

METHOD TIME DRIVEN ACTIVITY BASED COSTING – LITERATURE REVIEW

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Abstract:

This article presents a literature review of the method Time Driven Activity Based Costing, like an instrument to better assignment of costs to activities and their comparison with antecedent method Activity Based Costing. Paper shows the implementation of this method in the condition of manufacturing corporations, distribution centres, agriculture, but also in the field of services, especially in the hospitality. The article is trying to point out the benefits of this method for whole range of companies without difference to branch classification, determine base presumptions for implementation, but also disclose some drawbacks in the application of this new method in the practice with help of case studies, which have been published until this time. The aim of paper is to find out the base principles of method Time Driven Activity Based Costing in its right application.

Keywords: Activity Based Costing, Time Driven Activity Based Costing, time equations, customer profitability analysis, costs of processes

JEL Classification: L60, M10

1. Introduction

In contemporary high global competitive environment the knowledge of company's costs is a major driver of competitive advantage. Emphasis is putting to company's financial performance, quality of process ordering and innovation potential. Without detail understanding of true costs of services, manufacturing, delivery of products, the organizations will hardly survive in this competitive environment. The organizations must try to grasp, which customers are profitable and which are not and obtain valuable information that will be used to create successful managerial decisions and reach operational improvements. In order, Kaplan and Naraynan (2001) talk about increasing size of firms and organizational complexity, particularly in the area of services, it is necessary to understand customer profitability analysis (CPA). CPA enables to assign costs and obtain revenues to major customers or groups of customers rather than to organizational units, products or other objects. It is an application of segmented reporting in which a customer group is treated like a segment. Moreover, Cotton (2005) affirms that the efficient using of CPA enables firms to increase the customer satisfaction and increase their profitability.

Nevertheless, it is necessary to use proper cost system by using effectible cost techniques when one wants to receive accurate information about its customers and activities. However, the cost system used in many organizations is not assigned to activities. Contemporary calculation methods and formulas lack the ability to determine, how the processes, products and customers segments consume the sources and generating the revenues. As in the literature, Christopher (1998) sees the problems with traditional costs techniques in connection with a lack of understanding of types of customers, in the field of market segment; the costs are recorded in the high level of accumulation, the traditional system is functional in its orientation, but not in the output. This can lead to poor management decision making and misleading information. This weak point could be solved in the form of cost methods Activity Based Costing and their new version Time Driven Activity Based Costing. While Activity Based Costing found an application in practice itself, Time Driven Activity Based Costing has to seek the way to be used as a common method in the business practice. The main goal of article is to present TDABC like the instrument to evaluate costs of company's processes and identify the profitability group of customers.

2. Methods Activity Based Costing and Time Driven Activity Based Costing and their character

2.1. Method Activity Based Costing (ABC)

The method ABC was presented for manufacturing corporations in the half of 80's of the twentieth century in the USA. In fact, it was the reply to inaccurate American accounting standards. Kuchta and Troska (2007) maintained that ABC is a proper method for shaping of customers profitability. ABC also contributes to identify activities which produce the value and which do not. Although, it was argued that the information from ABC could boost up strategic and operational decisions. In order, Cooper and Kaplan (1992) claim that it still exists an empirical reason why the acceptance of this method has a big influence on the organization's performance. In addition Bogdanoiu (2009) claims ABC models the causal relationships between products and the resources used in their production and traces the cost of products according to the activities through the use of appropriate cost drivers.

ABC is proceeding in the two phases. Firstly, the costs of sources are assigned to activities by using cost factors. Then the costs of activities are divided to cost objects by measuring quantity and related cost drivers, which means that costs of activities are allocated to costs objects, which are based on the relevant cost factors (for instance the number of settings, number of customers visits). The method ABC uses causal relationship between costs objects and activities and between activities and sources.

According to Macurová (2009) the method ABC works with real costs and real occurrence of factors. The understanding of hierarchal level of costs enables a manager to recognize the costs reasons and then making better decisions and design better supply chain networks.

