www.ijmae.com

Examining the Disadvantages of Activity Based Costing (ABC) System and Introducing the Modern (Behavior Based Costing) (BBC) System

Saeid Bazrafshan

Faculty Member of Accounting Group, Bojnord University, Bojnord, Iran

Behnam Karamshahi[1]

Faculty Member of Higher Education Complex, Shahid Bahonar University of Kerman, Kerman, Iran

Abstract

The main objective of this study is to investigate the defects and problems of the ABC system and to offer a modern costing method called BBC system that is free from ABC problems. In the present study, 20 of the most important shortcomings of the ABC system based on previous research are listed. BBC system uses several techniques in order to solve these problems. First, instead of classification of overhead costs based on activity, it separates them based on their behavior (fixed, variable and semi-variable). Then for accumulation of costs, it uses a number of files (large pools) and folders (small pools) whose number depends on the diversity of products. Then in order to enhance the accuracy of the allocation, instead of using univariate driver, it uses multivariate driver. Because of solving 12 shortcomings of the ABC system entirely and seven shortcomings partially, BBC system is considered as a superior system compared with ABC.

Keywords: BBC, Files and folders, Cost behavior, Multivariate driver.

[1] *Corresponding author's email: behnamkaramshahi@gmail.com*

Introduction

Traditional costing systems collect all overhead costs in a pool, and then divide them among produced units on the basis of production volume measure, which is usually direct labor hours or machine hours (Alivar, 2006). Increased competition in domestic and international markets, mechanization and the change of products price structures have led the manufacturers to be required to adjust their traditional expectations in accordance with accounting systems and real time and actual information. Several decades ago, a great part of the produced goods price consisted of direct wage cost. At the present age, due to the mechanization of production, the share of direct labor costs has significantly reduced from the price of products. That's why manufacturers were expected to be after fundamental changes in the traditional costing.

In the late 1960s and early 1970s, some accounting authors such as Solomon and Staubus pointed to the relationship between activities and costs (Namazi, 1998). However, the attention of academic and professional circles drew more to this relation in 1980 (Turney, 1991; Emblemsvag, 1995). Cooper and Kaplan (1991) argued that traditional systems of calculating the final cost not only do not meet the needs of managers but using their information causes confusion and lack of proper management decisions and could eventually lead to huge losses of companies and due to these issues the authors attempted to introduce a new system called ABC system.

Esmalifalak et.al. (2015) argue that given that the industry and the academic community have paid particular attention to ABC method over the past three decades, and despite the fact that academic research has definitely proven the benefiting of companies that use this method, unfortunately the same studies show that the number of companies that have taken this method to operational phase is small. The reason for this can be the numerous problems that firms face in the implementation of ABS system. The problems that are discussed in detail in the next section are so remarkable that Rasiah (2011) claims it is time to invent a new costing system to resolve these problems.

Seeking to solve the problems of the ABC system, the present study first summarizes these problems according to the claims of former researchers and then offers a new method called "BBC" to eliminate or at least reduce these problems. In this method, by classification of costs based on their behavior (fixed, variable and semi-variable) and allocating them to the files and finally folders and defining cost drivers, a solution to problem of ABC is offered. In addition, with the help of a suitable assumption, the method of working in costing based on behavior is explained. Ease of use of the system, the accuracy of the results and low cost of its implementation are of the outstanding advantages of BBC method compared to ABC method.

Checking the shortcomings of ABC system

ABC system collects overhead costs in several cost pools related to necessary activities for production, and then on the basis of cost drivers allocates the cost of each pool to the goods. These processes according to previous research are shown in Table 1.

www.ijmae.com

According Blaxill and Haut (1991), some companies that ask for the implementation of ABC forget the point that in this system, overhead is not just regarded as part of the cost of production but analyzed in the context of the production process. In other words, these firms need to be aware the fact that the implementation of ABC requires managers' think tank, so as the production process for each stage is studied and analyzed in Table 1. The issue that is a kind of applicant's lack of awareness is a barrier to the implementation of this system in firms (Roohm et. al., 1992).

