): The total cost of the customer service representatives is fixed.

Theater Nurses (Fixed: ₺1,350 per month): The total cost of the theater nurses is fixed.

Nurses: (Fixed: ₺3,081.9 per month, Variable: ₺1,400 per month): The cost of the nurses, up to 750 interferences, is equal to ₺3,081.9. In addition, from the interferences of 751 to 1,500, the nurses will get an additional charge of ₺1.867 per interference.

Gardener (Fixed: ৳30 per month): The total cost of the gardener is fixed.

Cafeteria Staff: (Fixed: ৳500 per month, Variable: ৳471.1 per month): The cost of the cafeteria staff, up to 50 patient-day, is equal to ৳500. In addition, from the patient-day of 51 to 100, the staff will get an additional charge of ৳9.422 per patient-day.

Ambulance Men (Fixed: ৳260 per month): The total cost of the ambulance men is fixed.

Laboratory Personnel (Fixed: ৳375 per month): The total cost of the laboratory personnel is fixed.

Radiologists (Fixed: ৳400 per month, Variable: ৳200 per month): The cost of the radiologists, up to 100 patients, is equal to ৳400. In addition, from the patients of 101 to 200, the surgeon will get an additional charge of ৳2 per person.

2- Medical Instrument Cost Pool

Medical instrument cost pool (৳2,180.82) includes only fixed costs.

3- Building Cost Pool

Building Insurance (Fixed: ৳150 per month): The total building insurance cost is fixed.

Building Depreciation (Fixed: ৳200 per month): The total depreciation cost is fixed.

Building Maintenance and Repairing (Fixed: ৳50 per month): The total building maintenance and repairing cost is fixed.

Cleaning (Fixed: ৳725 per month): The total cleaning cost is fixed.

Electricity (Fixed: ₺1,750 per month, Variable: ₺850 per month): The fixed cost of the electricity, up to 850 patients, is equal to ₺1,750. In addition, the hospital will pay an additional charge of ₺1 per patient.

4- Daily Cost Pool

Water Consumption (Fixed: ₺20 per month, Variable: ₺40 per month): The fixed cost of the water consumption, up to 800 patient-day, is equal to ₺20. In addition, the hospital will pay an additional charge of ₺0.05 per patient-day.

Communication (Fixed: ₺50 per month, Variable: ₺150 per month): The fixed cost of the communication, up to 850 patients, is equal to ₺50. In addition, the hospital will pay an additional charge of ₺0.176 per patient.

Laundry (Fixed: ₺150 per month): The total laundry cost is fixed.

Accounting Department (Fixed: ₺468 per month): The total accounting department cost is fixed.

Office Requisites and Miscellaneous (Fixed: ₺36 per month): The total office requisites and miscellaneous cost is fixed.

5- General Medical Material Cost Pool

General medical material cost pool (₺3,240) includes only variable costs. In this regard, up to 850 patients, the hospital will pay ₺3.81 per patient.

6- Cafeteria Cost Pool

Cafeteria cost pool (₺1,867.5) includes only variable costs. In this regard, up to 100 patient-day, the hospital will pay ₺18.675 per patient-day.

7- Information System Cost Pool

Information system cost pool (₺155) includes only fixed costs.

The results of the computations can be summarized in Table 21 as follows:

Table 21
Fixed and Variable Costs of the Resource Pools

	Fixed Costs	**Variable Costs**	**Cost Drivers of Variable Costs**	**Factors for Assigning Variable Costs**
1- MANAGEMENT COST	**₺11,646.9**	**₺8,571.1**		
Surgeon	₺2,000	₺4,000	No of patient	₺40 per patient Patient>101
Anesthetist	₺1,500	-	-	-
Assistant Doctor	₺1,500	₺2,500	No of patient	₺25 per patient Patient>101
Customer Service Representatives	₺650	-	-	-
Theater Nurses	₺1,350	-	-	-
Nurses	₺3,081.9	₺1,400	No of interference	₺1.867 per interference Interference>750
Gardener	₺30	-	-	-
Cafeteria Staff	₺500	₺471.1	No of patient-day	₺9.422 per patient-day Patient-day>51
Ambulance Men	₺260	-	-	-
Laboratory Personnel	₺375	-	-	-
Radiologists	₺400	₺200	No of patient	₺2 per patient Patient>101
2- MEDICAL INSTRUMENT	**₺2,180.82**	-	-	-
3- BUILDING COST POOL	**₺2,875**	**₺850**		
Building Insurance	₺150	-	-	
Building Depreciation	₺200	-	-	
Building Maintenance and Repairing	₺50	-	-	
Cleaning	₺725	-	-	
Electricity	₺1,750	₺850	No of patient	₺1 per patient

Table 21 (continued)	Fixed Costs	Variable Costs	Cost Drivers	Assigning Factors
Water Consumption	₺20	₺40	No of patient-day	₺0.05 per patient-day Patient-day<800
Communication	₺50	₺150	No of patient	₺0.176 per patient Patient<850
Laundry	₺150	-	-	-
Accounting Department	₺468	-	-	-
Office Requisites and Miscellaneous	₺36	-	-	-
5- GENERAL MEDICAL MATERIAL COST POOL	-	**₺3,240**	**No of patient**	**₺3.81 per patient Patient<850**
6- CAFETERIA COST POOL	-	**₺1,867.5**	**No of patient-day**	**₺18.675 per patient-day Patient-day<100**
7- INFORMATION SYSTEM COST POOL	**₺155**	-	-	-
TOTAL	**₺17,581.72**	**₺14,718.6**		

Separating costs into fixed and variable, as shown in Table 21, gives a chance to managers of the hospital to make both short- and long-term decisions. When Table 21 is analyzed, it can be said that approximately 45 percent (₺14,718.6/₺32,300.6) of the total cost is evaluated as variable. Such a huge amount of cost can always affect the tactical decisions of managers. Thus, this study will first give emphasize on short term analysis. This will be done by allocating variable costs only to cost objects. Then, by allocating total cost to cost object, long term analysis will be provided. Besides the data given in Table 21, the consumption of resources by the activities should also be known to calculate the costs of the open and laparoscopic operations. Therefore, the consumption of resources by the activities can be given in Table 22 as follows:

Table 22
Consumption Of Resources By The Activities

	A1	A2	A3	A4	A5	A6	A7	A8	A9
1- Management Cost									
Surgeon (No of Patient)		132				22			
Anesthetist						(x)*			
Assistant Doctor						22			132
Customer Service Representatives	(x)								
Theater Nurses						(x)			
Nurses					856		267		157
Gardener									(x)
Cafeteria Staff								62	
Ambulance Men	(x)								
Laboratory Personnel			(x)						
Radiologists				55					
2- Medical Instrument		(x)	(x)	(x)	(x)	(x)	(x)		
3- Building Cost Pool									
Building Insurance	28	88	8	10	20	100	20	6	20
Building Depreciation	28	88	8	10	20	100	20	6	20
Building Maintenance and Repairing	28	88	8	10	20	100	20	6	20
Cleaning	28	88	8	10	20	100	20	6	20
Electricity	132	132	80	55	110	22	52	66	132
4- Daily Cost Pool									
Water Consumption	62	62	62	62	62	32	62	62	62
Communication	132	132	80	55	110	22	52	66	132
Laundry					(x)	(x)	(x)		
Accounting Department	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Office Requisites and Miscellaneous	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
5- General Medical Material Cost Pool	132	132	80	55	110	22	52	66	132
6- Cafeteria Cost Pool								62	
7- Information System Cost Pool	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)

*(x) means that the cost related to that activity is a fixed cost that can generally be allocated to activities equally.

After determining the fixed and variable costs of resource pools, factors for assigning variable costs, the consumption of resources by the activities, and the computations of costs

of the open and laparoscopic operations can now be given. In this regard, computations related to short- and long-term decisions will be given in the following sections subsequently.

5.6.3. Short-Term Analysis: Assigning Variable Resource Costs to the Activities

Once the relationships between resources and activities have been identified, the next step is to allocate activities costs to cost objects. There is an important point here is that the RCA system provides both short- and long-term views of price reductions. This section will obtain results that can only be used in short-term decisions.

