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Usability of Time Driven Activity Based Costing Methods in the Budgeting Process of SMEs*

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Abstract: *In this study budget and cost calculations, which can be applied by producer Small and Medium-sized Enterprises (SME), have been emphasized to contribute producer SME's having longer lifespans in today's conditions of high competition. Nowadays when we act on the fact that the budget and cost calculations are inadequate in SMEs, it is intended to be a useful work that can be implemented and contribute to the achievement of the objectives to managers. In the studies carried out, it is overemphasized on the interrelated studies of budget, product based costs and production targets (productivity). In product-based cost calculations, the most up-to-date approach in the distribution of manufacturing overhead costs was made using the Time-Driven Activity Based Costing (TDABC) method. In consequence of the application study, the idle capacity was determined and the productivity results were obtained with the improvement studies. Finally, the findings were interpreted and the suggestions were made.*

Keywords: SME, Budget, Cost, Time Driven Activity Based Costing, Idle Capacity, Productivity

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1. Introduction

SMEs undertake extremely important functions in terms of employment and regional development no matter what level economic development of countries is at, and in terms of economies of countries when viewed in macro terms. The most critical advantages of SMEs are supposed to have when undertaking these tasks are to easily adapt to changes, to have the ability to make demand-based production and to be sensitive to consumer preferences.

While socioeconomic and technical improvements ensure enlargement of markets at the present time, they also pave the way for competition. Both economic and technological developments have left enterprises in an abrasive competition environment. It is necessary for enterprises to be planned and organized in order to continue their existence and to be able to compete. In order to maintain their sustainability and to keep up with the competition under these circumstances, enterprises should place more emphasis on budget, cost and productivity.

Rapidly changing financial and technical conditions have made management processes of enterprises difficult. This process has ensured that new techniques and methods related to their management have been

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developed and new terms have been coined. The term of budget is one of the most important terms in this regard.

Budgets are numerical expression of management plans and costs related to target periods of enterprises. From this standpoint, budgets are extremely important control mechanisms for enterprises. Enterprises become more productive in terms of their activities and use their resources properly thanks to their budget implementations. In this context they have a chance to make correct decisions in terms of utilizing the opportunities they get or eliminating the risks.

A budget which is prepared in a balanced and realistic manner will enable to set objectives and achieve these objectives, to ensure that resources of enterprises are productively and efficiently used without causing any standstill in the process, to see whether or not they make progress in line with these objectives, and to make corrections when necessary. Budgets offer services to the management as an excellent planning and control mechanism in terms of cost and productivity from this aspect.

When the underlying reasons for SMEs' failure are investigated, it is seen that insufficient planning and failure to establish an effective control are the most critical disadvantages. Budgeting activities are the most suitable method for solving the problems of SMEs since budgeting aims at planning and auditing the enterprise activities in an efficient manner - in other words, ensuring that they are managed in the best possible way.

This study aims to lay emphasis on the necessity of budget and cost implementations in SMEs and to express that budgets prepared rationally are an efficient control and management tool. Based on this, the study comprises three sections. In the first section sketches out the development and functioning of Activity Based Costing and Time-Driven Activity Based Costing. The second section summarizes the literature review. The third section includes an enterprise implementation related to a model proposal for SMEs, and analysis of implementation results.

2. Activity Based Costing (ABC) & Time Driven Activity Based Costing (TDABC) Methods

Accepting that full costing can be a valid input to decision-making, particularly in the longer term, the question arises how to allocate indirect or overhead costs. Until the 1980s, when most were mass-produced, traditional cost accounting systems were employed, which used direct labour hours, machine hours or material expressed in currency units to allocate overhead costs to products. As the direct labour content of products decreased, through automation and industrial engineering-driven efficiencies, the percentage of total costs represented by the arbitrary allocations of overheads had continually grown (Mitchell and et al. 2013).

Activity-based costing seemingly solved the inaccurate allocation of overhead from standard cost systems by tracing these indirect and support costs first to the activities performed by the organization's shared resources, and then assigning the activity costs down to orders, products, and customers on the basis of the quantity of each organizational activity consumed (Kaplan & Anderson 2007b).

ABC Methods were concerned with what was done in terms of activities instead of what was spent. A number of cost pools and a variety of cost drivers are the key differences of ABC and traditional costing. Actually, the activity cost pool is the overall cost associated with an activity. In addition, the cost driver, which justifies changing the costs in an activity cost pool over time, is a feature that affects the cost and performance of the activity. Firstly, it is assigning indirect costs on activities and then on cost objectives (product, service or customer) what makes requests for these indirect costs. The expenses of indirect resources are allocated to different activities via resource drivers. Besides, activity drivers represent the consumption of activities by the different cost objects. It can be said that in ABC models, the causal relationships between products and the resources used in their production traces the cost of products according to the activities through the use of appropriate cost drivers (Monroy et al., 2014).

Activity-based costing identifies various activities that help explain why incurs the costs it currently classifies as indirect in its simple costing system. In other words, it breaks up the current indirect cost pool into finer pools of costs related to various activities (Horngren, 2015).

Thus managers used the more accurate ABC and profitability information to make better decisions about process improvements, order acceptance and rejection, pricing, and customer relationships. The decisions led to near-term and sustainable improvements in product and customer profitability (Kaplan & Anderson 2007).

The main costs and limitations of an ABC system are the measurements necessary to implement it. ABC systems require management to estimate costs of activity pools and to identify and measure cost drivers for these pools to serve as cost-allocation bases. Even basic ABC systems require many calculations to determine costs of products and services. These measurements are costly. Activity cost rates also need to be updated regularly.

As ABC systems get very detailed and more cost pools are created, more allocations are necessary to calculate activity costs for each cost pool. This increases the chances of misidentifying the costs of different activity cost pools (Horngren, 2015).