Ness and Cucuzza (1995) say that when a company decides to implement ABC system, in fact it has not changed its accounting system, but has changed the structure of the organization such as management and non-management. As the implementation of ABC is considered as a prelude to the implementation of Activity-Based Management, and because of this, many staffs consider the change to ABC system as a threat to their job security and cope with it.

Table 1: Steps in the implementation of ABC

Stage	Process of each stage
First	Identification and classification of experiences
Second	Calculating the costs associated with each activity
Third	Determining the cost driver for activities
Fourth	Cost allocation of experiences with cost driver to the goods
Resource: Anderson & Young (1999), Reyhanoglu (2004), Rasiah (2011) and Garrison et. al. (2014)	

Although the implementation of ABC gives a more accurate final cost, due to obligation to define various cost pools and suitable cost drivers for them tanks, it becomes very complex and costly (Hilton, 1994).

Kaplan and Anderson (2004) and Polimeni et al. (1991) claims that collecting data for the ABC system is very time consuming. This problem gets prominent when a company is at the beginning of ABC implementation process. In addition, according to Hundal (1997), problems such as collecting what information, how and where make the situation deteriorated.

Reyhanoglu (2004) in a study evaluated the advantages and disadvantages of ABC. He claims that although ABC has partially replaced traditional costing systems because of advantages such as improved management decisions, control of overhead costs and, it has been along hardship and problems such as resistance of personnel, uncertainties, implementation and execution problems and the need for accurate and timely data.

John (1995) and Evans and Ashworth (1995) claim that although in ABC method as the constituents of overhead costs get diverse, with the help of more pools, the costs can be allocated to products, at the end some costs remain that are allocated with an arbitrary stimulus such as direct labor hours or machine hours. In other words, according to Noreen (1991) and Datar and Gupta's (1994) claim, ABC fundamental flaw is that as the overhead cost increases, as the characteristics of the product cost increase, the percentage of error of this costing method increases.

In another study, McGowan and Klammer (1997) state that, most of the companies that have accepted ABC stop in its implementation stage. They state that the reason to this issue stems from concern and uncertainty about the effectiveness of the use of ABC in the company in the field of their activity to improve performance. In a study, Rasiah (2011) has compared the concerns to traps and claims that the companies wishing to implement AB Care exposed to some traps threatening them (e.g. heavy costs, a lot of time and effort to collect data for ABC system, engaging in very confusing and sometimes obscure details of ABC system, acquiring unsuitable data for ABC system if the company cannot implement a system able to record the details of the events, organizing and basic revision of the accounting system, implementation of this system requires a level of precision reaching which is difficult and time consuming and the cost of software requirements to implement and coordinate with the ABC system theories is too high).

Garrison et al (2014) say that the two main disadvantages of ABC are "time to implement" and "recurring costs". They claim that the condition to implement ABC in any company is that company management allocates sufficient time to analyze the process of its products, so that it is accurately determined which process of production the overhead costs are related to and how much they are. Due to problems and consuming a lot of time, small companies usually refuse to implement it, because the benefits of the implementation of the ABC is less than implementation costs. This result is consistent with the results of Akinyomi (2014). He claims there is a direct relationship between the size of the company and the use of ABC system. It is expected that as the size of a company is small, it is less likely to make use of ABC system. On the other hand, Garrison et al. (2014) claimed that in contrast to traditional costing system that is binding in accordance with GAAP, running ABC is optional. Perhaps this is the reason that ABC could not properly be used in firms. In addition, designing, implementation and continuation of ABC make the firms to be on the path to bear heavy, incremental and repetitive ABC costs. This is a barrier making small firms not want to run ABC system.