The costs to be allocated to activities will be calculated by multiplying actual quantity by the unit variable cost. Then, variable activity costs will be allocated to products by considering time as an allocation base. There is no denying the fact that many allocation bases can be used in the second stage (allocating activities costs to products) of the RCA system. However, since the time, which is used in the TDABC system, is a suitable cost driver producing accurate results, this study will also use time as an allocation base to assign activities costs to the open and laparoscopic operations. As a result, assigning variable resource costs to the activities can be summarized below:

1- Management Cost Pool

The Surgeon: The cost of the surgeon, up to 100 patients, is equal to ₺2,000. In addition, from the patients of 101 to 200, the surgeon will get an additional charge of ₺40 per person. When Table 22 is analyzed, it can be said that there are 154 (132+22) patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 100 patients = ₺2,000 per month
Variable cost: 54 patients (154 patients- 100 patients)*₺40 per patient = ₺2,160 per month (A2: ₺1,280, A6: ₺880)
Thus, the total cost of the surgeon will be equal to ₺4,160 per month

The Assistant Doctor: The cost of the assistant doctor, up to 100 patients, is equal to ₺1,500. In addition, from the patients of 101 to 200, the assistant doctor will get an

additional charge of ₺25 per person. When Table 22 is analyzed, it can be said that there are 154 (132+22) patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 100 patients = ₺1,500 per month
Variable cost: 54 patients*₺25 per patient = ₺1,350 per month (A6: ₺550, A9: ₺800)
Thus, the total cost of the assistant doctor will be equal to ₺2,850 per month

The Nurses: The cost of the nurses, up to 750 interferences, is equal to ₺3,081.9. In addition, from the interferences of 751 to 1,500, the nurses will get an additional charge of ₺1.867 per interference. When Table 22 is analyzed, it can be said that there are 1,280 (856+267+157) interferences so the fixed and variable costs can be given as follows:

Fixed cost: Up to 750 interferences = ₺3,081.9 per month
Variable cost: 530 interferences ₺1.867 per interference = ₺989.1 per month.

It is important to emphasize that the standard amount for the fixed cost will always be deducted from the first activity having interferences more than the standard amount. Then the difference found will be multiplied by the variable cost per unit to obtain the variable cost of the activity. Thus, A5 is found to be (856 interferences – 750 interferences = 106 interferences*₺1.867 per interference) ₺197.902 per month. A7 and A9 will also be equal to ₺498.489 and ₺293.119, respectively. Thus, the total cost of the nurses will be equal to ₺4,071 per month.

The Cafeteria Staff: The cost of the cafeteria staff, up to 50 patient-day, is equal to ₺500. In addition, from the patient-day of 51 to 100, the staff will get an additional charge of ₺9.422 per patient-day. When Table 22 is analyzed, it can be said that there are 62 patient-day so the fixed and variable costs can be given as follows:

Fixed cost: Up to 50 patient-day = ₺500 per month
Variable cost: 12 patient-day*₺9.422 per patient = ₺113.064 per month (A8: ₺113.064)
Thus, the total cost of the cafeteria staff will be equal to ₺613.064 per month

The Radiologists: The cost of the radiologists, up to 100 patients, is equal to ₺400. In addition, from the patients of 101 to 200, the radiologists will get an additional charge of ₺2

per person. However, since they render service to 55 patients only, the variable cost of the radiologists will be equal to zero.

2- Medical Instrument Cost Pool

Since it includes only fixed costs, the medical instrument cost pool cannot be considered in the short-term analysis.

3- Building Cost Pool

Electricity: The fixed cost of the electricity, up to 850 patients, is equal to ₺1,750. In addition, the hospital will pay an additional charge of ₺1 for each patient. When Table 22 is analyzed, it can be said that there are 781 patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 850 patients = ₺1,750 per month
Variable cost: 781 patients*₺1 per patient = ₺781 per month (A1: ₺132, A2: ₺132, A3: ₺80, A4: ₺55, A5: ₺110, A6: ₺22, A7: ₺52, A8: ₺66, A9: ₺132)
Thus, the total electricity cost will be equal to ₺2,531 per month.

4- Daily Cost Pool

Water Consumption: The fixed cost of the water consumption, up to 800 patient-day, is equal to ₺20. In addition, the hospital will pay an additional charge of ₺0.05 for each patient-day. When Table 22 is analyzed, it can be said that there are 528 patient-day so the fixed and variable costs can be given as follows:

Fixed cost: Up to 800 patient-day = ₺20 per month
Variable cost: 528 patient-day*₺0.05 per patient = ₺26.4 per month (A1: ₺3.1, A2: ₺3.1, A3: ₺3.1, A4: ₺3.1, A5: ₺3.1, A6: ₺1.6, A7: ₺3.1, A8: ₺3.1, A9: ₺3.1)
Thus, the total electricity cost will be equal to ₺46.4 per month.

Communication: The fixed cost of the communication is equal to ₺50. In addition, up to 850 patients, the hospital will pay an additional charge of ₺0.176 per patient. When Table 22 is analyzed, it can be said that there are 781 patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 850 patients = ₺50 per month
Variable cost: 781 patients*₺0.176 per patient = ₺137.456 per month (A1: ₺23.23, A2: ₺23.23, A3: ₺14.08, A4: ₺9.68, A5: ₺19.36, A6: ₺3.872, A7: ₺9.152, A8: ₺11.616, A9: ₺23.23)
Thus, the total communication cost will be equal to ₺187.456 per month.

5- General Medical Material Cost Pool

General medical material cost pool includes only variable costs. In this regard, up to 850 patients, the hospital will pay ₺3.81 per patient. When Table 22 is analyzed, it can be said that there are 781 patients so the variable costs to be allocated to activities can be given as follows:

Variable cost: 781 patients*₺3.81 per patient = ₺2,975.61 per month (A1: ₺502.92, A2: ₺502.92, A3: ₺304.8, A4: ₺209.55, A5: ₺419.1, A6: ₺83.82, A7: ₺198.12, A8: ₺251.46, A9: ₺502.92)

6- Cafeteria Cost Pool

Cafeteria cost pool (₺1,867.5) includes only variable costs. In this regard, up to 100 patient-day, the hospital will pay ₺18.675 for each patient-day. When Table 22 is analyzed, it can be said that there are 62 patient-day so the variable costs to be allocated to activities can be given as follows:

Variable cost: 62 patient-day*₺18.675 per patient-day = ₺1,157.85 per month (A6: ₺1,157.85)

7- Information System Cost Pool

Since it includes only fixed costs, the information system cost pool cannot be considered in the short-term analysis.

The total cost of the activities can be collected into Table 23 as follows;

Table 23

Total Cost of The Activities in the Short-Term Analysis

	A1	A2	A3	A4	A5	A6	A7	A8	A9
1- Management Cost (₺)									
Surgeon	-	1,280	-	-	-	880	-	-	-
Anesthetist	-	-	-	-	-	-	-	-	-
Assistant Doctor	-	-	-	-	-	550			800
Customer Service Representatives	-	-	-	-	-	-	-	-	-
Theater Nurses	-	-	-	-	-	-	-	-	-
Nurses					197.902		498.489		293.119
Gardener	-	-	-	-	-	-	-	-	-
Cafeteria Staff	-	-	-	-	-	-	-	113.064	-
Ambulance Men	-	-	-	-	-	-	-	-	-
Laboratory Personnel	-	-	-	-	-	-	-	-	-
Radiologists	-	-	-	0	-	-	-	-	-
2- Medical Instrument (₺)	-	-	-	-	-	-	-	-	-
3- Building Cost Pool (₺)									
Building Insurance	-	-	-	-	-	-	-	-	-
Building Depreciation	-	-	-	-	-	-	-	-	-
Building Maintenance and Repairing	-	-	-	-	-	-	-	-	-
Cleaning	-	-	-	-	-	-	-	-	-
Electricity	132	132	80	55	110	22	52	66	132
4- Daily Cost Pool (₺)									
Water Consumption	3.1	3.1	3.1	3.1	3.1	1.6	3.1	3.1	3.1
Communication	23.23	23.23	14.08	9.68	19.36	3.872	9.152	11.616	23.23
Laundry	-	-	-	-	-	-	-	-	-
Accounting Department	-	-	-	-	-	-	-	-	-
Office Requisites and Miscellaneous	-	-	-	-	-	-	-	-	-
5- General Medical Material Cost Pool (₺)	502.92	502.92	304.8	209.55	419.1	83.82	198.12	251.46	502.92
6- Cafeteria Cost Pool (₺)	-	-	-	-	-	-	-	1,157.85	-

Table 23 (continued)	A1	A2	A3	A4	A5	A6	A7	A8	A9
7- Information System Cost Pool (₺)	-	-	-	-	-	-	-	-	-
TOTAL (₺)	**661.25**	**1,941.25**	**401.98**	**277.33**	**749.562**	**1,541.292**	**760.861**	**1,603.09**	**1,754.369**

The total costs of the activities are presented at the last row of Table 23. The next step to be done is to allocate activities costs to products. As shown in Table 24, since the time is considered as an efficient allocation base, activities costs will be allocated to products on the basis of time to compute costs of the open and laparoscopic operations.