In summary, implementing conventional ABC encountered the following problems (Kaplan & Anderson 2007b):

- The interviewing and surveying process was time-consuming and costly.
- The data for the ABC model was subjective and difficult to validate.
- The data were expensive to store, process, and report.
- Most ABC models were local and did not provide an integrated view of enterprise wide profitability opportunities.
- The ABC model could not be easily updated to accommodate changing circumstances.
- The model was theoretically incorrect when it ignored the potential for unused capacity

TDABC is a system that makes understanding of complex activities more successful through simplifying ABC and removes complexity through using a single cost factor, the "time”. It also facilitates implementation and updates easily. TDABC that does not add leisure which occurs in the business to the cost calculation through obtaining more accurate cost information is a method that provides process efficiency and costing savings along with that is effective capacity management (Atalay & Kırlıoglu, 2016).

In 1990s, Activity Based Costing method became very popular in business and management environments and provided great benefits. Enterprises have explored the ways of far more efficient management of costs in institutional terms thanks to various opportunities which increase profitability through Activity Based Costing method practices (Kaplan & Anderson, 2003). However, staff interviews and survey research as well as the verification of time allocations are of high cost. There are a lot of restrictions caused by the difficulty of sustaining and updating a model on the grounds that individual orders and customer differences increase when new activities are added especially because of changes in process and resource costs (Kaplan & Anderson, 2007a).

Time Driven Activity Based Costing is a method developed by S. R. Anderson and Acorn Systems team in late 1990s in order to eliminate the challenges and restrictions of Activity-Based Costing. Historical process of this technique begins with the experiments of S. R. Anderson and Acorn Systems on more consistent and productive processes using their time equations and average time estimates. R. S. Kaplan defined how to establish cost system with two parameters (the unit cost of supplying capacity and the time required to perform a transaction or an activity) and laid emphasis on the background of Time Driven Activity Based Costing techniques. In 2004, S. R. Anderson and R. S. Kaplan came together and conducted academic studies with a view to completing and improving this technique and ensured that it was used as an efficient technique which would be incorporated into strategic cost management approaches (Everaert et al., 2008).

TDABC method differs from Activity Based Costing in terms of its convenience of designing and sustaining, its power to comprehend complex activities and its benefit in this regard, and in terms of introducing an idle capacity. TDABC aims to put an end to time-consuming and costly research and to obtain more accurate information. Thus it will be possible to increase the benefits of Activity Based Costing and reduce its shortcomings (Barrett, 2005).

According to McGowan (2009), TDABC enables to handle the complexity of activities by using time equations which can properly reflect time elapsed in a specified process and thereby removing the necessity to monitor more than one activity to calculate different costs related to a single activity.

TDABC method initiates the cost measurement process with the cost of resource supplied as is in Activity Based Costing method. First, resources are gathered together in a resource pool functioning like a cost pool. As is in Activity Based Costing, resource costs are distributed to the resource pool via costs drivers. While in Activity Based Costing a separate cost driver is required for each activity, TDABC determines how long it takes to carry out these activities. Therefore, a single time based cost driver is used instead of various confusing cost drivers (Kaplan & Anderson, 2007a).

The breakthrough of TDABC lies in using time equations to estimate the time spent on each activity. Through the use of multiple time drivers, TDABC can capture operational processes with detail easily and quickly, is less expensive to update, and can provide opportunities to design cost models more simply than ABC (Akhavan et al., 2016).

The new procedure starts, as with the traditional approach, by estimating the cost of supplying capacity. Identify the various groups of resources that perform activities. For example, consider a customer service department that performs three activities:

- handle customer orders
- process customer complaints
- perform customer credit checks.

Quantities of work for the quarter in these three activities are:

- 51.000 customer orders
- 1.150 customer complaints
- 2.700 credit checks

Assume that the cost of supplying resources-personnel, supervision, information technology, telecommunications, and occupancy-to perform these activities is $560,000 per quarter.

Measuring practical capacity of a group of resources is not a trivial issue, but neither is it an insurmountable issue. Often practical capacity is estimated as a percentage, say 80% or 85%, of theoretical capacity. That is, if an employee or machine normally can work 40 hours per week, practical capacity could be assumed to be 32 hours per week.

The capacity cost rate is defined below:

$$Capacity\ cost\ rate = \frac{Cost\ of\ capacity\ supplied}{Practical\ capacity\ of\ resources\ supplied}$$

In example, assume that 28 customer service employees do the front-line work. Each worker supplies about 10,560 minutes per month or 31,680 minutes per quarter. The practical capacity at about 80% of theoretical is therefore about 25,000 minutes per quarter per employee, or 700,000 minutes. The unit cost (per minute) of supplying capacity is therefore:

$$Cost\ per\ minute = \frac{\$560.000}{700.000} = \$0.80\ per\ minute$$

The time-driven ABC procedure uses an estimate of the time required each time the activity is performed. This unit time estimate replaces the process of interviewing people to learn what percentage of their time is spent on all the activities in an activity dictionary. The time estimates can be obtained either by direct observation or by interviews. Precision is not critical; rough accuracy is sufficient.

Returning to the example, suppose that the analyst obtains estimates of the following average unit times for the three customer-related activities:

- Handle customer orders : 8 minutes
- Process customer complaints : 44 minutes
- Perform credit check : 50 minutes

Now simply calculate the activity cost driver rate for the three activities:

Table 1. TDABC Allocation of Department's Costs

Activity	Quantity	Unit Time	Total Time Used (in minutes)	Cost driver-rate	Total Cost Assigned
Process customer orders	51.000	8	408.000	$6,40	$326.400
Handle costumer inquiries	1.150	44	50,600	$35,20	$40.480
Perform credit checks	2.700	50	135.000	$40,00	$108.000
Total Used			**593.600**		**$474.880**
Total Supplied			**700.000**		**$560.000**
Unused Capacity			**106.400**		**$85.120**

The analysis reveals that only 80% of the practical capacity (560.000/700.000) of the resources supplied during the period was used for productive work (and hence only 80% of the total expenses of $560,000 are assigned to customers during this period).