Method ABC assigns in good way the costs to particular activities, but on the other hand the application of method is linked with some problems. Particularly the upgrade of system is very time consuming, because for every variation of process separated activity is needed. ABC also used only one cost driver, worked with an average rate of costs to one occurrence of cost driver and high sophistication.

2.2. Method Time Driven Activity Based Costing (TDABC)

To overcome the difficulties inherent in traditional ABC, authors (Kaplan and Anderson 2004) presented a new method the Time Driven Activity Based Costing. This method was presented as a revolutionary method in the field of determined costs. On the other hand, (Adkins 2008) claimed that it is nothing new, but it is only an update of a traditional method ABC. Considering the assignment of sources to activities, a new version of ABC used time equations. The principle of this method is based on the transformation of cost drivers to time equation that express the time needed for performing of the activity as the function of sometime drivers. The characteristics are called 'time drivers', because they preside the consumption time of activity. But, Adkins (2008) proclaims, that any estimation process is prone to error. A one minute flaw in a time estimate multiplied by thousands of transaction can greatly skew results. In fact, such modest estimation error could possibly be greater than it would be under traditional method ABC. When multiplying the time needed for performing of the activity per unit of source, we could calculate the costs of individual activity and transaction. The required time for performing the activity is an estimate for every specific case. The time equations are modelling how time drivers managed the time that is consumed by activity. This way we could calculate an unlimited numbers of drivers. The time equations could cover up complication structure of activities. Having used TDABC, we could emphasize the cost of sub-tasks. The method needs to make an analysis of content of all activities in application. We must define all possible variations of running activities and their time factors. Thus we could estimate and determine the consumption of one factor from the computer's evidence by Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) or by time measuring. But in order, (Adkins 2008) suggests that only certain vendors can do TD-ABC. Several major costing software vendors can calculate costs through multiple assignment methods, which can either push costs based on collected driver quantities or pull through a cost model based on equations that reference automatically updated. Users have the option to choose method for different parts of their model.

- Application of method TD-ABC has the following steps according to (Brugemann 2005):
- A. Assessment the costs by particular spent sources on the one available capacity.
 1. Identification the group of sources, which have performed the activities.
 2. Estimation of costs on every group of sources.
 3. Estimation of practical time capacity of each group of sources.
 4. Calculation costs the group of sources by dividing total costs group of sources by their available capacity.
 - B. Assessment of time, which is needed for required variation of running activity.
 1. Identification of factors, which had influence on the time period of appropriate activity (time driver), when we determine the factors for every real variation of activity.
 2. Creation time equation, which express the dependence the time running of activity on all factors with next recognizing the values of factors and calculation total consumption of time for every concrete variation of activity.
 - C. Multiply the unit costs of particular sources by total consumption time of concrete variation of running process and summarizing the costs for every consumption sources.

The method TDABC has many advantages in comparison with traditional accounting techniques or with the antecedent method ABC. The method assigns the overhead costs only into the one time equations, which encompass all special aspects of choose activity in the firm's database of activities. TDABC allocates in better and fairly way the costs to the appropriate activity, customer, region or product. TDABC discovers the possibility of unused capacity, enables operational improvements, respects interaction between time drivers, detects the process without value in the way of trace of costs and changes in production, loading, delivering, storing etc. TDABC is good tool for design of new competitive strategy of supply chain not only with other members of chain, but also between particular company's divisions and as the instrument to identify the profitability of company's customers and new market opportunities.

2.3. Mathematical model used by TDABC

The whole model is built on the time equations. The mathematical formula depends on the characteristic of that specific activity in organizations.

$$\text{Cost of event E of activity A} = t_{A,E} * c_i \quad (1)$$

c_i – cost per time unit of resources
 $t_{E,A}$ – time consumed by event E of activity A

Source: (Brugemann 2005)

By using time equations, time consumed by event E of activity A can be expressed like a function of different characteristics, so called time drivers.