Table 24

An Allocation of Activities Costs to Gallbladder Operations in the Short-Term Analysis

Costs of the Activities (₺)	Total Time	Cost per Time (₺)	Time Needed by the Open Operation	Time Needed by the Laparoscopic Operation	Cost of the Open Operation (₺)	Cost of the Laparoscopic Operation (₺)
A1: 661.25	3,421 min	0.193	58 min	58 min	11.194	11.194
A2: 1,941.25	2,105 min	0.922	25 min	20 min	23.05	18.44
A3: 401.98	2,696 min	0.149	54 min	54 min	8.046	8.046
A4: 277.33	1,005 min	0.276	26 min	21 min	7.176	5.796
A5: 749.562	3,477 min	0.216	75 min	60 min	16.2	12.96
A6: 1,541.292	8,720 min	0.177	500 min	380 min	88.5	67.26
A7: 760.861	3,600 min	0.211	288 min	72 min	60.768	15.192
A8: 1,603.09	1,585 min	1.011	81 min	24 min	81.891	24.264
A9: 1,754.369	1,858 min	0.944	50 min	32 min	47.2	30.208
Total(₺):					**344.025**	**193.36**

Table 24 indicates that the costs to be allocated to open and laparoscopic operations are ₺344.025 and ₺193.36, respectively. These amounts can be added to direct costs so as to determine price strategically. Indeed, by excluding the fixed costs from the cost object, this system allows managers to determine lower selling prices which encourages and supports service companies to increase competitiveness. Notice that this can only be done for a short period of time. However, under normal business conditions, the hospital needs a different pricing option to fulfill its normal activities. Thus, an analysis of costs of the open and laparoscopic operations for a long period of time should be made.

5.6.4. Long-Term Analysis: Assigning Resource Costs to the Activities

The RCA system first allocates resource costs to activities. Since it provides both short- and long-term points of view, costs should be separated into fixed and variable. Unlike short-term analysis, all costs (fixed and variable) should be allocated to activities and then products in the long-term analysis.

The only difference between short-and long-term analyses is that short-term analysis considers variable costs only, however, long-term analysis includes both fixed and variable costs. On the other hand, since the time is a suitable cost driver producing accurate results, this study will also use time as an allocation base to assign activities costs to open and laparoscopic operations. As a result, assigning total resource costs to the activities of the general surgery department can be given below:

1- Management Cost Pool

The Surgeon: The cost of the surgeon, up to 100 patients, is equal to ₺2,000. In addition, from the patients of 101 to 200, the surgeon will get an additional charge of ₺40 per person. When Table 22 is analyzed, it can be said that there are 154 (132+22) patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 100 patients = ₺2,000 per month
Variable cost: 54 patients (154 patients- 100 patients)*₺40 per patient = ₺2,160 per month
Thus, the total cost of the surgeon will be equal to ₺4,160 (A2: ₺3,280, A6: ₺880) per month.

The Anesthetist: The total cost of the anesthetist is a fixed cost (A6: ₺1,500).

The Assistant Doctor: The cost of the assistant doctor, up to 100 patients, is equal to ₺1,500. In addition, from the patients of 101 to 200, the assistant doctor will get an additional charge of ₺25 per person. When Table 22 is analyzed, it can be said that there are 154 patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 100 patients = ₺1,500 per month
Variable cost: 54 patients*₺25 per patient = ₺1,350 per month

Thus, the total cost of the surgeon will be equal to ₺2,850 (A6: ₺550, A9: ₺2,300) per month.

The Nurses: The cost of the nurses, up to 750 interferences, is equal to ₺3,081.9. In addition, from the interferences of 751 to 1,500, the nurses will get an additional charge of ₺1.867 per interference. When Table 22 is analyzed, it can be said that there are 1,280 (856+267+157) interferences so the fixed and variable costs can be given as follows:

Fixed cost: Up to 750 interferences = ₺3,081.9 per month
Variable cost: 530 interferences ₺1.867 per interference = ₺989.1 per month.
Thus, the total cost of the nurses will be equal to ₺4,071 (A5: 3,279.802, A7: ₺498.489, A9: ₺293.119) per month.

Customer Service Representatives: The total cost of the customer service representatives is a fixed cost (A1: ₺650).

Theater Nurses: The total cost of the theater nurses is a fixed cost (A6: ₺1,350).

Gardener: The total cost of the gardener is a fixed cost (A9: ₺30).

Cafeteria Staff: The cost of the cafeteria staff, up to 50 patient-day, is equal to ₺500. In addition, from the patient-day of 51 to 100, the staff will get an additional charge of ₺9.422 per patient-day. When Table 22 is analyzed, it can be said that there are 62 patient-day so the fixed and variable costs can be given as follows:

Fixed cost: Up to 50 patient-day = ₺500 per month
Variable cost: 12 patient-day*₺9.422 per patient = ₺113.064 per month
Thus, the total cost of the cafeteria staff will be equal to ₺613.064 (A8: ₺613.064) per month

Ambulance Men: The total cost of the ambulance men is a fixed cost (A1: ₺260).

Laboratory Personnel: The total cost of the laboratory personnel is a fixed cost (A3: ₺375).

Radiologists: The cost of the radiologists, up to 100 patients, is equal to ₺400. In addition, from the patients of 101 to 200, the surgeon will get an additional charge of ₺2 per person. Thus, the total cost of the radiologists will be equal to ₺400 (A4: ₺400) per month.

2- Medical Instrument Cost Pool

The medical instrument cost pool includes only fixed costs (₺2,180.82) that are related to A2, A3, A4, A5, A6, and A7. Since the fixed costs are independent of the volume of output, these costs can be allocated to the activities equally (A2: ₺363.47, A3: ₺363.47, A4: ₺363.47, A5: ₺363.47, A6: ₺363.47, A7: ₺363.47).

3- Building Cost Pool

Building insurance, depreciation, maintenance and repairing, and cleaning costs (₺1,125 per month) are fixed. Although fixed costs can be allocated to the activities equally, these costs, in this study, will be allocated on the basis of square meter (A1: ₺105, A2: ₺330, A3: ₺30, A4: ₺37.5, A5: ₺75, A6: ₺375, A7: ₺75, A8: ₺22.5, A9: ₺75).

Electricity: The fixed cost of the electricity, up to 850 patients, is equal to ₺1,750. In addition, the hospital will pay an additional charge of ₺1 for each patient. When Table 22 is analyzed, it can be said that there are 781 patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 850 patients = ₺1,750 per month
Variable cost: 781 patients*₺1 per patient = ₺781 per month
Thus, the total electricity cost will be equal to ₺2,531 (A1: ₺326.44, A2: ₺326.44, A3: ₺274.44, A4: ₺249.44, A5: ₺304.44, A6: ₺216.44, A7: ₺246.44, A8: ₺260.44, A9: ₺274.44) per month.

4- Daily Cost Pool

Water Consumption: The fixed cost of the water consumption, up to 800 patient-day, is equal to ₺20. In addition, the hospital will pay an additional charge of ₺0.05 for each

patient-day. When Table 22 is analyzed, it can be said that there are 528 patient-day so the fixed and variable costs can be given as follows:

Fixed cost: Up to 800 patient-day = ₺20 per month
Variable cost: 528 patient-day*₺0.05 per patient = ₺26.4 per month (A1: ₺5.32, A2: ₺5.32, A3: ₺5.32, A4: ₺5.32, A5: ₺5.32, A6: ₺3.82, A7: ₺5.32, A8: ₺5.32, A9: ₺5.32)
Thus, the total electricity cost will be equal to ₺46.4 per month.

Communication: The fixed cost of the communication is equal to ₺50. In addition, up to 850 patients, the hospital will pay an additional charge of ₺0.176 for each patient. When Table 22 is analyzed, it can be said that there are 781 patients so the fixed and variable costs can be given as follows:

Fixed cost: Up to 850 patients = ₺50 per month
Variable cost: 781 patients*₺0.176 per patient = ₺137.456 per month (A1: ₺28.78, A2: ₺28.78, A3: ₺19.63, A4: ₺15.23, A5: ₺24.91, A6: ₺9.422, A7: ₺14.702, A8: ₺17.166, A9: ₺28.78)
Thus, the total communication cost will be equal to ₺187.456 per month.

Laundry: All laundry costs are fixed. Since the fixed costs are independent of the volume of output, these costs can be allocated to the activities equally (A5: ₺50, A6: ₺50, A7: ₺50).