By specifying the unit times to perform each instance of the activity the organization gets both a more valid signal about the cost and the underlying efficiency of each activity as well as the quantity (106,400 hours) and cost ($85.120) of the unused capacity in the resources supplied to perform the activity.

The main advantages of TDABC put forward by its designers are that it provides an answer to the shortcomings of the ABC method: long time to collect data, complex updating of the system necessitating repeat interviews in order to allot time to the activities, multiplication of the number of activities as the only way of dealing with its complexity, high data processing capacities and statements of time that never show idle capacity (Gervais et al., 2010).

To summarize, TDABC offers a lot of possibilities in the analysis of profitability and reporting of capacity utilization in complex and dynamic environments. The system provides more accurate costs, which leads to better decision-making by the management (Putteman & Bruggeman, 2008).

Activity-based costing, activity-based costing systems implementation method based on the time differences are summarized briefly as follows (Everaert et al., 2012):

<u>Steps of ABC System and TDABC System</u>

ABC

Step 1 Identify the different overhead activities

Step 2 Assign the overhead costs to the different activities using a resource driver

Step 3 Identify the activity driver for each activity

Step 4 Determine the activity driver rate by dividing the total activity costs by the practical volume of the activity driver

Step 5 Multiply the activity driver rate by the activity driver consumption to trace costs to orders, products or customers

TDABC

Step 1 Identify the various resource groups (departments)

Step 2 Estimate the total cost of each resource group

Step 3 Estimate the practical capacity of each resource group (e.g. available working hours, excluding vacation, meeting and training hours)

Step 4 Calculate the unit cost of each resource group by dividing the total cost of the resource group by the practical capacity

Step 5 Determine the time estimation for each event, based upon the time equation for the activity and the characteristics of the event

Step 6 Multiply the unit cost of each resource group by the time estimate for the event

3. Literature Review

There are several studies in the literature regarding applications ABC and TDABC. Yükçü and Gönen (2009) applied TDABC to an automobile parts manufacturing enterprise and compared the results with ABC. As a result, it is seen that the cost slippage caused by TDABC application provides more realistic cost information. Öker and Adıgüzel (2010) investigated how TDABC could be implemented in a manufacturing firm. They reached the conclusion that the application of TDABC in service enterprises is more convenient and easier, and it can also be convenient and useful for production enterprises where the capacity can be expressed as time scale. Polat (2011) in an industrial enterprise, Cengiz (2011) in an furniture manufacturing enterprise application both ABC and TDABC systems to undertaking and assessing the impacts on the results of cost analysis by determining the differences of both systems in terms of cost calculation. Both studies emphasize that the unused capacitor appears as a factor increasing the product costs in ABC. Similarly, Aktaş and Özata (2017) compared the ABC and TDABC. Overhead expenses of a firm that produces automotive components distributed to the product lines according to the ABC system and then according to the TDABC system by using the case study method and the differences between the ABC and the TDABC system were revealed. Results of the study showed that the TDABC system produced lower cost compared to the ABC because it does not include the idle capacity cost to the product cost. TDABC system calculates more accurate cost information while revealing the idle capacity. Therefore the TDABC attracts managers' attention to the areas where the idle capacities exist. Atalay and Kırlıoğlu (2016) the role of TDABC in ensuring success in cost and capacity management in the hospital business where fast and accurate response is important evaluated. According to the results of the study noticed that TDABC can be applied effectively in the health care business. Costs are calculated more detailed, timely, meaningful, realistic and accurate and it provides more reliable information. TDABC reveals more accurate and clear cost images through using time as a single cost factor and taking the unused capacity into account and it makes a significant contribution to the business administration in managing cost and capacity accurately. Yaşar (2017) made an application in the container terminal in order to determine the costs of the service production processes at the container terminals by TDABC method and to evaluate them in terms of applicability. Despite the limitations of the study, TDABC provides more accurate cost information and capacity analyzes makes it possible to emphasize that the method provides great benefits to the decision making mechanism. Köse and Ağdeniz (2017) compared TDABC and Resource Consumption Accounting (RCA) methods. On the sample studied in the study, common and different aspects of both methods are revealed. They highlighted that the main points of commonality are the approach to costs and the distribution of costs to products as well as the ABC, the fact that the costs are different from each other is that both methods make cost distributions by following a different philosophy.

4. Time Driven Activity Based Costing Method and Implementation of Enterprise

This section analyses a budget practices in a producer SME, cost calculations according to TDABC method, process improvement works and effects of these works on total productivity.

4.1. Purpose of Implementation

The essential goal of this study is to lay emphasis on budgeting in achieving global competitive power. Five primary subgoals are set with a view to achieve the essential goal of this study. These subgoals are as follows: to make suggestions on the number, price and sales volume of target products, to calculate income and expense according to budgeting method, to make cost calculations for each product according to TDABC method, to enable production growth thanks to improvements to be made as a result of idle capacity determined, and to observe capacity growth in terms of number, net sales and profitability of products.

4.2. Method Used in Implementation

Different research methods are used in the field of social sciences. While there are varying research methods in social sciences, it is possible to collect them under a few headings. Research methods used in social sciences are classified as experiment, survey, history, archival analysis and case study (Yin, 1994).

This paper uses case study method which is an experimental inquiry method analyzing current events under the present circumstances especially when events and circumstances leading to these events are not explicit.