General time equation needed for event E of activity A with p possible time drivers X:

$$t_{E,A} = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \dots + \beta_p * X_p \quad (2)$$

$t_{E,A}$ – Time required to perform event E of activity A
 β_0 – Constant amount of time for activity A
 β_1 – Time consumption for one unit of time driver X_1
 X_1 – Time driver 1, X_2 - Time driver 2, X_p - Time driver p
 p – Number of time drivers that determine the time needed to perform activity A

Source: (Brugemann 2005), amended

2.4. Comparison of methods ABC and TDABC

We are not able to assert, which cost method is better, because it depends on the actual condition in the firm, legislation in the particular country, type of company, product, entrepreneurial environment. TDABC is building on the weaknesses of traditional ABC. The main differences are not only in the approach to state the costs of the activity, when TDABC is using time drivers, whereas traditional ABC used only one cost drivers, but also in the ability to identify an unused capacity (ABC is not able to identify unused capacity).

Traditional method ABC is more time consuming to update the system for new conditions in company's practice. TDABC is able to encompass all special aspects of particular activity into the one time equation and needs smaller requirements to accounting system.

However, TDABC is also under critique. TDABC is no suitable for actions demanding forethought and creative thinking. Also the accurate assessment of time consumption of activities is forceless property and in many cases, the estimation of time is based on the subjective judgment. In the Table 1 are summarized all main aspects of both methods in the mutual comparison.

Table 1. Comparison of methods ABC and TDABC in chosen aspects

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

Source: (Macurová 2003)

3. Summary findings about practical application of method TDABC

Meanwhile, consciousness about the method Time Driven Activity Based Costing is not extended in the practical area so much. The results of actual published application of Time Driven Activity Based Costing display that benefits of this method for fair assigning of costs could be very important. Not only TDABC helps in the design of new accounting and information system and better profitability, but also in all-day corporate function. In the Table 2 is summarized list of particular case studies with considering to the method TDABC.

Table 2. List of practical case studies

	Source	The section of application	Purpose of case study
1	Brugemann, Everaert, Anderson, Levant (2005)	Nameless distribution company in Belgium.	Improving the profitability of company – understanding of customer’s profitability. Comparison the costs allocation accuracy with ABC.
2	Dalci, Veyis, Kosan (2010)	Hospitality, Hotel in city Mersin, Turkey.	Understanding customer profitability analysis. Using TDABC in area of service organization.
3	Bryon, Everaert, Lauwers, Van Meensel (2009)	Agriculture, private farm, pig production, Belgium.	Appling the four- week batch farrowing system in comparison with the weekly farrowing with application of TDABC.
4	Demeere, Stouthuysen, Roodhooft (2009)	Outpatient clinic, medical sector. London hospital, Great Britain.	Improving medical service of hospital. Better supply chain in hospital.
5	Kaplan, Anderson (2004)	Dairy works, Kemps LLC, USA.	Improving sales system.
6	Hoozée, Brugemann (2010)	Belgian warehouses of nameless company.	How leadership, motivation, cognitive factors influenced application of TDABC and setting of time equations.

Source: Own elaboration

In the next section all findings of particular case studies will be analyzed with rough description of economic situation before application of method Time Driven Activity Based Costing into the firm’s practice.

3.2. Results and discussion in application of method TDABC in practice

1. Modelling logistics costs using TDABC

From application of case study of authors (Brugemann, Everaert, Anderson, Levant 2005), who wanted to explore method TDABC in the practice, exactly in the conditions of distribution organization resulted, that method, is also applicable in the service companies, because primarily the method TDABC is addressed to manufacturing companies. The nameless Belgian distribution organization was under big competitive pressure, with range scope of costumers, products and order lines. The management of firm wanted to improve profitability of company and compare method TDABC with traditional method ABC. The results were clear. The management of firm understood who is profitable and who is not considering assigning of costs by method TDABC and streamlining the planning of deliveries. Brugemann *et al.* proclaimed that TDABC is less exacting for update of data for calculation than traditional method ABC. TDABC is able to captures all difficulties of activities, strong diversity in resources consumptions by the various customers, orders, routes, that could be not capture by traditional method ABC. TDABC in nameless distribution firm confirmed next literature assumption, TDABC understand the interactions between activities and every activity in the firm’s database has own time drivers.

