The Impact of the Magnitude of Overhead Costs on the Difference between ABC and TDABC Systems

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ABSTRACT

The objective of this study is to investigate the impact of the magnitude of overhead costs on the results of ABC and TDABC differences. A quantitative research method was used and data were gathered through an extensive literature review. A total of 170 articles that included both ABC and TDABC were found and 38 were used because only 38 articles included both the application of the systems and the comparison of the results of the systems. Correlation analysis and regression analysis were used to test whether there is a relationship between overhead costs and the differences in the results of ABC and TDABC systems. The results and findings indicated that there is a statistically significant relationship between the total amount of overhead cost and the differences in the results of ABC and TDABC systems.

Keywords: Time-Driven Activity-Based Costing System, Activity-Based Costing System, Advanced Costing Systems, Correlation Analysis, Regression Analysis

ÖZ

Bu çalışmanın amacı genel üretim giderleri büyüklüğünün FTM ve SDFTM sistemlerinin sonuçlarına etkisinin olup olmadığının araştırılmasıdır. Kantitatif araştırma metodu kulanılmış olup detaylı bir literatür taraması yapılımıştır. FTM ve SDFTM sistemini içeren 170 makale bulunmuş ve bulunan bu makalelerin sadece 38 tanesi uygulama ve kıyaslama içerdiği için dikkate alınmıştır. Korelasyon analizi ve regresyon analizi testleri kulanılarak genel üretim giderleri büyüklüğüyle FTM ve SDFTM sonuçları arasında bir ilişki olup olmadığı test edilmiştir. FTM ve SDFTM sistemlerinin sonuçlarının farklılığı ile genel üretim giderlerinin büyüklüğü arasında istatistiksel olarak anlamlı bir fark olduğu sonucuna varılmıştır.

Anahtar Kelimeler: Sürece Dayalı Faliyet Tabanlı Maliyet, Faliyet Tabanlı Maliyetleme, Gelişmiş Maliyet Sistemleri, Korelasyon Analizi, Regresyon Analizi

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LIST OF ABBREVIATIONS

Traditional Costing System	TCS
Activity-Based Costing	ABC
Time-Driven Activity-Based Costing	TDABC
Small- and Medium-Sized Enterprises	SMEs
Enterprise Resource Planning	ERP

Chapter 1

INTRODUCTION

1.1 Costing Systems: A General Overview

Nowadays, in the global business environment, organizations are facing heavy and intense competition on the prices and quality of products. Due to this, enterprises and businesses should investigate new strategies and innovations in their products and services in order to fascinate customers and neutralize competitors. In addition, organizations must find appropriate costing systems to use their resources more efficiently and effectively. It is essential for organizations to reduce risks when managers make decisions based on existing cost information. Consequently, cost accounting systems constitute the main structure of costing to make accurate, effective, and constructive decisions by managers.

In earlier years, organizations and businesses used traditional costing systems, which were easily adapted to fulfill the requirements of that time; a time period that was characterized by the lack of technology and low competition (Abad, 2016). However, service industries and manufacturing firms have developed new strategies to expand their businesses and increase organizational performance in today's business world. Therefore, organizations need modern and sophisticated cost systems to use resources more efficiently and effectively. Indeed, advanced cost accounting systems play a major role in organizations getting more accurate results. It is also essential for

decision makers to avoid over-costing or under-costing, which are not appropriate for long-term goals (Özyapici & Tanis, 2016).

In the current circumstances, traditional costing systems (TCS), such as absorption costing, standard costing, and variable costing, are not capable of compensating for organizational requirements (Celik, 2016). In addition, absorption costing is neither useful for controlling the costs of products nor suitable for managing planning functions (Polat, 2008). Accordingly, in the mid-1980s, Cooper and Kaplan developed a new costing system called the activity-based costing (ABC) system. ABC is a well-designed cost accounting system that is highly capable of solving complex and difficult cost accounting problems in service industries and other business sectors (Yilmaz, 2008).

ABC is known as a more adequate and accurate costing system than TCS. According to researchers and scientific evidence (e.g., Kaplan & Anderson, 2007; Celik, 2016), ABC ensures more appropriate and correct cost information. It assigns manufacturing overhead costs to products in a more logical way than TCS. ABC assigns overhead costs to products in two stages. In the first stage, ABC focuses on allocating the cost of each activity to products based on the cost of the resources used by each activity cost pool. In the second stage, it identifies appropriate cost drivers for each activity cost pool and allocates the costs of the activities to products or services (Masoumeh & Amir, 2015). However, organizations and service industries have faced several difficulties such as complex system design and lack of technical services during the implementation and integration of ABC. In addition, many organizations, especially medium- and large-sized organizations, abandoned the ABC system because it is costly to implement, maintain, and update (Kaplan &

Anderson, 2004). Therefore, in 2004, Kaplan and Anderson explored a new costing system called the time-driven activity-based costing (TDABC) system to minimize and eliminate the problems in the previous conventional ABC system. The TDABC system is easier to use, more effective, and less costly than the ABC system (Hajiha & Alishah, 2011).

1.2 The Objective of the Study

The objective of this study was to investigate whether the magnitude of overhead costs has an impact on the differences between the results of ABC and TDABC systems. Therefore, in this research study a quantitative literature survey method was used. There are many ways to implement this type of analysis in the social sciences. However, we applied regression analysis and correlation analysis, which are the common analysis methods used in this field (Pallant, 2013).

1.3 The Originality of the Study

According to previous studies, a group of researchers (e.g., Barrett, 2016; Everaert & Bruggeman, 2008; Kont, 2011; Namazi, 2016) investigated the theoretical background of the TDABC model and found that the TDABC system is more sophisticated and easier to update than the conventional ABC system. They found that the TDABC system can be implemented in all organizations and service industries with less difficulty in products and services. The researchers also mentioned that the TDABC system can be quickly adapted to fluctuating circumstances and provide more detailed resources for decision makers to get accurate managerial and financial results. In addition, the TDABC model can be considered as an instrument for developing and performing an effective management operation (Kaplan & Anderson, 2007; Putteman, 2008).

Another group of researchers (e.g., Dalci, Tanis, & Kosan, 2010; Demir, 2009; Kaplan & Anderson, 2007; Koşan, 2007; Oker & Ozyapici, 2013) examined the implementation of the TDABC system in organizations in order to demonstrate the efficiency and effectiveness of the system. They mentioned that the TDABC system is a new costing technique that is applied based on the time needed by activities and cost capacity rates in order to increase managerial and financial performance in organizations. In addition, they emphasized that this model requires less time and costs for collecting and analyzing resources. They also found that the TDABC system was developed to solve or eliminate the problems that occurred with the conventional ABC system. They noticed that the TDABC system increases the performance of organizations (Kaplan & Anderson, 2007).