Case study method is defined as a method in which a systematic research of a special case or example is conducted on a field basis in cost and management accounting activities. Therefore, case study management is frequently used in cost and management implementations. It is possible to define cost and management accounting methods through case study method and to explain how to use these methods (Scapens, 1990).

The most important reason for choosing case study method in this paper is that it is associated with the subject and goal of the study. This paper uses enterprise's actual data of 2014 and 2015.

4.3. General Information About Enterprise

The main activity of the sample business is to manufacture and sell air suspension airspring. The enterprise produces air suspension springs (air springs) which are used instead of steel springs, especially in commercial vehicles. The enterprise exports most of its production abroad while the rest is sold in the domestic market. The enterprise uses rubber, cord fabric and steel wire as raw material for air spring production. It consists of production stage; rubber and cord fabric cutting, rolling, strapping, vulcanization, assembly, quality control and traceability record processes.

4.4. Preparation of General Budget of Enterprise

This procedure comprises five stages. Sales budget was prepared in the first stage. At this stage, target sales volume and revenue were calculated with a view to draw up a revenue budget, and sales returns and deductions were calculated. Production budget, playing the most important role in expense budget, was prepared in the second stage while operating expenses budget in the third stage and investment budget in the fourth stage. Cash budget, proforma income statement and proforma balance sheet were prepared in the fifth stage.

Proforma income statement of the enterprise prepared using data obtained from its operating budget and operating expenses is given in Table 2 below.

Table 2. 2015 Proforma Income Statement

		(TRY)
GROSS SALES		**26.665.513,00**
(-) SALES DEDUCTIONS		(3.493.183,00)
SALES RETURNS	(26.740,00)	
SALES DEDUCTIONS	(3.466.443,00)	
NET SALES		**23.172.330,00**
(-) COST OF SALES		(12.184.360,30)
PROFIT OR LOSS FROM GROSS SALES		**10.987.969,70**
(-) OPERATING EXPENSES		(1.759.297,20)
RESEARCH & DEVPT. EXP.	(230.779,20)	
MARKETING-SELLING & DISTRIBUTION EXP.	(632.246,00)	
GENERAL ADMINISTR. EXP.	(896.272,00)	
OPERATING PROFIT OR LOSS		**9.228.672,50**
(+) INCOME/PROFIT FROM OTH. OP.		-
(-) EXP. AND LOSSES FROM OTH. OP.		-
(-) FINANCIAL EXPENSES		-
INCOME/PROFIT FROM OTH. OPERATIONS		**9.228.672,50**
(+) NON-OPERAT REVENUES/P		-
(-) EXTRAORD EXPENSES LOSSE		-
INCOME OR LOSS FOR THE PERIOD		**9.228.672,50**
(-) TAX (%20 CT)		(1.845.734,50)
NET PERIOD PROFIT OR LOSS		**7.382.938,00**

4.5. Product Based Cost Calculations

This model implementation aims to observe expense distributions and cost calculations before and after improvement works, and actual states of operations are obtained. However, in budgeting process implementation should be conducted on the basis of budget values. It should be observed whether or not sales prices and sales costs projected in the budget facilitate salability of that product and whether or not they maintain profitability.

Table of product based cost calculation which can be adapted to this sector and many other producer SME sectors in terms of implementation;

4.5.1. Direct Materials

In order to determine product based cost calculation tables, the number of materials which were included in material expenses and which were used in the said product were multiplied by purchase price or by stock price.

4.5.2. Direct Labor

Direct Labor Expenses calculated via budget calculations were reflected in accordance with TDABC method.

4.5.3. Manufacturing Overhead Costs

Manufacturing Overhead Costs calculated via budget calculations were distributed to product based costs in accordance with TDABC method.

4.5.4. Implementation of Time Driven Activity Based Costing

Before manufacturing overhead costs are distributed to product lines in accordance with TDABC method, direct raw material and supplies expenses and direct labor expenses will be distributed to product lines.

It was not possible to calculate a separate direct labor cost for each product since all products of enterprise are produced in the same product line. Therefore, costs having a direct effect on the production of products were calculated, it was divided by total working hours and thus unit cost per minute was calculated. At this stage, total working hours and practical capacity should be calculated. The model enterprise employ 24 employees in 2 shifts for its production line. The enterprise employ its employees 6 days a week, 286 working days a year. They work 8.5 hours a day. However, as they have one-hour break or meal break, their net working hours were calculated as 7.5 hours a day and the abovementioned calculations were made accordingly. Thus total theoretical capacity of 24 direct employees was calculated as 286 days*7.5 hours*60*24 employees=3.088.800 minutes, and rate was taken as 85% in practical capacity calculation. This calculation was made as a result of interviews made with the authorities of the enterprise. Under these circumstances, practical capacity was calculated as (3.088.800*85%) =2.625.480 minutes.

Unit cost per minute was calculated as TRY 0,2670 by dividing total direct labour expenses by practical capacity (TRY 701.150,00/2.625.480 minutes). In this case, direct labour cost was distributed as TRY 626.470,38 after 2.346.331 minutes - time spent - was multiplied by TRY 0,2670 - the relevant unit capacity cost.

Distribution of direct labour costs to product lines in accordance with TDABC method is given in Table 3 below.

Table 3. Distribution of Direct Labour Costs to Product Lines in accordance with TDABC Method

Total Direct Labor Cost (a)	Practical Capacity (Minute) (b)	Unit Capacity Cost (TRY/Minute) (c) = a/b	Total Direct Labor Duration (Minute) (d)	Used Capacity Cost (e) =c * d	Idle Capacity Cost f = a – e	Finished Goods	Production Time (Minute) (g)	Unit DLH Cost h = c * g
701.150,00	2.625.480	0,2670	2.346.331	626.470,38	74.679,62	R-8728	7,5	2,0025
						P-87783	10,7	2,8569
						K-84941	12,3	3,2841
						KPP-80881	11	2,9370
						KK-3K-3310	12,3	3,2841

Under these circumstances, total direct labor cost was TRY 701.150,00 and used capacity was calculated as TRY 626.470,38. The gap of TRY 74.679,62 was the idle capacity cost.