Accounting Department: All accounting department costs are fixed. Since the fixed costs are independent of the volume of output, these costs can be allocated to the activities equally (A1: ₺52, A2: ₺52, A3: ₺52, A4: ₺52, A5: ₺52, A6: ₺52, A7: ₺52, A8: ₺52, A9: ₺52).

Office Requisites and Miscellaneous: All office requisites and miscellaneous costs are fixed. Since the fixed costs are independent of the volume of output, these costs can be allocated to the activities equally (A1: ₺4, A2: ₺4, A3: ₺4, A4: ₺4, A5: ₺4, A6: ₺4, A7: ₺4, A8: ₺4, A9: ₺4).

5- General Medical Material Cost Pool

General medical material cost pool includes only variable costs. In this regard, up to 850 patients, the hospital will pay ₺3.81 per patient. When Table 22 is analyzed, it can be said that there are 781 patients so the variable costs to be allocated to activities can be given as follows:

Variable cost: 781 patients*₺3.81 per patient = ₺2,975.61 per month (A1: ₺502.92, A2: ₺502.92, A3: ₺304.8, A4: ₺209.55, A5: ₺419.1, A6: ₺83.82, A7: ₺198.12, A8: ₺251.46, A9: ₺502.92)

6- Cafeteria Cost Pool

Cafeteria cost pool (₺1,867.5) includes only variable costs. In this regard, up to 100 patient-day, the hospital will pay ₺18.675 for each patient-day. When Table 22 is analyzed, it can be said that there are 62 patient-day so the variable costs to be allocated to activities can be given as follows:

Variable cost: 62 patient-day*₺18.675 per patient-day = ₺1,157.85 per month (A6: ₺1,157.85)

7- Information System Cost Pool

All accounting department costs (₺155) are fixed. Since the fixed costs are independent of the volume of output, these costs can be allocated to the activities equally (A1: ₺17.22, A2: ₺17.22, A3: ₺17.22, A4: ₺17.22, A5: ₺17.22, A6: ₺17.22, A7: ₺17.22, A8: ₺17.22, A9: ₺17.22).

The total cost of the activities can be collected into Table 25 as follows;

Table 25

Total Cost of The Activities in the Long-Term Analysis

	A1	A2	A3	A4	A5	A6	A7	A8	A9
1- Management Cost (₺)									
Surgeon	-	3,280	-	-	-	880	-	-	-
Anesthetist	-	-	-	-	-	1,500	-	-	-
Assistant Doctor	-	-	-	-	-	550			2,300
Customer Service Representatives	650	-	-	-	-	-	-	-	-
Theater Nurses	-	-	-	-	-	1,350	-	-	-
Nurses					3,279.802		498.489		293.119
Gardener	-	-	-	-	-	-	-	-	30
Cafeteria Staff	-	-	-	-	-	-	-	613.064	-
Ambulance Men	260	-	-	-	-	-	-	-	-
Laboratory Personnel	-	-	375	-	-	-	-	-	-
Radiologists	-	-	-	400	-	-	-	-	-
2- Medical Instrument (₺)	-	363.47	363.47	363.47	363.47	363.47	363.47	-	-
3- Building Cost Pool (₺)									
Building Insurance, Depreciation, Maintenance and Repairing, and Cleaning	105	330	30	37.5	75	375	75	22.5	75
Electricity	326.44	326.44	274.44	249.44	304.44	216.44	246.44	260.44	274.44
4- Daily Cost Pool (₺)									
Water Consumption	5.32	5.32	5.32	5.32	5.32	3.82	5.32	5.32	5.32
Communication	28.78	28.78	19.63	15.23	24.91	9.422	14.702	17.166	28.78
Laundry	-	-	-	-	50	50	50	-	-
Accounting Department	52	52	52	52	52	52	52	52	52
Office Requisites and Miscellaneous	4	4	4	4	4	4	4	4	4
5- General Medical Material Cost Pool (₺)	502.92	502.92	304.8	209.55	419.1	83.82	198.12	251.46	502.92
6- Cafeteria Cost Pool (₺)	-	-	-	-	-	-	-	1,157.85	-

Table 25 (continued)	A1	A2	A3	A4	A5	A6	A7	A8	A9
7- Information System Cost Pool (₺)	17.22	17.22	17.22	17.22	17.22	17.22	17.22	17.22	17.22
TOTAL (₺)	**1,951.68**	**4,910.15**	**1,445.88**	**1,353.73**	**4,595.262**	**5,455.192**	**1,599.761**	**2,401.02**	**3,582.8**

The total costs of the activities are presented at the last row of Table 25. The next step to be done is to allocate activities costs to products. As shown in Table 26, since the time is considered as an efficient allocation base, activities costs will be allocated to products on the basis of time to compute costs of the open and laparoscopic operations.

Table 26
An Allocation of Activities Costs to Gallbladder Operations in the Long-Term Analysis

Costs of the Activities (₺)	Total Time	Cost per Time (₺)	Time Needed by the Open Operation	Time Needed by the Laparoscopic Operation	Cost of the Open Operation (₺)	Cost of the Laparoscopic Operation (₺)
A1: 1,951.68	3,421 min	0.57	58 min	58 min	33.06	33.06
A2: 4,910.15	2,105 min	2.333	25 min	20 min	58.325	46.66
A3: 1,445.88	2,696 min	0.536	54 min	54 min	28.944	28.944
A4: 1,353.73	1,005 min	1.347	26 min	21 min	35.022	28.287
A5: 4,595.262	3,477 min	1.321	75 min	60 min	99.075	79.26
A6: 5,455.192	8,720 min	0.625	500 min	380 min	312.5	237.5
A7: 1,599.761	3,600 min	0.444	288 min	72 min	127.872	31.968
A8: 2,401.02	1,585 min	1.515	81 min	24 min	122.715	36.36
A9: 3,582.8	1,858 min	1.928	50 min	32 min	96.4	61.696
Total:					**913.913**	**583.735**

Table 26 indicates that the costs to be allocated to the open and laparoscopic operations are ₺913.913 and ₺583.735, respectively. These amounts should be added to direct costs so as to determine the costs of the open and laparoscopic operations for a long period of time. The results of the RCA system will be compared to the results obtained by the TCS, ABC and TDABC systems in the next section.

5.7. Results and Discussion

A comparison of the results of the RCA system with the results obtained by the TCS, ABC, and TDABC systems will be given in this section. Thus, in order to provide a wide perspective, the results of the TCS, ABC, TDABC, and RCA systems can first be summarized in Table 27:

Table 27
The results of the TCS, ABC, TDABC, and RCA Systems

	TCS	
	Open Gallbladder Operation	**Laparoscopic Gallbladder Operation**
Direct	₺2,150	₺1,690
Indirect	₺1,562.91	₺520.97
Total (₺)	**₺3,712.91**	**₺2,210.97**
	CONVENTIONAL ABC SYSTEM	
	Open Gallbladder Operation	**Laparoscopic Gallbladder Operation**
Direct	₺2,150	₺1,690
Indirect	₺1,071.285	₺781.64
Total (₺)	**₺3,221.285**	**₺2,471.64**
	TDABC SYSTEM	
Direct	₺2,150	₺1,690
Indirect	₺777.902	₺444.475
Total (₺)	**₺2,927.902**	**₺2,134.475**
	RCA SYSTEM (LONG-TERM)	
	Open Gallbladder Operation	**Laparoscopic Gallbladder Operation**
Direct	₺2,150	₺1,690
Indirect	₺913.913	₺583.735
Total (₺)	**₺3,063.913**	**₺2,273.735**
	RCA SYSTEM (SHORT-TERM)	
	Open Gallbladder Operation	**Laparoscopic Gallbladder Operation**
Direct	₺2,150	₺1,690
Indirect	₺344.025	₺193.36
Total (₺)	**₺2,494.025**	**₺1,883.36**

Table 27 presents the differences between the RCA and other costing systems. Accordingly, the idea behind these systems will first be explained briefly. Then, the comparison of the RCA system with other systems will be clarified. Before analyzing the results, the percentage differences between the RCA and other systems should also be given below.