To the best of our knowledge, even though many studies related to TDABC have been done by researchers, no studies have investigated the impact of the magnitude of overhead costs on the results of the ABC and TDABC systems. Indeed, the magnitude of overhead costs may have an effect on the results of costing systems. Technological innovation has led companies to invest in advanced technologies. Accordingly, the overhead rate has risen (Tanış, 2005, pp. 32-34). In addition, increases in transactions result in variation in overhead costs (Banker, Potter, & Schroeder, 1995). Therefore, it is expected that costing systems using volume-based cost drivers will produce different results than the ones using the number of transactions as an allocation base. That is, increasing the magnitude of overhead costs may result in difficulties in managing and allocating overhead costs. Costing systems may also produce different results from each other when a company's overhead costs are high, because overhead costs include both variable and fixed components. Thus, different cost drivers may calculate different application rates,

especially for fixed overhead costs. According to this background the following research question is going to be investigated:

Research question: Does the magnitude of overhead costs have an influence on the difference of ABC and TDABC systems?

1.4 Structure of the Thesis

This research study investigated that how the magnitude of overhead costs affects the results of the TDABC system. This thesis is structured as follows. The introduction and a description of the originality of the study are provided in Chapter 1. Chapter 2 includes a detailed explanation of the ABC and TDABC systems. Chapter 3 includes the research methodology. All the research methods are explained in a detailed way. Moreover, the main data analysis methods, such as correlation analysis and regression analysis are discussed as well as the data collection and analysis methods of the study. Chapter 4 includes the study's data analysis and findings regarding the correlation analysis and regression analysis. In addition, the results of the study are briefly explained. Chapter 5 contains the study's conclusions and the final discussion of the findings and results. Moreover, the limitations of the study and recommendations for future research are mentioned.

Chapter 2

LITERATURE REVIEW

2.1 Traditional Costing Systems

TCS uses direct labor hours or machine hours to trace overhead costs to products (Bufi, 2014). Today, in spite of TCS being more than 70 years old, many organizations still use it to evaluate inventories for financial goals (Abbeele, Cattrysse, & Guzman, 2014; Manalo, 2004).

In today's business environment, organizations are facing obstacles with TCS. The main problems of TCS are limited technology, restricted product areas, and inaccurate cost resources. In addition, using a single application rate, which is mainly volume based, causes inappropriate results, especially in complex organizations producing various types of products (Rasiah, 2011; Tanis & Ozyapici, 2012). Managers may not implement TCS in companies with a wide range of products since it causes cost distortions (Krishnan, 2006). Moreover, TCS does not provide appropriate cost information because it uses single- or volume-based cost drivers such as direct labor hours and machine hours to trace overhead costs to products or services (Bufi, 2014; Koşan, 2007; Oker & Ozyapici, 2013). In addition, TCS, may not provide appropriate non-financial resources for enterprises, especially small- and medium-sized enterprises (SMEs) (Ghanbari, Khorasani, & Zabih, 2016; Rasiah, 2011). Accordingly, today's highly competitive environment has forced

organizations to implement advanced cost accounting methods (Ghanbari et al., 2016).

2.2 Activity-Based Costing System

ABC was developed by Robert S. Kaplan in the beginning of the 1980s as an alternative to TCS because of the problems, such as unproductiveness and cost estimations that were not accurate, encountered by cost accountants and managers (Adiguzel, 2008). ABC is a costing system that uses activities to assign the cost of resources to products or services (Oker & Ozyapici, 2013). ABC is a well-designed costing system that analyzes operations and updates information that is related to organizational structure (Turney, 1991).

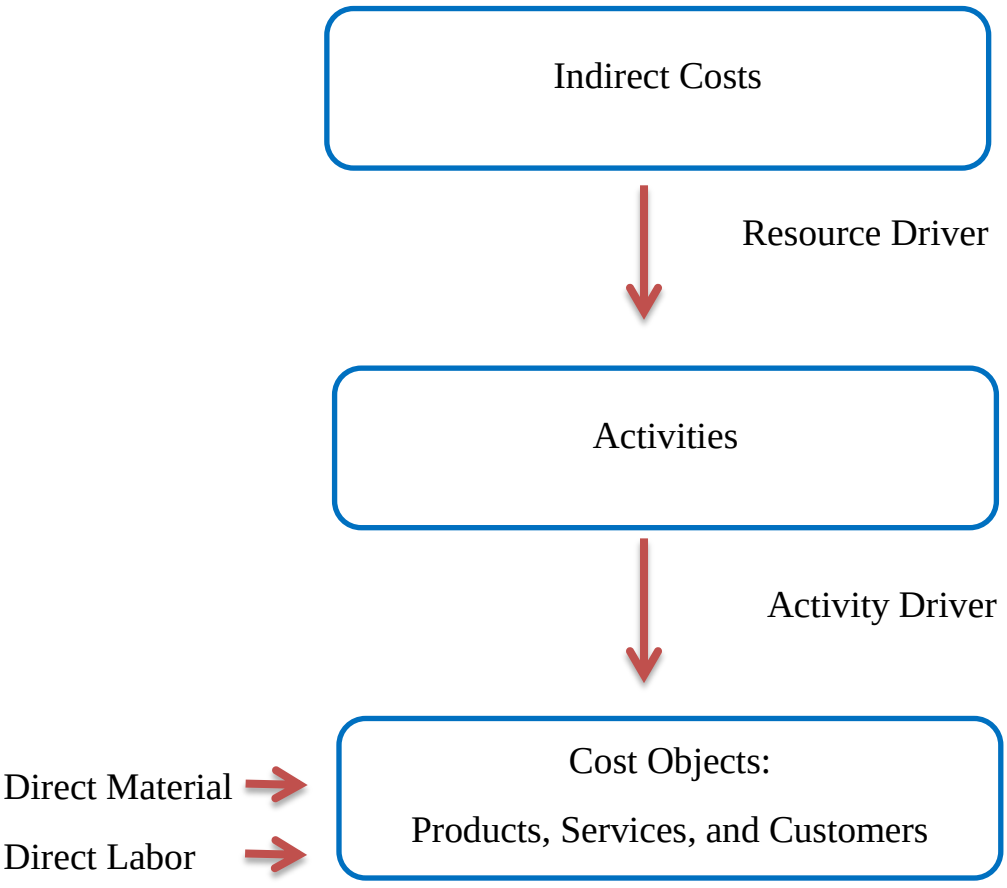

Figure 1: Activity-Based Costing System (Source: Kaplan & Cooper, 1998)