Steps used in the study of Everaert & Bruggeman (2007) were taken as a basis when implementing Time Driven Activity Based Costing. Hereinafter, TDABC method will be employed when distributing the manufacturing overhead costs of the enterprise where the model implementation is carried out.

Step 1. Specification of activities conducted for resource groups

Resource groups to be used in this step are as follows: Wage and Salary Expenses, Energy Expenses, Maintenance and Repair Expenses, Quality Control Expenses, Depreciation Expenses.

Step 2. Fixing costs of each resource group

Costs used for fixing total costs of resource groups are given in Table 4 below.

Table 4. Resource Costs and Resource Factors

Resource	Cost (TRY)	Resource Factor
Wage and Salary Expenses	264.500,00	Direct Labor Hours
Energy Expenses	524.000,00	Consumption Amount (kw)
Maintenance and Repair	65.600,00	Maintenance and Repair Hours
Quality Control Expenses	110.480,00	Specified Measures
Depreciation (Building + Machine)	284.000,00	Area covered (m^2)
TOTAL	**1.248.580,00**	

Step 3. Estimation of practical capacity for each resource group

Kaplan and Anderson (2004) stated that 80-85% of theoretical full capacity would be simply enough for practical capacity. As a result of the observations and interviews made in the enterprise, the practical capacity of resource groups was specified as follows.

Total production time of the relevant enterprise for 2015 was calculated as 286 days (7.5 hours*2 shifts) 15 hours machine working time when wage and salary costs of indirect personnel amounting to TRY 264.500,00 were reflected to product lines as its activity content. Theoretical capacity was calculated as 286 days*15*60*12=3.088.800 minutes, and rate was taken as 85% in practical capacity calculation. This calculation was made as a result of interviews made with the authorities of the enterprise. Under these circumstances, practical capacity was calculated as (3.088.800*85%) =2.625.480 minutes.

Practical capacity of energy resource group for 2015 in terms of its total production time was calculated as 286 days (2 shifts) 15 hours machine working time. Theoretical capacity was calculated as 286*15*60*12 machine (Vulcanization press - PLC) = 3.088.800 minutes, and rate was taken as 85% in practical capacity calculation. This calculation was made as a result of interviews made with the authorities of the enterprise. Under these circumstances, practical capacity was calculated as (3.088.800*85%) =2.625.480 minutes.

For Maintenance and Repair resource group, 12 primary machines were repaired and maintained for 6 hours a day for 286 days during which production was made. Under these circumstances, theoretical capacity was calculated as 286 days*6 hours*60 minutes=102.960 minutes. Practical capacity was calculated as 102.960*85%=87.516 minutes. As for maintenance and repair time per unit, it is calculated as 87.516 min./210.094 products pcs. (unit)=0.41 min.

For quality control activities, 2 employees were employed for a total of 210.094 products. Under these circumstances, theoretical capacity was calculated as 286*7.5*60*2 employees=257.400 minutes. Practical capacity was calculated as 257.400*85%=218.790 minutes.

Depreciation cost was composed of 12 primary machines making production (Vulcanization press-PLC), and daily operating time of these machines was calculated taking into consideration (2 shifts) 15 hours of actual operating time. Theoretical capacity of depreciation resource group was calculated as 286 days*15 hours*60 minutes*12 machines=3.088.800 minutes. Its practical capacity was calculated as 3.088.800*85%=2.625.480 minutes.

Step 4. Calculation of unit cost for each resource group

At this stage, costs related to resource groups were divided by practical capacity and unit cost for each resource group was calculated. These calculations are given in Table 5 below.

Table 5. Loading Rate for Each Resource Group

Resource	Resource Cost (a) (TRY)	Capacity (Minute) (b)	Loading Rate (a/b)
Wage and Salary Expenses	264.500,00	2.625.480	0,1007 TRY /min.
Energy Expenses	524.000,00	2.625.480	0,1995 TRY /min.
Maintenance and Repair	65.600,00	87.516	0,7495 TRY /min.
Quality Control Expenses	110.480,00	218.790	0,5049 TRY /min.
Depreciation Expenses	284.000,00	2.625.480	0,1081 TRY /min.

Step 5. Determination of time required for each activity

Total time spent for each activity was calculated by multiplying time defined for each activity unit by the number of activity units. As a result of time studies on production time of products, production time of products in total was calculated as 7.5 minutes for R-8728 type product, 10.7 minutes for P-87783 type product, 12.3 minutes for K-84941 type product, 11 minutes for KPP-80881 type product, 12.3 minutes for KK-3K-3310 type product. Breakdown of these durations is given in Table 6 below.

Table 6. Activity Times

Activity	Activity Unit	Product Type	Duration per Unit - Minute (a)	Number of Units (b)	Total Time (Minute) (a*b)
Rolling	Number of Products	R-8728	0,5	15.500	7.750
		P-87783	1	93.591	93.591
		K-84941	1	66.964	66.964
		KPP-80881	1	10.523	10.523
		KK-3K-3310	1	23.516	23.516
Strapping	Number of straps (Double)	R-8728	0,5	15.500	7.750
		P-87783	0,5	93.591	46.796
		K-84941	0,5	66.964	33.482
		KPP-80881	0,5	10.523	5.262
		KK-3K-3310	0,5	23.516	11.758
Vulcanization	Number of Products	R-8728	5,5	15.500	85.250
		P-87783	5,5	93.591	514.751
		K-84941	5,5	66.964	368.302
		KPP-80881	5,5	10.523	57.877
		KK-3K-3310	5,5	23.516	129.338
Installation	Number of Products	R-8728	0,5	15.500	7.750
		P-87783	3,2	93.591	299.491
		K-84941	4,8	66.964	321.427
		KPP-80881	3,5	10.523	36.831
		KK-3K-3310	4,8	23.516	112.877
Traceability Record	Number of Records	R-8728	0,5	15.500	7.750
		P-87783	0,5	93.591	46.796
		K-84941	0,5	66.964	33.482
		KPP-80881	0,5	10.523	5.262
		KK-3K-3310	0,5	23.516	11.758
TOTAL ACTIVITY TIMES					**2.346.331**