2. Customer profitability analysis with TDABC in hotel

The main assets from case study of Turkish authors (Dalci, Veyis, Kosan 2010) influenced from application of method TDABC in the unconventional business area, in the form of hospitality. Authors confirmed the range scope of application of method TDABC also in the service area. In the hotel was already used method ABC and authors focused to financial results, if managers decided to use new method TDABC. TDABC in the case study allow managers to design better cost system of theirs business activities with focused on the weak areas of their entrepreneurship and TDABC recognized that every customer’s group in hotel was profitable from aside to type of customers. In the case of used traditional method ABC, some groups of costumers were unprofitable. TDABC assigned costs to

groups in better and fair way than ABC. Next benefit, TDABC was able to identify unused capacity of personnel and on the base of stated results were design better recruitment and education systems of new employees and new marketing mix.

3. Time Driven activity Based Costing for supporting sustainability decisions in pig production

Belgian authors from university in Ghent (Bryon, Everaert, Lauwers, Van Meensel 2009) also decided to applied method in the agriculture. Method was tested in the conditions of one private farm in Belgium with production of pigs. The method TDABC was used like financial measure in the comparison of traditional system of farrowing with new approach of four-week farrowing. Experiences from this case study showed that TDABC could be used for decision problem of switching to batch farrowing. TDABC has shown like suitable measure for design a new approach (four week farrowing) to breeding of pigs. TDABC was able to decrease the labour of workers, which is needed for farming and common run of farm. TDABC assigned the costs to activities by better and fair way. The results were clear: decreased costs of labour, decreased costs of materials and better environments for pigs.

4. TDABC in an outpatient clinic environment: development, relevance and managerial impact

Next interesting case study was implemented in the one London hospital. The authors (Demeere, Stouthuysen, Roodhooft 2009) of this case study required to test method TDABC in the conditions of hospital environment. The management of this hospital was under pressure, because some detachment of clinic was forfeit. TDABC has shown like suitable cost system for clinic. The adaptability of this system was faster than traditional method ABC, the set up of method was simpler and TDABC has higher reflection of the complexity of the real world operations. In the Table 3 is described the particular steps of application in the clinic.

Table 3. Steps of application method TDABC in the clinic

Steps	Activity
1	Identify the various resource groups (departments)
2	Estimate the total cost of each resource group
3	Estimate the practical capacity of each resource group (e.g. available working hours)
4	Calculate the unit cost of each resource group by dividing the total cost of the resource group by the practical capacity
5	Determine the time estimation for each event, based upon the time equation for the activity and the characteristics of the event
6	Multiply the unit cost of each resource group by the time estimate for the event.

Source: Everaert *et al.* (2008).

Method TDABC identified and analyzed activities that drove the overhead costs. Needless activities were reduced and it was set up a new system with better communication between particular departments, secretaries were centralized to one place, telephone accessibility was improved through head-sets and voice recognition and management started frequently viewed interaction between accounting system of clinic with strategy. TDABC information clearly improved the communication system of clinic, increased the care of patient, and increased the value and effectiveness of clinic and better planning of suppliers and reserves in warehouse of hospital.

5. Strategic change at Kemps LLC

American authors (Kaplan, Anderson 2004) accomplished case study in full-line dairy company Kemps LLC in Minneapolis. The management of firm skirmished with problems of high competitive environment and decreased revenues of products. The direction of firms decided to applied new method TDABC. TDABC identified the main activities of company, packing (full stacks of six cases, individual cases), loading, routing, stocking, delivering (commercial carriers, own fleet) and method captured differences between system of accepted order to system (customer phone call, salesperson, fax, EDI, internet) and time spent by each driver to location.