As shown in Figure 1, the ABC system covers two stages (Bruggeman & Everaert, 2007). In the first stage, indirect costs are assigned to the activities by using resource drivers. In the second stage, the costs of the activities are allocated to the cost objects by using activity drivers (Bruggeman & Everaert, 2007). It ensures more accurate resources for companies, which had mostly moved from the old generation that used TCS to the well-designed modern generation (Cooper & Kaplan, 1992). TCS does not prepare appropriate reports about cost information and activities that are required by businesses (Gunasekaran, 1999). ABC is more appropriate than other cost accounting systems in assigning indirect costs to the unit cost. It also has more sophisticated costing and pricing advantages (Reddy, Venter, & Olivier, 2011). For this reason, ABC is one of the valuable costing systems for managers.

ABC helps managers to recognize and eliminate activities that cause costs to increase (Demir, 2009). From this perspective, the ABC system can be used to decrease costs by deleting activities that are not needed (Hajiha & Alishah, 2011). The main steps of this system can be given as follows (Kaplan & Anderson, 2007; Adiguzel, 2008; Oker & Ozyapici, 2013; Putteman, 2008):

- Define the activities that are performed by the firm.
- Identify overhead costs.
- Determine resource drivers.
- Assign overhead costs to the activities by using resource drivers.
- Determine activity drivers.
- Allocate the costs of the activities to the products by using activity drivers.

2.2.1 Research on ABC

Cooper & Kaplan 1992 emphasized that ABC helps managers to focus their concentration and energy to increase organizational performance (Cooper & Kaplan, 1992). Zhuang & Chang (2015) stressed that the purpose of the ABC system was to find resolutions for the cost distortion problems that occurred with the previous system (Zhuang & Chang, 2015). In addition, ABC system is one of the major accounting systems that analyze and evaluate the costs of a company as well as preparing information to help decision makers (Zhuang & Chang, 2015). The ABC system has also two main stages: in the first stage, it allocates overhead costs to the activities; in the second stage, it assigns the costs of those activities to the products or services (Zhuang & Chang, 2015). Hill (1995) stated that ABC system calculates the cost of each activity in an organization. The author also stated that to assign the costs of activities to the products, the ABC system offers more accurate results by applying multiple cost drivers (Hill, 1995).

ABC system is more valuable than the TCS system for pricing, decision making, eliminating overhead costs, and continuous upgrades (Maskell, 1991). Abbeele & Guzman, (2012) noticed that the ABC system uses multiple cost drivers to show how cost resources and activities are consumed and ensure effective cost information for decision makers (Terungwa, 2012).

2.2.2 ABC Benefits

The ABC system provides more accurate and detailed cost resources to firms (Adiguzel, 2008; Reyhanoglu, 2004). It evaluates the activities needed by each product as well as the costs that are consumed by each product. ABC is a strong and effective system for business and sales markets to determine product and service costs (Bufi, 2014). ABC is a significant method that provides performance measures

regarding costs (Bufi, 2014). ABC creates an accurate performance evaluation of sales in an organization, which determines profit growth (Bufi, 2014). Consequently, the ABC system has the following advantages (Putteman, 2008, p. 31):

- The ABC system is more useful than previous cost accounting systems in analyzing and offering more realistic product costs.
- Service industries can easily identify the efficiency and effectiveness of product costs by implementing and integrating ABC systems.
- The ABC system offers an accurate, trustworthy, and effective approach to product costs by using resources more efficiently.
- The ABC system improves the capability of the decision makers to estimate accurate cost information by dividing overhead costs by the activity cost pools and determining a cost driver for each cost pool.
- The ABC system makes the production process clearer and more understandable.

2.2.3 ABC Pitfalls

Although the ABC system has some benefits, such as providing more accurate results than TCS or disclosing details regarding activities, it is not convenient for the demands of modern business environments (Adiguzel, 2008). For this reason, companies have faced significant obstacles with the ABC system.

2.2.3.1 Estimation Errors with the ABC System

There are three main types of errors occur with the conventional ABC model: specification errors, aggregation errors, and measurement errors (Datar & Gupta, 1994). Specification errors may emerge when inaccurate activity drivers are implemented or applied to cost objects. An aggregation error may emerge when overhead costs are aggregated with diverse activities. A measurement error occurs

when employees spend less time on each activity, which causes incorrect cost resources (Salem & Mazhar, 2014). In addition, the ABC system is not able to solve problems and difficulties that come up during the operational process (Kırıklıoğlu & Atalay, 2014).

2.2.3.2 Deficiencies in the ABC Software System

Several research and academic studies (e.g., Barrett, 2016; Cengiz, 2011; Cohen, 2005) have indicated that many organizations come across several problems during the implementation and maintenance of the ABC system. For example, managers need more time and power to collect information to apply the ABC system (Nassar, Morris, Thomas , & Sangster, 2017). In addition, a survey performed in a Greek company and concluded that the major problems of the ABC system are poor top management support, lack of employee training programs, and internal and external obstacles during the operation process (Cohen, 2005).

2.2.3.3 Problems with Maintaining and Updating the ABC System

The time needed and the costs incurred are the main obstacles of the ABC system; it is also very difficult to maintain (Cengiz, 2011). Managers cannot integrate and update the ABC software packages when desired as conditions change (Davut , 2011). Organizations can only update the required portion of the system during a specific time period (Küçüktüfekçi, 2014). In conclusion, Kaplan and Anderson summarized the pitfalls in the implementation of the ABC model with the following points (Kaplan & Anderson, 2007, p. 17):

- The survey study and interviewing procedure were costly and took time to manage.
- The resources for the conventional ABC system were complex and difficult to confirm.

- The resources were costly to collect, analyze, and operate.
- The significant parts of the ABC package or model were local, and the model did not integrate with enterprise-wide profitability.
- It was difficult to maintain and update the model.
- The system gave inappropriate results when it extracted unused capacity[1].