Step 6. Multiplication of unit costs by the unit of time specified for cost objects and determination of costs

In TDABC method, the cost of each resource group can be directly distributed to product lines, customers or orders thanks to resource activity factor. E.g. 0.5 hours were spent for Rolling activity of R-8728 type product (see Table 6). The cost per minute for Wage and Salary expenses was TRY 0,1007 (see Table 5). Thus resource activity factor would be TRY 0,0504 (0.5*0,1007) for wage and salary expenses resource group cost in Rolling activity of each unit R-8728 type product. As Rolling activity was conducted for 15.000 units of R-8728 type product, the cost of labor expenses resource group amounting to TRY 780,43 (15.000*0.0504) in Rolling activity of R-8728 type product would be distributed.

The cost of labor resource group was distributed to each product line in terms of rolling, strapping, vulcanization, installation and traceability record activities by the instrument of resource activity factors. Table 7 below illustrates the distribution of wage and salary costs to product lines in accordance with TDABC Method.

Table 7. Distribution of Wage and Salary Costs to Product Lines in accordance with TDABC Method

Product Type	Activity Content	Time per Unit (min.) [X]	Cost per Unit [Y]	Resource Activity Factor (a) [X*Y]	Activity Unit (b)	Distributed Cost (a*b)
R-8728	Rolling	0,5	0,1007	0,0504	15.500	780,43
	Strapping	0,5	0,1007	0,0504	15.500	780,43
	Vulcanization	5,5	0,1007	0,5539	15.500	8.584,68
	Installation	0,5	0,1007	0,0504	15.500	780,43
	Traceability Record	0,5	0,1007	0,0504	15.500	780,43
P-87783	Rolling	1	0,1007	0,1007	93.591	9.424,61
	Strapping	0,5	0,1007	0,0504	93.591	4.712,31
	Vulcanization	5,5	0,1007	0,5539	93.591	51.835,38
	Installation	3,2	0,1007	0,3222	93.591	30.158,76
	Traceability Record	0,5	0,1007	0,0504	93.591	4.712,31
K-84941	Rolling	1	0,1007	0,1007	66.964	6.743,27
	Strapping	0,5	0,1007	0,0504	66.964	3.371,64
	Vulcanization	5,5	0,1007	0,5539	66.964	37.088,01
	Installation	4,8	0,1007	0,4834	66.964	32.367,72
	Traceability Record	0,5	0,1007	0,0504	66.964	3.371,64
KPP-80881	Rolling	1	0,1007	0,1007	10.523	1.059,67
	Strapping	0,5	0,1007	0,0504	10.523	529,83
	Vulcanization	5,5	0,1007	0,5539	10.523	5.828,16
	Installation	3,5	0,1007	0,3525	10.523	3.708,83
	Traceability Record	0,5	0,1007	0,0504	10.523	529,83
KK-3K-3310	Rolling	1	0,1007	0,1007	23.516	2.368,06
	Strapping	0,5	0,1007	0,0504	23.516	1.184,03
	Vulcanization	5,5	0,1007	0,5539	23.516	13.024,34
	Installation	4,8	0,1007	0,4834	23.516	11.366,69
	Traceability Record	0,5	0,1007	0,0504	23.516	1.184,03
TOTAL						**236.275,52**

All resource costs were distributed to product lines in a way similar to calculation above, and the results were given in Table 8 below.

Table 8. Distribution of Total Cost to Product Lines and Activities in accordance with TDABC Method

Activities	Manufacturing Overhead Costs Distributed to Product Lines					Activity Costs
	R-8728	P-87783	K-84941	KPP-80881	KK-3K-3310	**TOTAL**
Rolling	3.164,33	38.213,21	27.341,40	4.296,54	9.601,58	82.617,06
Strapping	3.164,33	19.106,60	13.670,70	2.148,27	4.800,79	42.890,69
Vulcanization	34.807,58	210.172,63	150.377,71	23.630,97	52.808,71	471.797,60
Installation	3.164,33	122.282,26	131.238,73	15.037,89	46.087,60	317.810,81
Traceability Record	3.164,33	19.106,60	13.670,70	2.148,27	4.800,79	42.890,69
Quality Control	3.912,98	33.077,87	27.048,10	4.250,45	10.685,91	78.975,31
Maintenance and Repair	4.763,07	28.760,05	20.577,70	3.233,67	7.226,35	64.560,84
TOTAL	**56.140,95**	**470.719,22**	**383.925,04**	**54.746,06**	**136.011,73**	**1.101.543,00**

According to the results obtained from model implementation, the resource cost amounted to TRY 1.248.580,00 and the distribution of costs to product lines was calculated as TRY 1.101.543,00 in accordance with TDABC method. The gap of TRY 147.037,00 was the idle capacity cost amounting to 11.78%.

As a result of efforts made so as to use the idle capacity, it is seen that it will be more suitable to improve vulcanization activity, which takes the longest time.

4.6. Process Improvement Works

The process improvement works guided by a mechanical engineer were conducted by observing the details of the process as follows.