Namazi (1998) believes that ABC system provides more accurate and better data than traditional costing methods for managers and helps them in making the right and appropriate decisions. Nevertheless, Shabahang (2007) claims in the implementation of ABC, firms face three basic problems making the implementation of the ABC system difficult. Therefore, if a company fails to resolve these problems properly, information obtained from ABC will not have the precision that was claimed either. One of these issues is the difference in the proportion of consumption of activities by products. Those overhead cost items are collected in a group that consumed almost equally by each of the products. The remarkable thing is that, if the ratio of consumption of activities by products varies in a pool, it will cause the distortion of products cost. The second problem is the possibility of weak correlation between activity consumption and consumption of cost driver, in other words, lack of proper allocation of costs. Given that the ABC system is mostly recommended to companies that manufacture a variety of products and their activity is extensive, the third problem is when the cost of implementing system gets heavier by increasing the number of activities (pool cost). Therefore, the probability of this problem in large firms is not unexpected.

www.ijmae.com

To facilitate judgment about the type, number and importance of the ABC system defects that the researchers mentioned, in Table 2, 20 of the most important of these flaws and defects are listed. In order to address these shortcomings, researchers such as Howell and Soucy (1990) suggest that companies can use some (rather than one) costing system. However, Reyhanoglu (2004) disagrees with this view and believes that firstly, using some costing system will be costly for the company. Secondly, as different information from various costing systems would be acquired, company's decision making confusing elements will be confused, and their decision-making power will severely be affected. Rasiah (2011) also believes that a better solution to solve this problem is to design and introduce a new costing system to the firms. In this study, with a very simple but effective way, we introduce a system called the BBC.

BBC system

In BBC system instead of classification of costs based on activity, classification is made on the basis of behavior cost. In other words, for costs related to overhead, always three files are formed, in the first file overhead fixed costs, in the second file variable overhead costs and in the third file semi-variable overhead costs are accumulated. In the first and second file, some folders (the number of which depends on the variety of products of the company) are placed, and accumulated costs are placed in the third file (which are eventually separated into 2 fixed and variable parts) and added to the first two files. For ease of understanding, all BBC system description stages are investigated with an example. It is assumed that a company produces two types of electronic receiver device of aircraft called *a* and *b*. To run BBC in the company, for the company's overhead costs, as mentioned above and according to what you see in Figure 1, three files are considered (for any company with any variety of products always three files are considered):

The first file

The first file is exclusively for the overhead fixed costs. In other words, in this file only fixed overhead costs are stored. According to the hypothetical example, the contents of each folder the file is as follows:

The first folder from the first file

In this folder, fixed costs of overhead are stored that are related to all the products and not necessarily one can accurately identify a share of a certain type of products.

According to the assumptions stated, fixed costs of overhead are placed in this folder that both *a* and *b* of electronic receiver device of aircraft get their share from it and in other words, these costs are not specific to one product, but both products get their share (e.g. plant depreciation costs, insurance costs and factory warehouse guardian salary).

The second folder from the first file

In the folder, those fixed costs of overhead are stored that are related to the production of certain goods. If the fixed costs related to several types of commodity are separable for

each product type, after separation of fixed costs, the product related to this folder has its share of fixed costs and the accumulated cost is stored in this folder.

According to a hypothetical example, in this folder only fixed overhead costs related to production of product *a* is accumulated. Of the fixed costs consumed to produce both *a* and *b* electronic receiver device of aircraft, provided that they are separable according to the type of product, the share of product *a* is accumulated in this folder after separation (e.g. equipment depreciation expense of receptor type *a*, the cost of insurance the equipment to produce receptor *a* and the cost of repair and maintenance of equipment used to produce receptor type *a*).

Third folder from the first file

In this folder as the second folder from the first file, fixed overhead costs related to the production of another certain types of products (except for the second folder product from the first file) are accumulated. If the fixed costs related to several types of goods are separable for each product type, after the separation of fixed costs, the product related to this folder gets its share of the mentioned fixed costs and the related cost is accumulated in this folder.

According to the example, in this folder only fixed overhead costs related to production of product *b* are accumulated. Of the fixed costs consumed to produce both *a* and *b* electronic receiver device of aircraft, provided that they are separable according to the type of product, the share of product *b* is accumulated in this folder after separation (e.g. equipment depreciation expense of receptor type *b*, the cost of insurance the equipment to produce receptor a and the cost of repair and maintenance of equipment used to produce receptor type *b*).If there were a product of a different kind, such as *c*, a fourth folder would be formed for first file to place the fixed costs related to the product type *c*. This action is repeated for more products as well.