2.3 Time-Driven Activity-Based Costing System

As a reaction to the inadequacy of the conventional ABC system, the TDABC system was created by Robert S. Kaplan and Steven Anderson (Kaplan & Anderson, 2007). Even though the ABC system is still used to find solutions for problematic issues, many organizations, especially large-sized ones, have relinquished the conventional ABC system because of its shortcomings. Indeed, new cost concepts are available in more sophisticated and simplified ways (Somapa, Cools , & Dullaert, 2012).

The TDABC system is a modernized cost accounting model created by Kaplan and Anderson in the beginning of the 2000s to figure out the complexities and impediments in the conventional ABC system (Abbeele et al., 2014). TDABC is easier, less costly, and stronger than previous cost accounting systems (Kaplan & Anderson, 2007). The TDABC system is implemented simply with two parameters: the first parameter is the unit cost required by each activity associated with the cost objects; the second parameter is the duration needed to carry out each activity

[1] For more information, please see Kaplan & Anderson (2007). Kaplan, R. S., & Anderson, S. R. (2007). *Time-driven activity-based costing system.* Boston: Harvard Business School Press, vol.33,No. 5 (2007)

(Adiguzel, 2008). The TDABC system uses a new cost structure based on time duration and cost capacity rate in order to improve cost management performance. The new system also allows managers to obtain accurate cost resources for establishing organizational long-term strategies (Oker & Ozyapici, 2013; Namazi, 2016).

The main objective of the TDABC system is to use a method or technique based on the duration of activities, which can remove the obstacles and restrictions of the previous system (Kowsari, 2013). TDABC offers convenient and detailed preferences for defining capacity, costs, operations, and customers (Abad, 2016). The TDABC system involves the following main steps (Chansaad, 2012, p. 24):

- Identify the significant resources that affect activities.
- Identify costs for all activities.
- Identify the practical capacity of resources.
- Determine cost for per unit time.
- Determine time units for activities.
- Determine cost for each transaction.

Sanders (2003) study (as cited in Abad, 2016) emphaszied thatstated that in TCS, direct costs, like direct labor and materials, are transferred to the services, whereas indirect costs like training and marketing are allocated to the services by applying single cost drivers, such as direct labor and machine hours (Abad , 2016).

However, in some business environments, especially for large service industries, such as the automobile sector, indirect costs play a more major role than direct costs.

Researchers have sought to find solutions for these limitations and problems. They explored more appropriate cost systems, such as the ABC system (Abad, 2016). The ABC system offers better solutions for existing problems and provides better results than previous systems (Davut , 2011). Nevertheless, the ABC system has substantial constraints and limitations, for example, the ABC system is costly and time consuming during the implementation process, it may be inappropriate and irrelevant for some organizations, and it may estimate inaccurate time proportions for each activity; unrestrained time, information, and money for collecting (Kaplan & Anderson, 2007; Dalci et al., 2010). The TDABC system is a cost accounting system investigated by Kaplan and Anderson to solve the major problems, obstacles, and limitations faced by previous systems (Kaplan & Anderson, 2007). The TDABC system assigns costs directly to the cost objects by applying more appropriate and effective methods (Çapuk, 2012). Khan (2014), in his work regarding the implementation of the TDABC system in one of the hospitals in Isfahan, emphasized that all the hospitals and medical centers in the world could obtain correct and real cost resources by using the TDABC system. The system can avoid the damage that occurs by gathering incorrect costs and utilizing time durations (Khan, 2014).

According to scientific research, the practical capacity of and time duration for each activity is the main framework of the TDABC system (Koroglu, 2012). TDABC is an excessively efficacious accounting method that allows enterprises to recognize unused capacity and gather cost information in a detailed way (Manner, 2015).

2.3.1 The Transition to TDABC from ABC

Today, service companies such as banks, hospitals, and hotels are using a more fundamental structure of ABC in their operations (Abad, 2016). Researchers and

analysts of the ABC system have pointed out that it helps an organization to obtain accurate cost information. In addition, it offers opportunities to forestall improper and catastrophic decisions regarding the prices of products and long-term goals (Demeerec, Stouthuysena, & Roodhooft, 2009). Fortunately, the ABC system provides advanced cost information to managers to help them to understand the structure of their problems (Demir, 2009). Even though the above studies and approaches have emphasized the efficiency of the ABC system, this system is not very simple to apply and update (Sarens, Anderson, & Levant, 2008). To find out about upgrading a conventional ABC system, researchers surveyed managers and asked them to predict the amount of time that they expected to spend on various upgrade activities (Kaplan & Anderson, 2007). The ABC system becomes complex and difficult in large enterprises, especially those with high overhead costs (Stouthuysen, Swiggers, Reheul , & Roodhooft, 2013). Another limitation is that the ABC model must be continuously updated, which increases time costs and the use of resources (Demeerec et al., 2009). According to Pernot et al. (2007), the ABC model can stay in its basic format, but it will provide inaccurate and limited managerial and financial resources (Özyürek, 2014). In 2004, Kaplan and Anderson offered the new costing system (TDABC). The new system identifies the cost and practical capacity of each department. During the organization's operations, the practical capacity is indicated as the time duration that employees can work with eliminating idle time. The cost of practical capacity is frequently predicted as 80%-85% of theoretical capacity. The TDABC system has the ability to estimate time duration, which helps managers to obtain accurate cost resources while making operational decisions (Cengiz, 2011).

2.3.2 TDABC Time Equations

Activities performed in a company may be separated into sub-activities, creating problems and obstacles for managers. To reduce problems and increase effectiveness, time equations can be established for each activity. Accordingly, managers may use time equations to increase the efficiency and effectiveness of an organization (Oker & Ozyapici, 2013). The time needed for each activity is calculated for every particular circumstance of the activity. Everaert, Anderson, and Bruggeman (2005) developed the following mathematical equations:

Cost of an individual event k of activity

Where ci: the cost per time unit of the resource pool

tj,k: the time consumed by event k of activity j.

Total Cost of a Cost Object =

ci: the cost per time unit of the resource pool

tj, 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.

Time equations used to estimate the time of situation E of activity A can be represented as a function of different characteristics, which are called time drivers (Dejnega, 2011). The time equation required for situation E of activity A is:

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

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

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

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

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

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

2.3.3 TDABC Benefits

As mentioned before, the problems, obstacles, and complexities faced by managers during the implementation of the ABC system (Reddy et al., 2011). Consequently, these problems forced Kaplan and Anderson to introduce the TDABC system in 2004 to eliminate the problems and obstacles that occur with the conventional ABC system (Oker & Ozyapici, 2013). The TDABC system helps managers to develop and modernize the various organizational processes through the objectives of the main accounting method (Demeere et al., 2009).