4.6.1. Improvement Works

1. In order to homogenize intra-mould steam circulation and distribution and to keep the whole mould at the same temperature, the required steam circulation curtains were developed and thus the required productivity was ensured.
2. Special design rockwool sheets were prepared so as to prevent extra-mould heat loss and to stabilize the temperature required for vulcanization, and moulds were covered by these sheets. It prevented external heat loss and retained heat within the mould.
3. With a view to shortening the process improvement and vulcanization durations within the scope of lean production; PLC (Programmable Linear Circuit) controlled heat control system was developed, and heat loading automation required for maintaining the same temperature in three sections of the mould (upper head, middle body and lower head) was enabled in line with the process, and it was avoided to waste time in this process.

Vulcanization time was shortened thanks to improvement works specified in the paragraph 1, 2 and 3 above.

<u>Time savings realized thanks to improvement works:</u>

Vulcanization time before improvement works : 5.50 minutes

Vulcanization time after improvement works : 4.95 minutes

Time savings thanks to improvement works : 0.55 minutes

Table 9. Post-Improvement Activity Time and Product Outputs

Product Type	**BEFORE IMPROVEMENT WORKS**			**AFTER IMPROVEMENT WORKS**	
	Vulcanization Time	**Product Outputs**	**Total Vulcanization Time**	**Vulcanization Time**	**Product Outputs**
R-8728	5,50	15.500	85.250	4,95	17.222
P-87783	5,50	93.591	514.751	4,95	103.990
K-84941	5,50	66.964	368.302	4,95	74.404
KPP-80881	5,50	10.523	57.877	4,95	11.692
KK-3K-3310	5,50	23.516	129.338	4,95	26.129
TOTAL		**210.094**	**1.155.517**		**233.437**

While Total Activity Time before improvement works was 2.346.331 minutes for 210.094 products, it was 2.478.636 minutes for 233.437 products after improvement works.

Distribution of total costs to product lines and activities after improvement works is given in Table 10 below.

Table 10. Distribution of Total Costs to Product Lines and Activities in accordance with TDABC Method After Improvement Works

Activities	Manufacturing Overhead Costs Distributed to Product Lines					Activity Costs
	R-8728	P-87783	K-84941	KPP-80881	KK-3K-3310	TOTAL
Rolling	3.515,87	42.459,12	30.379,15	4.773,84	10.668,47	91.796,45
Strapping	3.515,87	21.229,56	15.189,58	2.386,92	5.334,24	47.656,17
Vulcanization	34.807,13	210.172,63	150.376,81	23.630,53	52.808,93	471.796,03
Installation	3.515,87	135.869,17	145.819,94	16.708,45	51.208,66	353.122,09
Traceability Record	3.515,87	21.229,56	15.189,58	2.386,92	5.334,24	47.656,17
Quality Control	4.347,69	36.753,19	30.053,26	4.722,63	11.873,28	87.750,05
Maintenance and Repair	4.775,92	28.837,99	20.633,35	3.242,37	5.875,11	63.364,74
TOTAL	**57.994,22**	**496.551,22**	**407.641,67**	**57.851,66**	**143.102,93**	**1.163.141,70**

Before improvement works were conducted, the total idle capacity cost was TRY 147.037,00 and resource cost amounted to TRY 1.101.543,00. At the end of improvement works conducted in accordance with TDABC method, it was calculated as TRY 1.163.141,70. The gap of TRY 85.438,30 was the idle capacity cost amounting to 6.84%.

At the end of vulcanization improvement works, the number of products, which was then 210.094, rose to 233.437 with an increase of 23.343 products. This increase is of high importance in terms of the productivity of enterprise and its effects on product based costs.

4.6.2. Process Improvement Works and Their Effects on Productivity

Productivity is the ratio of products to materials necessary to produce goods and it is expressed as follows: Productivity = Output / Input. Measurement of output factor in the denominator of the fraction does not pose a problem. The product is expressed in terms of amount, money, quantity, weight, etc. Sales revenue is the most preferred measurement in a system where various products are produced. However, expression of inputs used in a production with a single measurement can cause a mistake. In addition; all, some or just one input(s) can be used. If all input factors are used, the obtained portion is called as "total factor productivity" or shortly as productivity (Kobu, 2003).

Total productivity is measured with the ratio of outputs obtained from service provision to all inputs used. Calculation of total productivity enables to make assessments on various expenses. Increase in total productivity ratio indicates that savings were achieved in one or more than one of inputs (Oral & Yüksel, 2007).

The number of products produced in an enterprise where model implementation was conducted was 210.094 before improvement works and this number would rise to 233.437 after improvement works. Total productivity gradient of the enterprise is given below.

Table 11. Productivity Before and After Improvement

Description	Before Improvement Works	After Improvement Works
Number of Products	210.094	233.437

Factor	Before Improvement Works	After Improvement Works
Sales	**23.172.330,00**	**25.746.948,00**
Raw Material Expenses	10.465.015,00	11.627.755,00
Direct Labor Expenses	627.690,00	627.690,00
Manufacturing Overhead Costs	1.113.496,00	1.237.214,00
Operating Expenses	1.759.297,20	1.759.297,00
TOTAL	**13.965.498,20**	**15.251.956,00**
(+) Total Stock for Opening Period	133.915,50	133.915,50
(-) Period-end Total Stock	155.756,20	155.756,20
PROFIT (LOSS) BEFORE TAX	**9.228.672,50**	**10.516.832,70**

Stocks	155.756,20	155.756,20
Fixed Facilities	14.486.540,00	14.486.540,00

Assuming that inflation rate would be 8.81% in the implementation year and with the expectation of investor that minimum capital cost would be 10%, the following figures were obtained at the end of calculations of total productivity before and after improvement works:

1. Before improvement works: 23.172.330,00 / [10.465.015,00 + 627.690,00 + 1.113.496,00 + 1.759.297,00 + (0.10)(155.756,20 + 14.486.540,00)] = 23.172.330,00 / 15.429.727,62 = 1,5018
2. After improvement works: 25.746.948,00 / [11.627.755,00 + 627.690,00 + 1.237.214,00 + 1.759.297,00 + (0.10) (155.756,20 + 14.486.540,00)] = 25.746.948,00 / 16.716.185,62 = 1,5402

After improvement works, total productivity will increase by (1,5402 - 1,5018) / 1,5018 = 2,56%.