The second file

In this file only variable overhead costs are stored. According to example, the contents of the folders of this file are as follows:

The first folder of the second file

In this folder, variable overhead costs associated with more than one type of product are stored. According to a hypothetical example, the amount of glue, wire and screws used in the production of electronic receivers *a* and *b* are variable costs of overhead that are stored in this folder.

The second folder from the first file

In this folder variable costs of overhead related only to the production of a specific product type are stored. Based on the assumption, variable costs only related to the production of product *a* are put in this folder. Such as cost of capacitors that are used in manufacturing product *a*.

Third folder from the second file

In this folder, like the second folder, the third file is acted upon with the difference that the variable costs only related to product type *b* are stored in this folder.

The third file

This file is the last file in the BBC system and related to the semi-variable overhead costs. Today, with the help of statistical software, data related to this type of cost can scientifically (such as the method of least squares) be analyzed and separated into two categories: fixed and variable.

After separation of semi-variable overhead costs into two fixed and variable parts, its fixed part is added to the first file. This cost is added to the folder of the first file where the explanation and conditions listed in that folder apply to the fixed costs. In Figure 1, arrow marked with 1 shows this. The variable part of semi-variable overhead cost is added to the second file. The cost is added to the folder of the second file where explanation and conditions listed in that folder are true for variable cost. In Figure 1, arrow number 2 shows this.

Introducing the cost drivers of the first file

After allocating the costs of the third file to the first and second files (steps 1 and 2 in Figure 1), it is turn to the calculation of the price of every single unit of the product. For this purpose, cost drivers are introduced for each folder of the first and second files. Nevertheless, it should be noted that the cost of the first folder of second and third files is allocated to folders of its same files with the help of multivariate driver (steps 3 through 8 in Figure 1), and then the cost of goods is calculated. This issue is discussed in detail below:

The first folder from the first file

Given that fixed costs accumulated in this folder are linked to more than one type of product, using univariate cost driver would certainly have no desirable outcome (Unfortunately, some cost pools in ABC method that is a combination of several activities, due to the use of single-variable driver for cost allocation distorted the cost of product).
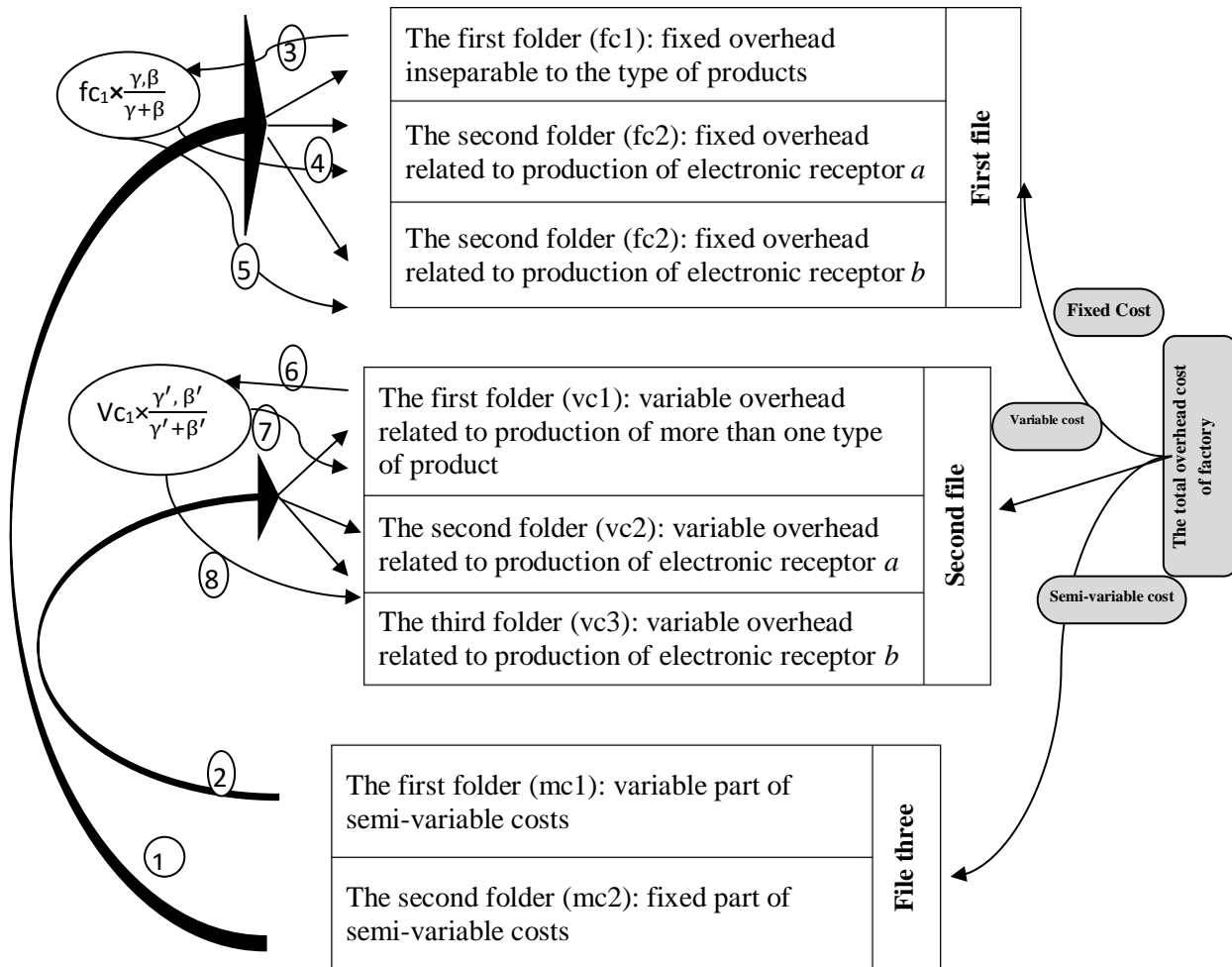
Figure 1: Files and folders in BBC system