The TDABC system also provides significant predictions regarding the costs of resource consumption and capacity utilization (Cengiz, 2011). Demeere et al. (2009) emphasized that the TDABC system discloses activities, resources, and costs that

were excluded from previous accounting attempts. They also indicated that decision makers can examine the time and costs of overused capacity and search for new technologies to develop them. Kaplan and Anderson (2007) and Demeerec et al. (2009) indicated that the TDABC system can be upgraded and improved more easily and less costly than the conventional ABC system.

Decision makers and managers who have implemented the conventional ABC system in their companies have pointed out that this model is limited, inefficient, and in convenient, especially when organizational operations are complicated and more difficult than other operations or when customer orders are taking more time and having more problems than other orders (Abad, 2016). By implementing the TDABC system, the decision makers used their time more efficiently and effectively. In addition, they needed lower costs for collecting resources and focusing on problems like ineffective processes and unprofitable products (Abad, 2016). To stay in a competitive position, organizations have to achieve a meaningful understanding of their financial, managerial, and operational resources and evaluate the profitability in every level, such as customer, channel, and product (Yilmaz, 2008).

Organizations have limited capacities, so they cannot provide or produce every unit product needed by the customer. The most appropriate option for this problem is to investigate the most profitable products for the organization (Yilmaz, 2008). The TDABC model suggests the crucial profit and resources needed to control business activities and the profitability of both products and services. This information allows companies to transfer from a difficult and costly financial system to a model that provides more accurate and understandable outcomes, such as the TDABC system

(Yilmaz, 2008). The TDABC system provides the following advantages (Kaplan & Anderson, 2007, p. 34):

- The TDABC system provides accurate and constructive cost resources, and it is cheaper, easier, and faster than previous cost models.
- The TDABC system suggests and defines opportunities for decision makers to make the right decisions to increase performance and productivity in an organization.
- The TDABC system is easier and less costly to maintain and update than the conventional ABC system and it quickly integrates and fulfills organizational requirements.
- TDABC has the potential to integrate with other systems, such as enterprise resource planning (ERP) and customer relationship management systems (CRM).
- The TDABC system ensures the cost visibility of customers, products, and services.
- The TDABC system provides cost information related to unnecessary resources, which allows decision makers to specify how to increase product and service output[2].

[2] For more information, please see Kaplan & Anderson (2007). Kaplan, R. S., & Anderson, S. R. (2007). *Time-driven activity-based costing system.* Boston: Harvard Business School Press, vol.33,No. 5 (2007)

2.3.4 TDABC Pitfalls

In spite of the important advantages of the TDABC system, several shortcomings may occur during its implementation (Adiguzel, 2008). To illustrate, organizations using cycle times for their operational functions are accurately, simply, and reliably returned or recovered from the system. However, some of the resources cannot be simply recovered from the system so decision makers should forecast cycle times. When the cycle time resource is irrefutable, the amount of costing a resource contains subjective predictions from the decision makers (Adiguzel, 2008). Manufacturing firms and service industries have faced problems with activities that are not homogeneous and repetitive (Cengiz, 2011). In this regard, the implementation of the TDABC system may not result in accurate and appropriate outcomes (Adiguzel, 2008). The TDABC system creates more problems instead of minimizing problems if trustworthy and accurate drivers are not available (Kowsari, 2013). According to Barrett (2016), the TDABC system is easy for organizations that do a single activity. However, most organizations do two or more activities, which require direct and indirect information to be gathered (Abbeele & Guzman, 2012). In addition, some study results have mentioned TDABC problems. For instance, Gervis et al. (2014) found that some of the decision makers and users of this model complained strongly about TDABC system when they defined the time required for each activity (Namazi, 2016). Ghanbari et al., (2016), in their case study, pointed out that the employees of the organization may be under stress when the TDABC system is being applied (Sarokolaei, Saviz, Moradloo, & Dahaj, 2013).

Chapter 3

RESEARCH METHODOLOGY

3.1 Research Strategy

The purpose of this study was to investigate and analyze the relationship between the total amount of overhead costs and the differences in the results of ABC and TDABC systems. Accordingly, published articles and research studies were analyzed. The population of this study is all published scientific research studies related to ABC and TDABC systems. It is complex and expensive to collect all data regarding the systems. Nevertheless, 170 scientific articles were investigated and evaluated; out of these 170, only 40 articles were found and 2 of them were removed because of outliers. Finally, after controlling and checking for completion of the data, only 38 samples were appropriated and used for the study. Table 1 given in (appendix A) presents a list of the articles used in this research study.

3.2 Types of Studies

Qualitative and quantitative studies are the types of research methods that can be used by researchers. The qualitative research method is used for a wide range of research studies. It provides advanced knowledge for the better understanding and examining of a subject. This method is important for behavioral sciences, where the purpose is to find out basic reasons for human behavior. With this kind of research method, researchers can easily analyze the major factors that influence people to act or behave in a specific manner. The qualitative research method is particularly

complex and difficult to apply. Therefore, researchers should look for guidance from advanced researchers and psychologists (Kothari, 2004).

The quantitative research method, on the other hand, defines, analyzes, and measures incidents based on numerical principles. This method collects statistical data based on numerical forms that can be categorized. Furthermore, the quantitative method starts with the collection of resources regarding the hypothesis (Pallant, 2013).

3.3 Types of Sources

Research data can be collected from primary, secondary and tertiary sources (Kothari, 2004).

3.3.1 Primary Sources

Primary sources provide direct, new, and original data about events, objects, and works for research studies. Primary sources include historical evidence, observational resources, statistical information, magazines, and audio or video recordings (Kothari, 2004). Personal interviews, questionnaires, and observational methods are common ways of collecting primary resources. Original documents, research data, scientific articles, the Internet, communications, and e-mails are other examples of primary sources. Primary sources provide advantages for scientific researchers in presenting original evidence because they are more accurate and helpful than secondary resources (Pallant, 2013).

3.3.2 Secondary Data

Secondary sources are used to evaluate, criticize, and interpret primary. Sometimes, secondary sources do not provide enough or accurate resources and evidence (Kothari, 2004). The purpose of secondary sources is to collect, arrange, analyze, and present primary resources along with different perspectives or approaches. Online

encyclopedias, bibliographies, literature reviews, and textbooks are examples of secondary sources (Pallant, 2013).