Table 28
The Percentage Differences Between the RCA and Other Systems

	Open Gallbladder Operation	Laparoscopic Gallbladder Operation
RCA System	**₺3,063.913**	**₺2,273.735**
TCS	**₺3,712.91**	**₺2,210.97**
Difference	(648.997)	62.765
Change (%)	(17.5%)	2.84%
RCA System	**₺3,063.913**	**₺2,273.735**
ABC System	**₺3,221.285**	**₺2,471.64**
Difference	(157.372)	(197.905)
Change (%)	(4.88%)	(8%)
RCA System	**₺3,063.913**	**₺2,273.735**
TDABC System	**₺2,927.902**	**₺2,134.475**
Difference	136.011	139.26
Change (%)	4.64%	6.52%

It is important to note that since the TCS, ABC, and TDABC systems are based on absorption costing, the RCA system for a long period of time has only been used in Table 28.

Notice that Mağusa Yaşam Hospital uses the TCS to calculate the costs of their services. The TCS considers only patient-day in the allocation of costs to cost objects. Open and laparoscopic gallbladder operations are the main cost objects of this study.

The ABC system can also be used to calculate the costs of the open and laparoscopic gallbladder operations. This system first assigns overhead costs to activities based on the resources used by the activities. Then, it assigns the cost of activities to the open and laparoscopic gallbladder operations based on the activities consumed by the operations.

On the other hand, the TDABC is a new system that is simpler, and more accurate than the conventional ABC system. It uses two parameters “the time needed to perform an activity” and “the cost of unit time” to allocate costs to the open and laparoscopic gallbladder operations.

Finally, the RCA system is a new and advanced system including the major benefits of both German and U.S. Costing Systems. This system first collects resources into resource pools and then allocates the costs of the resource pools to activities. Afterwards, the costs of activities are allocated to the open and laparoscopic gallbladder operations by using both volume-based and non-volume-based cost drivers.

When the RCA (Long-term) system is compared with the TCS, it can be said that the cost of open gallbladder operation should be less than the cost obtained by the TCS. On the other hand, the cost of laparoscopic gallbladder operations should be more than the cost obtained by the TCS. Indeed, the open gallbladder operation should be decreased from ₺3,712.91 to ₺3,063.913. In contrast, the cost of laparoscopic gallbladder operations should be increased from ₺2,210.97 to ₺2,273.735. When the percentage values are considered, it can be noted that the open gallbladder operation requires a 17.5 percent less cost allocation and the laparoscopic gallbladder operation requires 2.84 percent more cost allocation in the RCA system. It is important to emphasize that considering patient-day as an allocation base is not efficient since one patient staying in a hospital may consume resources more than another patient staying in the hospital during the same time period. Thus, the RCA system produces more accurate results than the TCS does.

When the RCA (Long-term) system is compared with the ABC, it can be said that the RCA system assigns lower costs to open and laparoscopic gallbladder operations. Indeed, the open gallbladder operations should be decreased from ₺3,221.285 to ₺3,063.913. In the same way, the laparoscopic gallbladder operation should be decreased from ₺2,471.64 to ₺2,273.735. When Table 28 is analyzed, it can be said that the open and laparoscopic gallbladder operations should be less than the ABC system by 4.88 and 8 percent respectively. It is important to emphasize that the ABC system does not take the unused capacity into account so the cost of open or laparoscopic gallbladder operation would be more than it should be. In this respect, it can be said that the RCA system produces more accurate results than the ABC does.

When the RCA (Long-term) system is compared with the TDABC, it can be said that the RCA system assigns a higher cost to open and laparoscopic gallbladder operations. Indeed, the open gallbladder operations should be increased from ₺2,927.902 to ₺3,063.913. In addition, the laparoscopic gallbladder operation should be increased from ₺2,134.475 to ₺2,273.735. When Table 28 is analyzed, it can be said that the open and laparoscopic gallbladder operations should be more than the TDABC system by 4.64 and 6.52 percent, respectively. It is also important to note that, depending on both the consumption of resources and the percentage of fixed cost in total cost, the RCA system which allocates a higher cost to the open and laparoscopic operations in this study, may allocate lower costs to the same operations in a different hospital.

Unlike the TCS and ABC systems, the RCA and TDABC systems consider the unused capacities so it can be said that these systems are efficient. However, an important point here is that since the RCA system has different resource perspective than the TDABC system, it produces more accurate results than the TDABC does. This is because the RCA system assumes that the cost of unused capacity is occurred by only resources that have variable cost. As noted earlier, the RCA system first separates costs into fixed and variable. Then, since fixed costs are independent of the volume of output, these costs are excluded from the cost of unused capacity. To illustrate, the general surgery department made an agreement with anesthetist to pay him ₺1,500 per month. This is a fixed cost and considering the time spent for each patient by the anesthetist becomes meaningless. In addition, when the building insurance, building depreciation, or building maintenance and repairing costs are considered, it can be said that these costs are fixed. Thus, regardless of the number of patients, the general surgery department should incur these costs. This is the advantage of the resource-based view of the RCA system. However, the TDABC system, which has the activity-based view only, allocates these costs to activities. In other words, each activity includes fixed costs in the TDABC system. Then, allocating the costs of these activities by considering the time needed by each patient produces inaccurate information about the costs of the operations. This is due to the fact that the time needed per patient or the total time needed by all patients should always be independent of the fixed cost within

the relevant range. This can be understood by analyzing Table 29 and Table 30 given below.

Table 29
The Costs of Unused Capacities in the TDABC System

ACTIVITIES	COMMITTED COST (₺)	ALLOCATED COST (₺)	COST OF UNUSED CAPACITY (₺)
A1: Patient Acceptance and Discharging	**1,507.85**	**760.279**	**747.571**
Ambulance man	477.01	426.955	50.055
Customer Service Representative:	1,030.84	333.324	697.516
A2: Medical Examination	**6,138.609**	**2,156.074**	**3,982.535**
Surgeon	6,138.609	2,156.074	3,982.535
A3: Laboratory Test	**1,442.99**	**1,385.422**	**57.568**
Laboratory Personnel	1,442.99	1,385.422	57.568
A4: Ultrasound Control	**1,063.42**	**1,007.51**	**55.91**
Radiologist	1,063.42	1,007.51	55.91
A5: Nurse Services before Hospitalization	**2,780.59**	**2,603.74**	**176.85**
Nurses	2,780.59	2,603.74	176.85
A6: Surgical Operation	**11,763.16**	**4,801.558**	**6,961.602**
Surgeon	3,228.29	1,674.02	1,554.27
Assistant Doctor	4,028.29	1,101.49	2,926.8
Anesthetist	2,328.29	1,516.238	812.052
Theater Nurses	2,178.29	509.81	1,668.48
A7: Nurse Services after Hospitalization	**2,571.42**	**2,493.36**	**78.06**
Nurses	2,571.42	2,493.36	78.06
A8: Meal Services	**2,973.95**	**2,222.71**	**751.24**
Cafeteria Staff	2,973.95	2,222.71	751.24
A9: Giving Morale and Patient Discharging	**2,058.674**	**1,362.406**	**696.268**
Assistant Doctor	1,149.217	472.557	676.66
Nurses	909.457	889.849	19.608
TOTAL(₺)	**32,300.663**	**18,793.059**	**13,507.604**

Table 30
The Costs of Unused Capacities in the RCA System

RESOURCE POOL	COMMITTED COST (₺)	ALLOCATED COST (₺)	COST OF UNUSED CAPACITY (₺)
1- MANAGEMENT COST	**20,218**	**16,259.474**	**3,958.526**
Surgeon	6,000	4,160	1,840
Anesthetist	1,500	1,500	0
Assistant Doctor	4,000	2,850	1,150
Customer Service Representatives	650	650	0
Theater Nurses	1,350	1,350	0
Nurses	4,481.9	4,071.41	410.49
Gardener	30	30	0
Cafeteria Staff	971.1	613.064	358.036
Ambulance Men	260	260	0
Laboratory Personnel	375	375	0
Radiologists	600	400	200
2- MEDICAL INSTRUMENT	**2,180.82**	**2180.82**	**0**
3- BUILDING COST POOL	**3,725**	**3,656**	**69**
Building Insurance	150	150	0
Building Depreciation	200	200	0
Building Maintenance and Repairing	50	50	0
Cleaning	725	725	0
Electricity	2,600	2,531	69
4- DAILY COST POOL	**914**	**887.856**	**26.144**
Water Consumption	60	46.4	13.6
Communication	200	187.456	12.544
Laundry	150	150	0
Accounting Department	468	468	0
Office Requisites and Miscellaneous	36	36	0
5- GENERAL MEDICAL MATERIAL COST POOL	**3,240**	**2,975.61**	**264.39**
6- CAFETERIA COST POOL	**1,867.5**	**1,157.85**	**709.65**
7- INFORMATION SYSTEM COST POOL	**155**	**155**	**0**
TOTAL	**32,300.32**	**27,272.61**	**5,027.71**

Table 29 and Table 30 summarize the costs of unused capacities in the TDABC and RCA systems, respectively. As noted earlier, since the TDABC system does not separate

fixed costs from the activity costs, it calculates a higher unused capacity cost in the general surgery department. The RCA, which is a unique and powerful system, overcomes this obstacle by separating costs into fixed and variable.