To solve this problem and to boost the accuracy of accumulated cost allocation in this folder, in BBC method multivariate driver is used. It should be noted that this multivariate driver does not allocate the costs of first folder directly to the products. At first, the costs of the first folder are allocated to the second folder (using the formula 1), the third folder (using the formula 2) and this file and then the costs of the second and third folders are allocated to the products. The share of first and second folder is specified as follows:

Formula 1:

Share of the second folder from the costs of the first folder $= fc_1 \times \frac{\gamma}{\gamma+\beta} = fc_1 \times \frac{Dm_a + Dl_a + fc_2}{Dm_{a,b} + Dl_{a,b} + fc_{2,3}}$

Formula 2:

Share of the third folder from the costs of the first folder=$fc_1 \times \frac{\beta}{\gamma+\beta} = fc_1 \times \frac{Dm_b + Dl_b + fc_3}{Dm_{a,b} + Dl_{a,b} + fc_{2,3}}$

γ : Total costs of "direct material of product (Dm_a) a", "direct wage of product (Dl_a) a" and "the costs of the second folder from the first file (fc_2) before getting a share of fc_1 cost"

β: Total costs of "direct material of product (Dm_b) b", "direct wage of product (Dl_b) b" and "the costs of the third folder from the first file (fc_3) before getting a share of fc_1 cost."Graphical allocation of first folder to the second and third folders is shown in Figure 1 by arrows 3, 4 and 5. The reason for allocation of fc_1costs to the second and third folders with a compound driver of direct materials of direct wage and $fc_{2,3}$ is that there must be a relationship between f_{c1} and these variables.

There is a relationship between direct material consumption with costs accumulated in fc_1. In other words, the product that consumes more raw material ($Dm\uparrow$) should have a larger share of the cost such as cost of rent of raw material storage ($fc_1\uparrow$). In addition, the goods that more workers work on them have a greater proportion of direct labor costs ($Dl\uparrow$), and considering that more time dedicated to the production of them compared to other goods, it is expected that they have a higher share of costs such as public area lighting of the factory and the cost of guards' salary (fc_1) compared to other goods. In addition, it is expected that cost of $fc_3$and fc_2folders have a relationship with folder fc_1. For example, if in a company, it is decided to increase the number of shifts from one to three shifts, costs such as depreciation of plant, cost of factory guards salary and technical management (fc_1) increase, and it is also expected that costs such as depreciation of production equipment and maintenance increase (fc_2 and fc_3). Therefore, there is a direct relationship between "fc_1" with "Dm" and "Dl" and "$fc_{2,3}$". In multivariate driver, this relationship was used to allocate costs to second and third folders.