However; when the followings and labor productivity are calculated Sales Revenues/ (Direct Labor + General Expenses)

The following figures will be obtained:

1. Before Improvement Works: 23.172.330,00 / (627.690,00 + 1.113.496,00) = 13,308
2. After Improvement Works: 25.746.948,00 / (627.690,00 + 1.237.214,00) = 13,806

This productivity measurement indicated that there would be an increase of (13,806 - 13,308) / 13,308 = 3,74%.

At this point, there was no change (in stocks and new investments) which could influence productivity percentage before and after improvement works. Accordingly, we can conclude that productivity has increased thanks to improvement works.

As a result, savings will be achieved in Direct Labor expenses which are included in manufacturing overhead costs of the firm. In addition, the shortened vulcanization time will ensure productivity increase and an enhanced capability to produce goods. This will also downsize the portion of expenses per product in terms of energy expenses, maintenance and repair expenses and manufacturing overhead costs. In a sense, an enterprise which can produce 210.094 products with a resource cost of TRY 1.248.580,00 will become an enterprise which produce 233.437 products with the same resource cost. This technology adaptation will decrease product-based expenses of the enterprise and increase productivity. While it lands a net sale of TRY 23.172.330,00 with 210.094 products, this figure will reach to TRY 25.746.948,00 with 233.437 products. This will contribute to profitability with an additional turnover of TRY 2.574.618,00.

In this budget practice, the idle capacity of the enterprise was established as a result of cost calculations made in accordance with TDABC method. As a result of these improvement works, the number of products, which is currently 210.094, will rise to 233.437 with an increase of 23.343 products in production volume. It means that net sales of the enterprise will rise to TRY 25.746.948,00 from TRY 23.172.330,00 and pre-tax profit will rise to TRY 10.516.832,70 from 9.228.672,50.

With this budget practice; the raw material expenses were calculated as TRY 10.465.015,00, direct labor expenses as TRY 627.690,00, manufacturing overhead costs as TRY 1.113.496,00 and total operating expenses as TRY 13.965.498,20 for 210.094 products. While the expenses were supposed to amount to TRY 13.965.498,20/210.094 pcs.*233.437 pcs. = TRY 15.517.168,52 for 233.437 products, it was calculated that they would amount to TRY 15.251.956,00. In such a case, TRY 15.517.168,52-TRY 15.251.956,00=TRY 265.212,52 would have a positive effect upon product based costs.

5. Conclusion

This paper tries to clarify the importance of budgets in ensuring that SMEs achieve competitive power, the profitability, and their contribution to ensure that SMEs have longer lifespans. Problems which SMEs encounter in implementing budget systems in the current situation may be caused not only by details and challenges but also by lack of knowledge of personnel. From this standpoint; an applicable budget is emphasized in achieving objectives and planning expenses of SMEs at the end of budgeting activities, predicting the future sales revenues, planning the amounts of raw materials and supplies and the direct labor hours, and calculating the manufacturing and operating costs for the predicted production volumes.

This paper analyzes products currently produced by the enterprise. Cost and sales data related to the products comprising the available production range of the enterprise were included in the study.

Product based cost calculations were priced with the purchase price or material stock unit price specified through product indexes. A budget was allocated for each product. It was multiplied by the target production number. The total material expenses comprised 710-Direct Raw Materials and Supplies Expenses. 720-Direct Labor Expenses and 730- Manufacturing Overhead Costs were obtained from budget expenditure calculations and they were distributed to costs in accordance with TDABC method. This method aims to make a budget so as to calculate product based costs and to calculate product based costs so as to make a budget. It is possible to determine the target production number, make a budget and calculate product based costs for a producer SME by using this method.

As is also observed in various researches, the contrary situation is that SMEs assume that their costs only comprise the primary expenses such as personnel expenses, raw material expenses -expenses that first spring to mind - without making any budgets, and they realize their budgets through a cost calculation method.

As a result, products are sold mostly without knowing if they make a profit or a loss, and, in the end, they make a loss and go bankrupt within the process.

One of the most critical factors of budgeting method is that cost improvement of each product that is produced is specified separately with a holistic viewpoint. It will ensure that there will be more cost-related items, a more powerful command will be achieved, and the relevant items related to savings will be emphasized. Additionally, studies enable the enterprise to see its actual profit or loss related to each product at the end of the actual realizations.

The price is one of the most critical factors under the present conditions of competition. This compels the enterprises to produce high quality products but set lower prices under the conditions of competition.

The sales prices set in this paper accord with the conditions of competition. When compared to product based costs, it is observed that they are prices which enable sustainability of profitability.

The material expenses were specified through product indexes and they were reflected to the costs. In addition, the labor expenses and manufacturing overhead costs of the enterprise was budgeted, and were reflected to product based costs in terms of target production numbers in accordance with TDABC method.

Thanks to this method:

- Sales targets were set,
- Sales prices were set,
- Production numbers which would keep the labor productivity at maximum level as well as the producibility of these numbers were determined.

Thus target output that should be produced and sold was clarified, and salability of the product in question was established as a result of all expenses reflected, and profitability was achieved at the rate, which is above the target after-tax profit.

This paper features cover management phases of an enterprise with a method and systematics that would be suitable for producer SMEs, in terms of their implementation and their applicability to control phase.

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