The RCA system indicates that a total of ₺5,027.71 is found to be an unused capacity cost of the general surgery department. Thus, the management of the hospital should exert an effort to eliminate the unused capacity of employees by reducing their working hours or by directing them to other productive areas.

Besides obtaining an accurate result related to the cost of unused capacity, the RCA system is an advanced system since it provides insights into the short-term decision making. Indeed, the sales prices of the open and laparoscopic operations can be decreased up to ₺2,494.025 and ₺1,883.36, respectively. This low cost strategy will enable the hospital to increase its competitive advantage.

CHAPTER VI

CONCLUSION

This chapter includes four main sections. In the first section, the summary and conclusion will be given. In the second section, the contribution to the literature will be discussed. The limitations of the study will be mentioned in the third section. Implication for further research will also be given in the last section.

6.1. Summary and Conclusion

Managers, who are the people inside an organization, use the data obtained by the cost system of the organization for internal purposes. This is due to the fact that their primary role is to direct and manage the organization to increase its profitability. However, if the cost system is not efficient, the managers cannot boost the organizational profitability. Thus, managers should first use an efficient cost system

Using an efficient cost system is one of the most important strategies for companies to achieve their own goals. In this respect, Mağusa Yaşam Hospital uses the TCS to find out cost of services, to perform activities and to maximize its own profit. In this system, the management of the hospital allocates overhead costs to the open and laparoscopic operations on the basis of patient-day. However, using patient-day as an allocation base is not efficient since one patient staying in a hospital may consume resources more than another patient staying in the hospital during the same time period.

The ABC system can be used as an alternative model to the TCS. The ABC is a two-stage costing system. In the first stage, costs are allocated to the activities performed in the general surgery department based on the resources used. In the second stage, the costs of activities are allocated to the open and laparoscopic operations based on the activities consumed. However, the ABC system has no ability to point out idle capacity since it assumes employees work at full capacity.

Since the TDABC system reveals the unused capacity, it can be used by the hospital. However, in order to determine the cost of the unused capacity, this system constitutes a relationship between fixed costs and work performed in the hospital. This is because it first assigns all overhead costs to activities. Then, without separating fixed and variable costs, all activities costs are divided by practical capacities to find out capacity cost rates. Since activity costs include fixed costs, the capacity cost rates will be higher than it should be. Indeed, fixed costs are independent of the work performed so these costs should not be allocated proportionally to the unused capacity cost. Then, the difference between the practical capacity and the time needed by the job will be multiplied by the capacity cost rate to calculate the cost of unused capacity. As a result of this, the unused capacities of resources are calculated inaccurately. Thus, a new and efficient system, RCA, can be used by the hospital.

The RCA is a new, comprehensive, and integrated management accounting system. It combines the principles of GPK with the ABC system. This system identifies the origin of the unused capacity problem. Indeed, unlike the TDABC system identifying the unused capacities of activities, the RCA system identifies the unused capacities of resources so it displays the root causes of inefficient uses of resources.

The RCA system has been used in this study. Accordingly, resources were first collected into resource pools. In addition, resources in each resource pool were classified into two categories, variable and fixed. Then, by allocating variable and fixed costs to the open and laparoscopic operations, this system provides short- and long-term perspectives on the costs of the open and laparoscopic operations.

It is also important to emphasize that the research method of the study is a Case Study. This is because it provides a wide perspective to researchers on a research topic. In this regard, a descriptive case study was first carried out for identifying the current situation of the company. An exploratory case study was then conducted to reveal the results of the RCA system.

As noted earlier, the major objective of the study is to show both the importance and applicability of the RCA system. This can be done by answering the research questions given as below.

- Whether or not an RCA system can be used in determining the cost of products,
- To identify if there are any significant differences between the results of the RCA and TDABC systems,
- To identify whether or not the RCA system can be applied in a service company.

To answer the first research question, it can be said that the RCA system can be used in determining the cost of products or services. Not only does the RCA system give an accurate result, it can also be applied easily. Indeed, it does not allocate the unused capacity cost to the cost objects. In addition, by considering resources used by the cost objects, cost allocation is done accurately. On the other hand, the implementation process of the RCA system is not difficult. This is because the RCA system is a systematic approach. In this regard, resources were first collected into resource pools. Second, resources in each resource pool were classified into two categories, variable and fixed. Third, costs of resource pools are allocated to the activities. Fourth, the costs of activities are allocated to the cost objects based on the activities consumed. In this process, using both volume-based and non-volume-based cost drivers increases the flexibility of the system.

To answer the second research question, it can be said that there are two major differences between the results of the RCA and TDABC systems. The first one is that, unlike the TDABC system, the RCA system can calculate lower unused capacity costs. This is for the reason that the RCA system assumes that the cost of unused capacity is occurred by only resources that have variable cost. Thus, all fixed costs to be incurred should not be added to the costs of the unused capacities. This can easily be understood by considering the stages of these systems. The TDABC system determines the unused capacity in the stage of allocating activities costs to products or services. However, the RCA system determines the unused capacity in the stage of allocating resource costs to activities. Thus, it can also be said that the RCA system produces an accurate data related

to the unused capacity by analyzing the root of the problem. The second one is that while the TDABC system produces results that can only be used in making long-term decisions, the RCA system produces results that can be used in making both short- and long-term decisions. This will help companies to provide a competitive advantage.

To answer the third research question, it can be said that RCA system can be applied in a service company. It is also important to emphasize that there are five advantages that can be obtained by using the RCA system. First of all, companies can use activity-based and volume-based cost drivers. Thus, the RCA system helps managers to allocate costs accurately. Second, the idea of the RCA system can increase the flexibility of the companies having distinct costing systems. To illustrate, a company using the TDABC system can separate costs into fixed and variable so as to obtain results in making short-term decisions. Third, the RCA system enables managers to make both short- and long-term decisions. Fourth, the costs of unused capacities are calculated accurately. In addition, resources that have unused capacity are clearly presented. Fifth, the difficulty in analyzing resources has been reduced by collecting them into resource pools.

To sum up, the RCA system was successfully implemented in the general surgery department of the hospital. Thus, it can be said that the RCA is an efficient system that can be used to obtain accurate results. This system can also be used to get a broad picture of the consumption of the company's resources.

6.2. Limitations of The Study

Like the most research studies, this thesis has several limitations that can be given below:

- Because of time constraints, the implementation was realized in the general surgery department only. However, since it is an advanced system that has the same logic for any department inside the company, managers need only time gaps to implement this system to all parts of the hospital.

- The RCA system uses the replacement cost depreciation method. However, since it is time consuming and expensive task to determine the replacement values, the historical cost data were used. It is also important to emphasize that by using the same data, the differences between the RCA and TDABC systems were clearly displayed.
- The RCA system separates costs into fixed and proportional. While fixed costs are always fixed, the proportional costs can change in proportion to changes in cost centre output. According to the interviews and observations, the proportional costs of the hospital do not change in proportion to the changes of output. Thus, the term “variable cost” was used instead of the term “proportional cost".

6.3. Contribution to the Literature

When the data of “The Council of Higher Education” are analyzed, it can be said that this is the first thesis related to the RCA system conducted in both Cyprus and Turkey. Thus, this thesis will contribute to the spread of the RCA system studies among the managerial accounting researchers in both Cyprus and Turkey.

On the other hand, one of the most important results of this study is that the cost of unused capacity in the TDABC system is more than it should be. In this regard, it helps the implementers of TDABC system to revise the data concerning the cost of unused capacity.

By giving an idea of separating costs into fixed and variable, it will also help managers to create a combined system that can produce both short- and long-term decisions.

Finally, the study provides a number of interesting results for researchers. Indeed, some results of the study may be useable by the other healthcare institutions. To illustrate, the RCA system, in this study, shows that when a company has a mixed cost, the RCA system, contrary to the TDABC system, can calculate lower unused capacity costs. This can be adapted to suit other areas.

6.4. Implications For Further Research

This study, which was conducted in a healthcare institution, was clarified the applicability and efficiency of the RCA system. In this regard, by overcoming the limitations of this study, a future research could be conducted in other service-providing industries. It is also recommended that many management accounting systems such as Balanced Scorecard, Quality Cost or TDABC could also be used as a complementary of the RCA system to create an approach to provide additional insights.