Second folder from the first file

After this folder has its share of costs of first folder, if the total fixed costs accumulated in this folder, which is related to only one type of product, are divided into the number of product produced of the same type, the overhead absorption rate for the second folder of the first file for a single unit of product is achieved. According to the assumption, of dividing fixed costs accumulated in this folder into the number of production of *a*, the overhead absorption rate for the second folder of the file is achieved.

Third folder of the first file

The operation in this folder is similar to the second folder of the first file, except that cost driver in this folder is the total production of specified type of another product. According to the assumption, by division of fixed costs accumulated in this folder into the number of receptor type *b*, overhead absorption rate for the third folder of the first file is achieved.

Introducing cost drivers of the second file

First folder of the second file

In this folder, variable costs related to more than one type of product that are not separately identifiable for products are accumulated. It is expected that direct variable costs are related to the costs of vc1 folder. In the hypothetical example, as the volume of production of the electronic receptor is more, or in other words, as the direct materials used in production are more (Dm↑), it is expected that variable overhead costs such as glue, screws and wires used in digital receptor be more (Vc↑). On the other hand, there must be a relationship between direct labor and costs of Vc_1 folder. In the event of an increase in staff working hours, direct labor cost increases (Dl↑),and this issue will also bring about the increase in the cost of fuel and lighting of production departments of the factory due to increased working hours (Vc↑).

Formula 3:

The share of the second folder of the costs of the first folder $= Vc_1 \times \frac{\gamma'}{\gamma' + \beta'} = Vc_1 \times \frac{Dm_a + Dl_a}{Dm_{a,b} + Dl_{a,b}}$

Formula 4:

The share of the third folder of the costs of the first folder $= Vc_1 \times \frac{\beta'}{\gamma' + \beta'} = Vc_1 \times \frac{Dm_b + Dl_b}{Dm_{a,b} + Dl_{a,b}}$

γ': Total cost of direct materials of product a (Dm_a) and direct labor of product a (Dl_a)

β' :Total cost of direct materials of product b (Dm_b) and direct labor of product b (Dl_b)

It is generally expected that as direct material and direct labor of a product is high, it gets a higher share of the costs of folder Vc_1. The costs of this folder are allocated to the second and third folders of this file using formulas 3 and 4, so that through the driver used in these folders, they are finally allocated to products.

Second folder from the second file

After this folder gets its share of the costs of the first folder, if total variable overhead costs accumulated in this folder are divided into the number of products that these costs are related to, the overhead absorption rate for that type of product is achieved. According to the assumption, by dividing the variable costs accumulated in this folder into the number of receptor type *a*, overhead absorption rate for the product *a* in second folder can be achieved the first file.

Third folder from the second file

The operation required in this folder is similar to the second folder of the second file, except that cost driver of volume of production is another type of product. According to the assumption, by dividing variable overhead costs accumulated in this folder into the number of production type b, the overhead absorption rate for the product b in a third calculates folder from the second.

Table 2: Summary of ABC system problems

Problems related to ABC system	Are the problems in ABC system solved?
1- The need for management think tank	Yes
2- Making fundamental changes in accounting, managerial and non-managerial structure	Yes
3- Creating a sense of threat to the staff	To some extent
4- The complexity of identifying experiences and defining cost pools	Yes
5- The complexity of identifying the appropriate cost driver for each cost pool	Yes
6- Unknown number of cost pools until after the full implementation of ABC	Yes
7- The costly process of deployment of ABC	Yes
8- The time-consuming process of deployment of ABC	Yes
9- The difficulty in the implementation of ABC in the early years	Yes
10- The need for accurate and timely information	To some extent
11- The allocation of some costs with the help of optional cost drivers in ABC method	To some extent
12- Increase in percentage of error of ABC, with increase in diversity of constituting costs of ABC	To some extent
13- Concerns and doubts about the effectiveness of implementation of ABC	To some extent
14- The need for a system to record events detail	Yes
15- The high cost of preparing the software to run ABC	Yes
16- Higher cost than benefit to implement ABC in the small businesses	Yes
17- Non-binding nature of implementation of ABC, according to legislative body	No
18- The difference in the proportion of use of experiences byproducts	To some extent
19- Possibility of weak correlation between experience consumption and driver consumption	To some extent
20- Increase in the cost of the system by increasing the number of activities	Yes