3.3.3 Tertiary Data

Tertiary sources consist of primary and secondary source information which has been collected and distilled. "*They present summaries of or introductions to the current state of research on a topic, summarizes or condenses information from primary and secondary sources, or provide a list of primary and secondary sources of more extensive information*" (Rawlings et al., 1998).

3.4 Data Analysis Methods: In General

In this section, we briefly explain the methods that we applied in the research study. The results of the methods will be provided in the next section.

3.4.1 Correlation Analysis

The correlation analysis method is used to examine the relationship between two variables (Rawlings et al., 1998). When there is a visible change in one variable, it will also show a visible change in the other variable. Pearson's correlation coefficient (r) is used to investigate the strength, direction, and significance of the relationship between two variables (Kothari, 2004). A strong and positive correlation indicates that there is a strong and positive relationship between two variables, whereas a weak negative correlation indicates that there is a weak and negative relationship between two variables. The range of -1 and +1 demonstrates the strength of the linear relationship between two variables. The zero value between two variables indicates that there is no relationship between the two variables. The +1 value between two variables indicates that there is a perfect strong and positive correlation between the variables, whereas the -1 value indicates that there is a perfect strong and negative correlation between the variables (Rawlings et al., 1998).

3.4.2 Regression Analysis

Regression analysis is a statistical method used to investigate the linear relationship between variables. Bivariate regression indicates the correlation between an independent variable (X) and a dependent variable (Y) (Campbell & Campbell, 2008).

$$Y = a + bX + e$$

The regression method is commonly used to predict the statistical analysis between a dependent variable and an independent variable. Several techniques implement regression analysis, such as linear regression and ordinary least squares (Campbell & Campbell, 2008). The linear regression model (LRM) is used to depict the relationship between a pair of variables. The multiple regression models are used to depict the relationship between various variables (Kothari, 2004).

3.5 Data Collection and Analysis Methods of the Study

The data were collected through scientific articles, journals, and dissertations that were gathered from a comprehensive review of online databases, such as Emerald, Jstore, Elsevier, Science Direct, Springer and SAGE. The databases were searched with combinations of the search words, such as "time-driven activity-based costing system"; "time-driven ABC"; "Time Driven"; "TDABC"; and "activity-based costing." The searches resulted in 172 studies related to this topic and the tertiary data was used. The research period began in January 2016 and was completed in February 2017. The research data was analyzed with SPSS version 20. After completing 38 research articles out of 172, the results reported in the articles were entered into SPSS. The study measured the differences in the results of ABC and TDABC systems as a dependent variable and the total amount of overhead cost as an independent variable. In this study, Pearson's correlation analysis and regression analysis were used to interpret the results.

Chapter 4

DATA ANALYSIS

4.1 Data Analysis and Findings

This chapter presents the results of the correlation analysis and regression analysis.

4.1.1 Correlation Analysis

Table 1 indicates that the correlation coefficient (r) is .878, determining a strong relationship. The number of articles in the sample is 38. The P-value for the correlation coefficient is .000, which is less than .05. The test is statistically significant. There is a strong positive correlation between the total amount of overhead costs and the differences in the results of the ABC and TDABC systems, r = .878, n = 38, P < 0.05.

H1: There is a statistically significant relationship between the total amount of overhead costs and the differences in the results of the ABC and TDABC systems.

Table 1: Correlation Analysis

Correlations			
		Overhead cost	ABC-TDABC differences
Overhead cost	Pearson Correlation	1	.878**
	Sig. (2-tailed)		.000
	N	38	38
ABC and TDABC differences	Pearson Correlation	.878**	1
	Sig. (2-tailed)	.000	
	N	38	38

** Correlation is significant at the 0.01 level (2-tailed).

4.1.2 Regression Analysis

A regression analysis model indicates the relationships between the variables in the research data. The model summary and regression analysis are described below.

4.1.2.1 Model Summary

Table 2 shows both R square and adjusted R square values. The R square value indicates the variation of the differences in the results of ABC and TDABC systems that can be determined by the overhead costs. The R square value is 77%, which is very strong. R square values less than 0.2 are determined as weak, R square values between 0.2 and 0.4 are determined as moderate, and R square values higher than 0.4 are determined as strong (Pallant, 2013).

The adjusted R square for this model is .764, which means that the difference in the results of the ABC and TDABC systems can be explained as 76.4% of the total overhead cost.

Table 2: Model Summary

Model Summary			
Model	R	R Square	Adjusted R Square
1	.878[a]	.770	.764

a. Predictors: (Constant), Overhead cost
b. ABC-TDABC differences

4.1.2.2 Interpretation of Regression Analysis

Table 3 presents the regression output. The regression output is .912. This means that if the amount of the total overhead cost increased by 1%, the value of the difference in the results of ABC and TDABC would increase by 91.2%. In this case, the intercept value is -.475. The t-statistics and P-value used to determine whether a coefficient result is significantly different from zero. By using 95% confidence levels, the regression for the total overhead cost (.912) is significantly different from zero because its P-value is equal to .000, which is less than .05.

Table 3: Regression Analysis

Regression Analysis			
Model	B	t	Sig.
Constant	-.475	-1.042	.304
Overhead Costs	.912	10.989	.000

a. Dependent Variable: ABC-TDABC differences

Based on this result, it is concluded that the magnitude of overhead cost has statistically significant effect on the difference between ABC and TDABC. Accordingly, the research question of this study has met.

4.2 Results and Discussion

In this research study, the impact of overhead costs on the differences in the results of ABC and TDABC systems has been analyzed. We conducted a literature review on the topic by collecting previous research articles. We performed correlation analysis and regression analysis to investigate our objective.

Table 1 demonstrates the correlation between the total amount of overhead costs and the differences in the results of ABC and TDABC systems. According to Table 2, the correlation is .878, with $P < .05$ ($P = .000$), indicating a significant and strong relationship. This means that the differences in the results of ABC and TDABC systems become larger when a company's overhead cost is high. In other words, when overhead cost is high or when the proportion of overhead cost to the total cost is high, the TDABC system produces more accurate results when compared to the ABC system.

Table 3, on the other hand, demonstrates the regression output, which is .912. This means that if the amount of total overhead cost increased by 1%, the value of the difference in the results of ABC and TDABC would increase by 91.2%. Table 2 demonstrates that the adjusted R square for this model is .764, which means that the difference in the results of ABC and TDABC systems can be explained by 76.4% of the total overhead cost.