REFERENCES

Abdul Rahim, A. R., & Nabi Baksh, M. S. (2003). Case study method for new product development in engineer-to-order organizations. *Work Study*, *52*(1), 25-36.

Ahmed, S. A., & Moosa, M. (2011). Application of resource consumption accounting (RCA) in an educational institute. *Pakistan Business Review, 12*(4), 755-775.

Alshawi, S., Themistocleous, M., & Almadani, R. (2004). Integrating diverse ERP systems: A case study. *The Journal of Enterprise Information Management*, *17*(6), 454-462.

Atkinson, A. A., Banker, R. D., Kaplan, R. S., & Young, S. M. (2001). *Management Accounting* (3th ed.). New Jersey: Prentice Hall.

Baker, T. L. (1994). *Doing social research* (2nd ed.), Singapore: McGraw-Hill.

Barrett, R. (2005). Time driven costing: The bottom line on the new ABC. *Business Performance Management, 3*(1), 35-39.

Beheshti, H. M. (2006). What managers should know about ERP/ERP II. *Management Research News, 29*(4), 184-193.

Benjamin, L., & Simon, T. (2003). A planning and control model based on RCA principles. *Cost Management, 17*(4), 20-27.

Blocher, E. J., Stout, D. E., & Cokins, G. (2010). Cost management: A strategic emphasis (5th ed.). New York: McGraw-Hill/Irwin.

Cengiz, E. (2012). Gelişmiş bir maliyetleme yaklaşımı olarak kaynak tüketim muhasebesi. *Muhasebe Bilim Dünyası Dergisi, 14*(1), 215-233.

Cepeda, G., & Martin, D. (2005). A review of case studies publishing in Management Decision: Guides and criteria for achieving quality in qualitative research. *Management Decision, 43*(6), 851-876.

Chalos, P., & Bader, A. H. (1986). Focus On Industry. *Journal of Accountancy 161*(3), 106-115.

Chen, Z. & Wang, L. (2007). A generic activity-dictionary-based method for product costing in mass customization. *Journal of Manufacturing Technology Management, 18*(6), 678-700.

Cheney, G. (2005). German cost accounting: Will it work in America? *Assurance*, *19*(9), 14-16.

Chung, B. Y., Skibniewski, M. J., Lucas, H. C., & Kwak, Y. H. (2008). Analyzing enterprise resource planning system implementation success factors in the engineering–construction industry. *Journal Of Computing In Civil Engineering, 22*(6), 373-382.

Dalcı, İ., Tanış, V. N., & Koşan, L. (2010). Customer profitability analysis with time-driven activity-based costing: A case study in a hotel. *International Journal of Contemporary Hospitality Management*, *22*(5), 609-637.

Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: combining rigour, relevance and pragmatism. *Information Systems Journal, 8*(4), 1998, 273-289.

Dejnega, O. (2011). Method time driven activity based costing – literature review. *Journal of Applied Economic Sciences, 6*(1-15), 7-15.

Demeere, N., Stouthuysen, K., & Roodhooft, F. (2009). Time-driven activity-based costing in an outpatient clinic environment: Development, relevance and managerial impact. *Health Policy, 92*(2-3), 296–304.

Dezdar, S., & Ainin, S. (2010). ERP implementation success in Iran: Examining the role of system environment factors. *World Academy of Science, Engineering and Technology, 66*, 449-455.

Drury, C. (1992). *Management and Cost Accounting* (3th ed.). Hong-Kong: Chapman-Hall.

Ekmekçi, F. Ö. (1999). *Research Manual for Social Sciences* (2nd ed.). İstanbul: Selt Publishing.

Ernst & Young, and Institute of Management Accountants. (2003). *2003 Survey of Management Accounting*. Retrieved February 2, 2012, from http://www.3csoftware.com/wp-content/uploads/2010/08/2003 _Survey_Management_Accounting. pdf

Everaert, P., & Bruggeman, W. (2007). Time driven activity based costing: Exploring the underlying model. *Cost Management, 21*(2), 16-20.

Everaert, P., Bruggeman, W., & Creus, G. D. (2008). Sanac Inc.: From ABC to time-driven ABC (TDABC) – An instructional case. *Journal of Accounting Education, 26*(3), 118-154.

Everaert, P., Bruggeman, W., Sarens, G., Anderson, S., & Levant, Y. (2008). Cost modeling in logistics using time-driven ABC. Experiences from a wholesaler. *International Journal of Physical Distribution & Logistics Management, 38*(3), 172-191.

Ferratt, T. W., Ahire, S., & De, P. (2006). Achieving success in large projects: Implications from a study of ERP Implementations. *Interfaces, 36*(5), 458-469.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*(2), 219-245.

Friedl, G., Hammer, C., Pedell, B., & Küpper, H. U. (2009). How do German companies run their cost accounting systems. *Management Accounting Quarterly, 10*(2), 38-52.

Friedl, G., Küpper, H. U., & Pedell, B. (2005). Relevance added: Combining ABC with German cost accounting. *Strategic Finance, 86*(12), 56-61.

Gattiker, T. F., & Goodhue, D. L. (2000). Understanding the Plant Level Costs and Benefits of ERP: Will the ugly duckling always turn into a swan? *Proceedings of the 33rd Hawaii International Conference on System Sciences*.

Gervais, M., Levant, Y., & Ducrocq, C. (2010). Time-driven activity-based costing (TDABC): An initial appraisal through a longitudinal case study. *Journal of Applied Management Accounting Research, 8*(2), 1-20.

Grasso, L. P. (2005). Are ABC and RCA accounting systems compatible with lean management? *Management Accounting Quarterly, 7*(1), 12-27.

Gunasekaran, A. (1999). A framework for the design and audit of an activity-based costing system. *Managerial Auditing Journal, 14*(3), 118-126.

Gunasekaran, A., & Sarhadi, M. (1998). Implementation of activity-based costing in manufacturing. *International Journal of Production Economics, 56-57*, 231-242.

Gunasekaran, A., & Singh, D. (1999). Design of activity based costing in a small company: A case study, *Computers and Industrial Engineering, 37*(1–2), 413–416.

Gurowka, J., & Lawson, R. A. (2007). Selecting the right costing tool for your business needs. *Journal of Corporate Accounting & Finance, 18*(3), 21–27.

Hansen, D. R., Mowen, M. M., & Guan, L. (2009). *Cost management: Accounting and control* (6th ed.). USA: South-Western Cengage Learning.

Heitger, L., Ogan, P., & Matulich, S. (1992). *Cost accounting* (2nd ed.). United States of America: South Western Publishing.

Horngren, C. T., Bhimani, A., Foster, G., & Datar, S. M. (1999). *Management and cost accounting*. Italy: Prentice Hall.

Horngren, C. T., Datar, S. M., & Rajan, M. (2012). *Cost accounting: A managerial emphasis* (14th ed.). New Jersey: Pearson Prentice Hall.

Hughes, A. (2005). ABC/ABM– activity-based costing and activity-based management: A profitability model for SMEs manufacturing clothing and textiles in the UK. *Journal of Fashion Marketing and Management, 9*(1), 8 – 19.

IFAC. (2009). *Evaluating the Costing Journey: A Costing Levels Continuum Maturity Model.* Retrieved March 5, 2012, from http://www.ifac.org/sites/default/files/publications/files/evaluating-the-costing-jour.pdf

Ismail, N. A. (2010). Activity-based management system implementation in higher education institution. *Campus-Wide Information Systems, 27*(1), 40 – 52.

Jackson, S., Sawyers, R. & Jenkins, G. (2006). *Management accounting* (International Student Edition). Singapore: Thomson South-Western.

Kaplan, R. S. (1984). Yesterday's accounting undermines production, *Harvard Business Review*, *62*(4), 95-101.

Kaplan, R. S., & Anderson, S. R. (2004). Time driven activity based costing. *Harvard Business Review, 82*(11), 131-138.

Kaplan, R. S., & Anderson, S. R. (2007a). *Time driven activity based costing: A simpler and more powerful path to higher profits*. Boston: Harvard Business School Press.

Kaplan, R. S., & Anderson, S. R. (2007b). The innovation of time-driven activity based costing. *Cost Management, 21*(2), 5-15.

Kaplan, R. S., & Atkinson, A. A. (1998). *Advanced management accounting* (6th ed.). United States of America: Prentice Hall.

Keys, D. E., & Lefevre, R. J. (1995). Departmental activity-based management. *Management Accounting, 76*(7), 27-30.