Brief comparison of ABC and BBC

According to the claim of some researchers such as Blaxill and Haut (1991) to investigate, analyze and identify experiences in ABC method there is need for a think tank of managers. In addition, some researchers such as Hilton (1994) consider identifying of experiences and drivers of cost pools in ABC to be highly sophisticated. Nevertheless, as claimed in BBC, in this method there is no need to mobilize a lot of people to implement, and moreover, cost drivers are pre-determined in the system.

In ABC system, as detailed information is needed, there should be a system to record the details. This will result in drastic changes in the accounting, managerial and non-managerial system and finally employees feel threatened (Reyhanoglu, 2004; Namazi, 1998, Ness and Cucuzza, 1995, etc.). However, in BBC system, there is no need for a system to record the details and make drastic changes, because in BBC system is enough to be recognize how the cost behavior is.

Given the above, it can be claimed that implementation of BBC is much less costly and quicker than ABC. Because most of the criteria required by BBC such as the number of folders, files and cost drivers are pre-determined. Therefore, supplying accounting software, unlike ABC, will not be costly (Rasiah, 2011).In BBC method, due to use of multivariate drivers, the percentage of allocation error compared to ABC that uses univariate driver is somewhat reduced. In addition, due to the clarity of the way of implementation of the BBC certainly concerns and doubts about the effectiveness of the implementation of this method sharply decrease.

Given that in BBC method costs are classified based on behavior and different products, and as inseparable costs are allocated by multivariate drivers, the correlation between the type of cost and cost driver increases compared to ABC, because sometimes in ABC, different activities are accumulated in a cost pool and inevitably it is allocated to the products with an optional driver (John, 1995; Evans and Ashworth, 1995; Datar and Gupta, 1994).

According to many studies examined in detail in the second section, in short, 20 of the most important shortcomings ABC are listed in Table 2. From 20 defects that researchers have attributed to ABC method, BBC method improves many of the shortcomings completely and others partially.

Companies wanting to use BBC will be able to calculate the files and folders before from using this system. If a company produces *n* different products, in the first file will have (1+ n) folder and in the second file (1+ n) folder, this can be seen in Table 3.

Table 3: Predicting the number of folders and files in BBC method

Diversity of products	Number of folders	Number of files
Two types	6	3
Three types	8	3
Four types	10	3
n type	$2n+2$	3

Conclusion

Previos studies have attributed many shortcomings to ABC system. In Table 2, the most important shortcomings of this system (20) were listed. Since BBC method of costing separate overhead costs on the basis of their behavior (fixed, variable and semi-variable), the number of the files and folders can be predicted in advance according to the diversity of products. Any company that can respond to the following two questions will be able to use BBC system to calculate the final cost of manufactured goods:

- What behavior does the intended overhead cost have? Fixed, variable and semi-variable? (Determining the appropriate file)

- In which folder of the intended file should the cost be placed?

In BBC system, cost drivers are pre-determined. This system uses multivariate drivers to improve the allocation of costs accumulated in the folders. In general, according to BBC techniques, 12 of the 20 problems of ABC system are solved and 7 cases are partly resolved. Therefore, what is clear in comparison is the advantage BBC to ABC.

It is recommended that, in order to verify the above, future researchers evaluate the advantages and disadvantages of both costing systems in the actual environment and scientifically compare the two systems in terms of being costly, time consuming, and the accuracy of results.