According to the findings and results of the study, when the overhead costs are increased, the TDABC system produces more different than ABC. This finding is very important for organizations and service industries, especially those operating with a high amount of cost such as automobile sectors, heavy industries,

telecommunications, and energy sectors. This result provides a better reason for managers to use a suitable costing system in order to calculate the cost of resources more efficiently and effectively. The TDABC system offers a comprehensive solution for eliminating complexity and obstacles during operations by using time equations. Our findings indicate that the results of the TDABC system may provide more appropriate outcomes for organizations, particularly those operating with high amounts of cost. Consequently, our research study shows that the magnitude of overhead cost or an increase in the proportion of overhead cost will affect the difference in the results of ABC and TDABC systems.

Chapter 5

SUMMARY AND CONCLUSION

5.1 Conclusions

In the global business environment, organizations are facing many obstacles, problems, and strong competition. Organizations seek new opportunities to increase their productivity and services. Mangers need effective and accurate product costs to minimize financial and managerial risks when they deal with problems in their organizations.

Advanced costing systems play a crucial role in assisting organizations to reach accurate cost results. TCS was developed to analyze the costs of products and services. In the last few decades, organizations have had limited products and passive competition, so TCS could solve certain problems simply. However, nowadays, organizations deal with many difficulties and obstacles that affect the productivity and performance of the organization. In the mid-1980s, Cooper and Kaplan introduced the ABC model to reduce problems that occurred in the previous systems (Cooper & Kaplan, 1992). The ABC system produced more accurate cost information than TCS. However, ABC systems are not appropriate for some organizations because the implementation of the ABC model is expensive and takes time to maintain and update (Kaplan & Anderson, 2007). Therefore, a new costing system, TDABC, was developed to meet the needs of organizations.

In this research, we conducted a literature review and collected scientific research articles from different fields related to the ABC and TDABC systems. We used the methods of correlation analysis and regression analysis to clarify our objective. The objective of the research thesis was to clarify the relationship between total overhead cost and the difference in the results of ABC and TDABC systems.

The correlation analysis demonstrated that there is a significant relationship between overhead costs and the differences in the results of ABC and TDABC systems. In addition, the regression results confirmed that every amount of cost increase in the total overhead cost will affect the difference in the results of ABC and TDABC systems. To sum up, this study concludes that the magnitude of overhead cost has an effect on the results of ABC and TDABC. In this regard, increases in overhead costs will result in increases in the difference of ABC and TDABC. Consequently, this study indicated two implications. First, companies especially those using ABC can use TDABC to have alternative pricing strategies because when the overhead costs are increased in total cost the TDABC system produces more different results than ABC. Second, the TDABC system estimates time duration and use to drive costs directly from the cost resources to the cost objects, eliminating the tedious and error-prone stage of assigning resource costs to activities (Kaplan & Anderson, 2007). Accordingly, by considering the philosophies of TDABC system, managers can solve the existing system's restrictions and consolidate their strategies to improve the performance and profitability of their organizations. Based on the findings, the magnitude of overhead costs will positively affect the differences in the results of ABC and TDABC systems, especially when the amount of total overhead costs is high, such as in large manufacturing firms.

5.2 Limitations of the Study

This study provides clear evidence of and outcomes about the effects of the magnitude of overhead cost on the difference in the results of ABC and TDABC systems based on data analysis and findings. However, two limitations have resulted in some gaps in the study. The data collection process and evaluation procedure is quite long. It was difficult and time consuming to find the resources and data needed. Accordingly, the research study was done over a period of one year, from January 2016 to February 2017. The second limitation is that only a small number of articles about the research topic were available; therefore, only 38 articles were analyzed. The outcomes of this study would have been more comprehensive and meaningful if a wider range of articles and research journals had been available.

5.3 Recommendations for Future Research

Research studies may specify critical research recommendations for future studies to improve the knowledge and the literature in the field. Accordingly, this research study analyzed the impact of the total amount of overhead cost on the difference in the results of ABC and TDABC systems. As a result, three recommendations can be suggested for future research. First, researchers can divide data into low level and high level, and then investigate whether there are any statistically significant differences between the means of two groups. Second, researchers may try to investigate the relationship between the differences in the results of ABC and TDABC systems and total overhead costs in a specific industry, such as healthcare, hospitality, or banking. Third, it would be valuable to investigate the impact of overhead costs on the difference between the results of TDABC and Resource Consumption Accounting (RCA) system.

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APPENDICES

Appendix A: Table 1: Complete List of Articles Used in the Research Study

	Authors	Year	Overhead Costs	Differences	Title
1.	Max MITCHELL	2007	774,900.00	43,945.00	Leveraging Process Documentation for Time-Driven Activity-Based Costing
2.	Levent KOŞAN	2007	2,719,776.00	291,036.00	Sürece Dayalı Faaliyet Tabanlı Maliyet Sisteminin Müşteri Karlılık Analizinde Kullanılması: Bir Konaklama İşletmesinde Uygulama
3.	Gülay GÜĞERÇİN İRAK	2007	250,000.00	33,000.00	Sürece Dayalı Faaliyet Tabanlı Maliyetleme Sistemi : Özel bir Otel İşletmesinde Uygulama
4.	Patricia Everaert Werner Bruggeman Gertjan De Creus	2008	362,880.00	142,272.00	Sanac Inc.: From ABC to Time-Driven ABC (TDABC) – An Instructional Case
5.	Hümeyra Adigüzel	2008	8,486,773.00	6,638,971.6	Time-Driven Activity-Based Budgeting: An Implementation in a Manufacturing Company
6.	Levent Polat	2008	1,287,560.00	7,862.00	Zaman Sürücülü Faalyet Tabanli Maliyetleme ve Bir Sanayi Isletmesinde Uygulamasi
7.	Hasan Özyapici	2013	14,184.00	280.01	Time-driven activity-based costing system: Unit cost analysis of open and laparoscopic cholecystectomy
8.	Michel Gervais Yves lem	2009	49,920.00	3,900.00	Le Time-Driven Activity-Based Costing (TDABC) : un premier bilan à travers une étude de cas longitudinale
9.	İnci Demir	2009	2,507,520.00	1,141,387.4	Sürece Dayalı Faaliyet Tabanlı Müşteri Karlılık Analizi: Bir Eğitim Kurumunda Uygulama
10.	Ilhan Dalci Veyis Tanış Levent Kosan	2009	2,092,135.00	19,941.00	Customer Profitability Analysis with Time-Driven Activity-Based Costing: A case Study in a Hotel