Method TDABC helped to understand management of Kemps LLC to recognize the lost customers, disclosed the saves in daily operation and changed the price policy of firm. TDABC facilitated to identify who is profitable customer and who not and transformed these unprofitable customers into a profitable. Method design the new system of deliveries of product and made easy and fair relationship between Kemps LLC and suppliers and customers.

6. Identifying operational improvements during the design process of TDABC system: The role of collective worker participation and leadership style

The last case study, which interested in application of method Time Driven Activity Based Costing into the practice originated from Belgian authors (Hoozée, Brugemann 2010). In their case study is presented employee participation and leadership style like important instrument to successful implementation of method TDABC to company's common activities. The method was tested in nameless Belgian distribution centre, in the warehouses of this distribution centre. Authors focused to role of group discussions, attitude, ideas and leadership of managers of these warehouses to implementation of method TDABC in practice. More specifically, authors tell, that for operational improvements to materialize, the group discussion playing very important role, especially if discussion is convey by leader with appropriate management style. The participations could propose new ideas, improvements, requests and they can reach required aim. When the group discussion are dominated by an autocratic leader, operational improvements are in danger and TDABC like new system in business operation could be accept by workers as taint and not like a pony instrument for their daily work. In the cooperation with leadership style, which is an additional influencing factor in designing an accounting information system in which workers participate collectively, the managers with positively attitude to novelties and with more friendly-workers leadership have obliging access to implementation of method TDABC in theirs warehouses. In this case study we can talk about synergic effect of relationship between leadership and group discussion, because the suitable combination of these factors could carry positive ideas for next develop in practice.

4. Conclusion

The article is trying to give comprehensive picture about method Time Driven Activity Based Costing like suitable instrument for assignment of costs to firm's activities. It would be a mistake to comprehend method TDABC like multi-purpose instrument to solve every problems of assignment of costs to processes, customers, products, supply chains and routes. With respect to the ABC literature, the article presents the collection of all substantial knowledge from case studies and points attention on the pitfalls, which are linked with application of method in the different types of institutions.

The method Time Driven Activity Based Costing in the comparison with traditional method Activity Based Costing assigns the costs to activities by time drivers. These time drivers are insert in the time equations, which capture all differences of given activities. Method Time Driven Activity Based Costing is able to identify unused capacity of workers and these results could be used in the design of new recruitment system, workout, education or lead to the transfer of employee between particular departments.

The method is not so much demanding to update in comparison with traditional method Activity Based Costing, because we do not have to make next activity, if some change in the activity occurred, like in the method ABC. On the other hand TDABC is based on the presumption of estimated time. This is a weak point of method, because without ERP systems like SAP or ORACLE we are bequest to estimation or interviews with employees, which have subjective overtones. Then, if the wrong

assign of costs to products, customers groups or processes happened, it could result to the ‘domino effect’ of pitfalls.

TDABC is able to identify which customers are profitable and which are not, which has an impact on the negotiations with highly loss-making customers, changes the conditions (presentation of minimal order, maximal rebate policy) with these business partners. It also reflects in dealings with company suppliers in which can achieve the balance and a fair relationship among all members of the supply chain (win to win).

TDABC is suitable instrument to achieve operational improvements in practice, reduced useless activities and merge similar activities into to the one place. Although the application of method TDABC in practice is considered like target-setting process, it could be influenced by many factors, like group discussion, motivation, participation or leadership.

Finally it can be suggested that there are some potential areas for further researches. It would be useful to test methods in the public service, because the acts of clerks could comprehend like services or products and citizens like customers of particular municipality. Secondly, it would be valuable to study the relationship between leadership of managers and application of method Time Driven Activity Based Costing in practice with possible synergic effects. Thirdly try to prove the relationship between method TDABC and particular supply system in practice. And finally, it would be worthy to implement some surveys of method in the legislative and business environments in the countries of middle, east and south-east Europe.

Acknowledgements

The paper is supported by the SGS research project SP/201085 ‘Research of logistics chains with focus on risks and cost and possibilities of simulations techniques utilization’.

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