References

Akinyomi, J,. (2014). Effects of Firm Size on Activity-based Costing Implementation in Nigerian Manufacturing Sector. *International Journal of Innovation and Scientific Research*, 3(1), 82-87.

Alivar, A,. (2006). *Cost Accounting*. Tehran, Auditing organization publication.

Anderson, S. W,. & Young, S.M,. (1999). The impact of contextual and process factors on the evaluation of activity based costing systems. *Accounting, Organizations and Society*, 24(7), 525–559.

Blaxill, Mark, F,. & Hout, Thomas, M,. (1991). The fallacy of the overhead quick fix. *Harvard business Review*, 69(4), 93-101.

Cooper, R,. & Kaplan, R,. (1991). Profit priorities from activity based costing, *Harvard Business Review*, 68(3), 130–135.

Datar, S. M,. & Gupta, M,. (1994). Aggregation, specification, and measurement errors in product costing. *The Accounting Review*, 69(4), 567–591.

Emblemsvåg, J,. (1995). Activity-Based Costing in Designing for the Life-Cycle, MS Thesis. *School of Mechanical Engineering*, Georgia Tech, Atlanta, Georgia.

Esmalifalak, H,. Albin, S,. & Behzadpoor, M,. (2015). A comparative study on the activity based costing systems: Traditional, fuzzy and Monte Carlo approaches. *Health Policy and Technology Journal*, 4(1), 58-67.

Evans, H,. & Ashworth, G,. (1995). Activity-Based Management: Moving Beyond Adolescence. *Management Accounting*: *Magazine for Chartered Management Account*, 73(11), 26– 30.

Garrison, R,. Noreen E. & Brewer, P,. (2014). *Managerial Accounting.* New York, McGraw-Hill Higher Education, Edition: 15th. www.directtextbook.com /publisher/ mcgraw-hill-higher-education

Hilton, Ronal W,. (1994). *Managerial Accounting*. New York. McGraw-Hill, Second Edition. http://www.directtextbook.com/publisher/mcgraw-hill-higher-education

Howell, R. A,. & Soucy S. R,. (1990). Customer profitability: As critical as product profitability. *Management Accounting*, 43-47.

Hundal, M.S,. (1997). Product Costing: A Comparison of Conventional and Activity-based Costing Methods. *Journal of Engineering Design*. 8(1), 91-103.

John, I,. (1995). ABC: A follow-up survey of CIMA members. *Management Accounting: Magazine for Chartered Management Account,* 73(7), P50.

Kaplan, R,. & Anderson, S,. (2004), Time-driven activity-based costing, *Harvard Business Review*, 82(11), 131-138.

McGowan, A. S,. & Klammer, T. P,. (1997), Satisfaction with activity-based cost management implementation. *Journal of Management Accounting Research*, 9(4), 217–237.

Namazi, M,. (1998). The investigation Activity Based Costing system in management accounting and its behavioral considerations, Journal of Accounting and Auditing, 7(27), 71-106

Ness, Joseph A,. & Cucuzza, Thomas G,. (1995). Tapping the potential of ABC. *Harvard Business Review*, 73(4).

Noreen, E,. (1991). Conditions under which activity-based cost systems provide relevant costs. *Journal of Management Accounting Research*, 3(4), 159-168.

Polimeni, S,. (1991). *Cost Accounting*. Singapore. McGrraw-Hill, Inc., Third Edition. http://www.directtextbook.com/publisher/mcgraw-hill-higher-education

Rasiah, D,. (2011). Why Activity Based Costing (ABC) is still tagging behind the traditional costing in Malaysia?. *Journal of Applied Finance & Banking*, 1(1), 83-106.

Reyhanoglu, Metin,. (2004). Activity based costing system advantages and disadvantages. 1st july, http://ssrn.com/abstract=644561.

Roehm, A,. Critchfield, F,.& Costellano, F,. (1992). yes, ABC works with purchasing, too. *Journal of accountancy*, 174(5), 58-62.

Shabahang, R,. (2007). *Management Accounting*. Tehran, Auditing organization publication.

Turney, P,. (1991). How Activity-Based Costing Helps Reduce Costs. *Journal of Cost Management*, 4(4), 29-35.