11.	Metin Saban	2009	567,000.00	46,260.00	Çağdaş Maliyet Yönetimi Sistemlerinden Sürece Dayalı Faaliyet Tabanlı Maliyetleme
12.	Michel Gervais Charles Ducrocq	2010	51,170.00	2,754.00	Time-Driven Activity-Based Costing (TDABC): An Initial Appraisal Through a Longitudinal Case Study
13.	Figen Oker Humeyra Adiguzel	2010	9,998,303.00	6,638,972	Time-Driven Activity-Based Costing: An Implementation in a Manufacturing Company
14.	Mark Thomas Stelling Rajkumar Roy Ashutosh Tiwari Basim Majeed	2010	56,250.00	21,154.00	Evaluation of Business Processes Using Time-Driven Activity-Based Costing
15.	David E. Stout Joseph M. Propri	2011	6,624.00	2,751.68	Implementing Time-Driven Activity-Based Costing at a Medium-Sized Electronics Company
16.	Emre Cengiz	2011	19,547.00	4,325.71	Faaliyet Tabanlı Maliyetleme ve Sürece Dayalı Faaliyet Tabanlı Maliyetleme Arasındaki Farklar-Bir Mobilya Üreticisi Firmada Vaka Çalısması
17.	Ayşe Aydın	2011	47,131.14	11,036.75	Zamana Dayalı Faaliyet Tabanli Maliyet Sistemi ile Hizmet Karlılık Analizi: Diş Hekimliği Fakültesinde Uygulama
18.	Olavi Uusitalo	2012	4,667,414.00	1,139,909	Creating a Product Portfolio Strategy Via Activity-Based Costing Application in Food Production
19.	Selçuk Çapuk	2012	56,730.00	9,315.00	Bir Havayolu Şirketinde Zaman Etkenli Faaliyet Tabanlı Maliyet Uygulaması
20.	Azende Terungwa	2012	1,938,000.00	496,192.00	Time-Driven Activity-Based Costing and Effective Business Management: Evidence from Benue State, Nigeria

21.	Çağrı Köroğlu	2012	795,721.54	23,673.88	Stratejik Maliyet Yönetimi Kapsamında Sürece Dayalı Faaliyet Tabanlı Maliyetleme Yönteminin Analizi ve Bir Otel İsletmesinde Uygulama
22.	Samad Safari Alishah	2012	5,670,000.00	377,471.34	The implementation of Time Driven ABC System
23.	Fatemeh Kowsari	2013	3,862.00	654.00	Changing Costing Models from Traditional to Performance Focused Activity-Based Costing (PFABC)
24.	Morteza Bagherpour Afshin Kamyab Nia Mehdi Sharifian Mohammad Mahdavi Mazdeh	2013	346,000.00	85,814.23	Time-Driven Activity-Based Costing in a Production Planning Environment
25.	Kristof Stouthuysen Michael SwiggersAnne-Mie Reheul Filip Roodhooft	2013	10,756.00	2,067.00	Time-Driven Activity-Based Costing for a Library Acquisition Process: A Case Study in a Belgian University
26.	Paul Grant	2013	1,941,000.00	267,200.00	How Much Does a Diabetes Out-Patient Appointment Actually Cost? An Argument for PLICS
27.	Jaroslaw Mielcarek	2014	560,000.00	89,040.00	Falsification of Time-Driven Activity-Based Costing (TDABC) and Instead What?
28.	Hilmi Kirlioğlu Bedia Atalay	2014	2,866.27	308.00	Hastane İşletmelerinde Sürece Dayalı Faaliyet Tabanlı Maliyetleme Modellemesi
29.	Zheng-Yun Zhuang Shu-Chin Chang	2014	350,000.00	104,155.00	Deciding Product Mix Based on Time-Driven Activity-Based Costing by Mixed Integer Programming

30.	Bas Basuki Mertzha Dwiputri Riediansyaf	2014	14,432,932.53	289,897.36	The Application of Time-Driven Activity-Based Costing In the Hospitality Industry: An Exploratory Case Study
31.	Murat Küçüktüfekçi	2014	500,000.00	5,027.00	Zamana Dayalı Faaliyet Tabanlı Maliyetleme Sistemi ve Faaliyet Tabanlı Maliyetleme Sisteminin Karşılaştırılması: Bir Üretim İşletmesinde Uygulama
32.	Sina Akhavan Lorrayne Ward Kevin J. Bozic	2015	14,349.00	6,559.80	Time-Driven Activity-Based Costing More Accurately Reflects Costs in Arthroplasty Surgery
33.	Muhsin Celik	2016	560,000.00	12,648.00	Bulanık Sürece Dayalı Faaliyet Tabanlı Maliyetleme Sistemi
34.	Seyed Taha Hossein Mortaji Morteza Bagherpour Mohamed Mahdavi Mazdeh	2016	1,872,000.00	97,120.00	Fuzzy Time-Driven Activity-Based Costing
35.	Robert S. Kaplan Steven R. Anderson	2016	567,000.00	32,760.00	The Innovation of Time-Driven Activity-Based Costing
36.	Doğan Özata	2016	37,190.00	2,976.48	Çağdaş Bir Maliyetleme Yöntemi Olarak Zaman Etkenli Faaliyet Tabanlı Maliyetleme ve Otomotiv Sektöründe Faaliyet Gösteren Bir Firma Örneği
37.	Mehrdad Ghanbari	2016	59,167.00	8,053.00	Reasons of Limited Development of Time-Driven Activity-Based Costing Compared to Activity Based Costing System
38.	Yangyang R. Yu Paulette I. Abbas Carolyn M. Smith Kathleen Carberry Hui Ren Binita Patel	2016	4,335.00	1,582.00	Time-Driven Activity-Based Costing to Identify Opportunities for Cost Reduction in Pediatric Appendectomy

Appendix B: Table 2: Correlation Analysis

Correlations			
		Overhead cost	ABC-TDABC differences
Overhead cost	Pearson Correlation	1	.878**
	Sig. (2-tailed)		.000
	N	38	38
ABC-TDABC differences	Pearson Correlation	.878**	1
	Sig. (2-tailed)	.000	
	N	38	38

** Correlation is significant at the 0.01 level (2-tailed).

Appendix C: Table 3: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.878[a]	.770	.764	.52878

a. Predictors: (Constant), Overhead cost
b. ABC-TDABC differences

Appendix D: Table 4: Regression Analysis

Regression Analysis						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.475	.456		-1.042	.304
	Overhead cost	.912	.083	.878	10.989	.000