Khataie, A. H., Bulgak, A. A., & Segovia, J. J. (2011). Activity-based costing and management applied in a hybrid decision support system for order management. *Decision Support Systems, 52*(1), 142-156.

Kinney, M. R., & Raiborn C. A. (2011). *Cost accounting: Foundations and evolutions* (8th ed.). United States of America: South-Western Cengage Learning.

Kloock, J., & Schiller, U. (1997). Marginal costing: Cost budgeting and cost variance analysis. *Management Accounting Research, 8*(3), 299-323.

Krumwiede, K. R. (2005). Rewards and realities of German cost accounting. *Strategic Finance, 86*(10), 27-34.

Krumwiede, K. R., & Suessmair, A. (2008). A closer look at German cost accounting methods. *Management Accounting Quarterly, 10*(1), 37-49.

Krumwiede, K. R., Suessmair, A., & MacDonald, J. (2007). An exploratory study of the factors affecting the implementation success of German cost accounting methods. *AAA MAS Meeting Paper*. 1-55. Available at SSRN: http://ssrn.com/abstract=1003833 or http://dx.doi.org/10.2139/ssrn.1003833.

Labro, E., & Vanhoucke, M. (2008). Diversity in resource consumption patterns and robustness of costing systems to errors. *Management Science, 54*(10), 1715-1730.

Lambino, C. & (2007). Time driven activity based costing. *Government Finance Review, 23*(4), 74-75.

Lanen, W. N., Anderson, S. W., & Maher, M. W. (2011). *Fundamentals of cost accounting* (3th ed.). New York: McGraw-Hill/Irwin.

Lere, J. C. (2000). Activity-based costing: A powerful tool for pricing. *Journal Of Business & Industrial Marketing, 15*(1), 23-33.

MacArthur, J. B. (1993). Theory of constraints and activity-based costing: Friends or foes. *Journal of Cost Management, 7*(2), 50-56.

MacArthur, J. B. (2006). Cultural influences on German versus U.S. management accounting practices. *Management Accounting Quarterly, 7*(2), 10-16.

Mackie, B. (2006). Merging GPK and ABC on the road to RCA. *Strategic Finance, 88*(5), 33-39.

Martin, J. R. (n.d.). *Summary of "Resource consumption accounting: The next generation of cost management systems"*. Retrieved February 6, 2012, from http://maaw.info/ArticleSummaries/ArtSumClintonKeys.htm#Note 1.

McWatters, C. S., Morse, D. C., & Zimmerman, J. L. (2001). *Management accounting: Analysis and interpretation* (2nd ed.). New York: McGraw Hill/Irwin.

Morabito, V., Pace, S., & Previtali, P. (2005). ERP marketing and Italian SMEs. *European Management Journal, 23*(5), 590–598.

Morse, W. J., Davis, J. R., & Hartgraves, A. L. (2003). *Management accounting: A strategic tool* (3th ed.). United States of America: Thomson South-Western.

Ozyapici, H. (2008). *An implementation of time driven activity based costing system in a healthcare institution.* Unpublished master's thesis, Marmara University, İstanbul.

Periasamy, P. (2010). *A textbook of financial, cost, and management accounting*. Nagpur: Himalaya Publishing House.

Pernot, E., Roodhooft, F., & Van den Abbeele, A. (2007). Time driven activity based costing for inter-library services: A case study in a university. *The Journal of Academic Librarianship, 33*(5), 551-560.

Polimeni, R. S., Fabozzi, F. J., & Adelberg, A. H. (1991). *Cost accounting: Concepts and applications for managerial decision making* (3rd ed.). Singapore: McGraw-Hill.

Portz, K., & Lere, J. C. (2009). Is German cost accounting right for your firm? *CMA Management, 82*(9), 48-50.

Qi, S. (2009). Case study in contemporary educational research: Conceptualization and critique. *Cross-Cultural Communication 5*(4), 21-31.

Rowley, J. (2002). Using case studies in research. *Management Research News, 25*(1), 16-27.

Roztocki, N., Porter, J. D., Thomas, R. M., & Needy, K. L. (2004). A procedure for the smooth implementation of activity based costing in small companies. *Engineering Management Journal, 16*(4), 19-27.

Ryan, B., Scapens, R. W., & Theobald, M. (1992). *Research method and methodology in finance and accounting*. London: Academic Press.

Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research methods for business students* (4th ed.). Spain: Prentice Hall Financial Times.

Shah, S. I. H., Bokhari, R. H., Hassan, S., Shah, M. H., & Shah, M. A. (2011). Socio-technical factors affecting ERP implementation success in Pakistan: an empirical study. *Australian Journal of Basic and Applied Sciences, 5*(3), 742-749.

Sharman, P. A. (2003a). Bring on German cost accounting. *Strategic Finance, 85*(6), 30-38.

Sharman, P. A. (2003b). The case for management accounting. *Strategic Finance, 85*(4), 42-47.

Sharman, P. A., & Vikas, K. (2004). Lessons from German. *Strategic Finance, 86*(6), 28-35.

Singh, Y. K. (2006). *Fundamental of Research Methodology and Statistics*. New Delhi: New Age International Publisher.

Stout, D. E., & Propri, J. M. (2011). Implementing time-driven activity-based costing at a medium-sized electronics company. *Management Accounting Quarterly, 12*(3), 1-11.

Stouthuysen, K., Swiggers, M., Reheul, A. M., & Roodhooft, F. (2010). Time-driven activity-based costing for a library acquisition process: A case study in a Belgian University. *Library Collections, 34*(2-3), 83-91.

Supramaniam, M., & Kuppusamy, M. (2009). Investigating the critical factors in implementing enterprise resource planning system in Malaysian business firms. *World Academy of Science, Engineering and Technology, 57*, 332-341.

Tanış, V. N. (1996). Change in manufacturing and its effects on cost and management accounting. *Hacettepe Üniversitesi İİBF Dergisi, 14*(2).

Tanış, V. N. (2005). *Teknolojik değişim ve maliyet muhasebesi* (1st ed.). Adana: Nobel Kitabevi.

Tse, M., & Gong, M. (2009). Recognition of idle resources in time-driven activity-based costing and resource consumption accounting models. *Journal of Applied Management Accounting Research*, *7*(2), 41-54.

Van Damme, D. A., & Van Der Zon, F. L. A. (1999). Activity Based Costing and Decision Support. *The International Journal of Logistics Management, 10*(1), 71-82.

Van Der Merwe, A., & Keys, D. E. (2002). The case for resource consumption accounting. *Strategic Finance*, *83*(10), 30-36.

Wang, Y., Zhuang, Y., Hao, Z., & Li J. (2009). Study on the application of RCA in college education cost accounting. *International Journal of Business and Management, 4*(5), 84-88.

Webber, S., & Clinton, B. D. (2004). Resource consumption accounting applied: The Clopay case. *Management Accounting Quarterly, 6*(1), 1-14.

Weetman, P. (2010). *Management Accounting* (2nd ed.). England: Pearson Education Limited.

Wegmann, G. (2009). The activity-based costing method: Development and applications. *The ICFAI University Journal of Accounting Research, 8*(1), 7-22.

Wensing, M. (2008). Research methods from social science can contribute much to the health sciences. *Journal of Clinical Epidemiology, 61*(6), 519-520.

Weygant, J. J., Kieso, D. E., & Kimmel, P. D. (2005). *Managerial accounting: Tools for decision making* (3th ed.). United States of America: John Wiley Sons Inc..

White, L. (2009). Resource consumption accounting: Manager-focused management accounting. *Journal of Corporate Accounting & Finance, 20*(4), 63–77.

Wild, J. J. & Shaw, K. W. (2010). *Managerial Accounting.* New York: McGraw Hill/Irwin.

Williamson, D. (1996). *Cost and management accounting* (1st ed.). London: Prentice Hall.

World Health Organization, (2001). *Health research methodology: A guide for training in research methods* (2nd ed.). Manila Philippines: Regional Office for the Western Pacific.

Yennie, H. (1999). ABC: The new cost-cutting tool. *Behavioral Health Management, 19*(5), 26-32.

Yin, R. K. (2003a). *Case study research: Design and methods* (3th ed.). Applied Social Research Methods Series, Volume 5, United States of America: Sage Publications.

Yin, R. K. (2003b). *Applications of case study research* (2nd ed.). Applied Social Research Methods Series, Volume 34, United States of America: Sage Publications.

Zeng, Y., Chiang, R. H. L., & Yen, D. C., Enterprise integration with advanced information technologies: ERP and data warehousing. *Information Management and Computer Security, 11*(3), 115-122.

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2010). *Business research methods* (8th ed.). Singapore: South-Western College Publication.

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