ITJ | The International Tax Journal

The role of time-driven activity based costing in reducing the company costs and increasing the earnings: Case study of Athmani diary in Khenchla

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Abstract---This study sheds light on the time-driven activity based costing TD-ABC and on its effect on the increase of the company's profits. In so doing, the study focuses on all the technical specifications of the study product, which is the milk case made by Athmani diary in Khenchla, and tries to coordinate the different determinants of the operational costs that increase the added value. In addition, it excludes the activities that neither add value nor improve the activity. Findings show that the application of TD-ABC allows reducing the costs of the milk liter in the study diary with a rate of 16.41%. Besides, the system is based on essential and strategic points, namely the control, decrease, or omission of the operational costs to stop wasting the available financial resources and regulate the earnings. Moreover, the system identifies the cost items that add a service to the company and deletes or excludes the items that do not add a value in order to improve the earnings, decrease the costs, and foste the competitive advantage.

Keywords---company costs, Athmani, Khenchla, company profit, operational costs.

1. Introduction:

Today, costs accounting is one of the main accounting systems thanks to its ability to provide financial and accounting information on the aggregate costs and the costs items to the decision makers. The use of the traditional cost accounting systems in cost analysis did not cope with the development in business, the high competition between the companies, and the current commercial movements and activities. Therefore, it was necessary to find a more exact system that helps provide information of costs allocation, mainly the indirect ones. This gave birth to the activity based costing ABC, which

How to Cite:
Aziz, L., & Amel, G. (2025). The role of time-driven activity based costing in reducing the company costs and increasing the earnings: Case study of Athmani diary in Khenchla. *The International Tax Journal*, *52*(3), 657–665. Retrieved from https://internationaltaxjournal.online/index.php/itj/article/view/91

The International tax journal ISSN: 0097-7314 E-ISSN: 3066-2370 © 2025

Submitted: 20 Nov 2024 | Revised: 12 Feb 2025 | Accepted: 10 April 2025

provides important and valuable financial information for the decision makers regarding the indirect costs' allocation or overhead. Under the increasing criticism to ABC, mainly that it did not cope with the complicated and interrelated activities, Kaplan & Anderson developed a modern method, which is a scientific mathematical system based on mathematical equations used for calculating the time needed in activities to calculate the different costs.

1.1 The problematic and sub-questions:
Based on what was said, we raise the following problematic, "what is the role of TD-ABC in improving earnings?"
To deal with this question, we must tackle the following sub-questions:

- Does TD-ABC provide valuable information for the real use of the company resources?
- Does TD-ABC help reduce costs and increase earnings?

1.2 The study hypothesis:
The study hypothesizes that the application of TD-ABC helps identify the activities with an added value and, thus, increase earnings.

1.3 Aims of the study:
This study aims at:

- Finding our more about TD-ABC because it is one of the modern methods for costs accounting.
- Showing the role and contribution of TD-ABC in reducing the costs of Athmani diary in Khenchla.

1.4 Importance of the study:
The importance of the study lies within the fact that TD-ABC is one of the modern techniques in costs accounting and to is vital for the exact determination of the production costs in due time. In addition, it helps take the necessary administrative decisions, rationally manage the costs, protect the available resources, and exclude the activities with no added value.

1.5 Methodology:
We used the analytical descriptive method to describe the study variables and show their relations in the theoretical chapter. Then in the practical, we used the case study to focus on Athmani diary in Khenchla.

1.6 Literature review:
The study of Mohamed Abdellah Abu Rahma Khaled Yusuf Imad, 2019) titled "the effect of the application of TD-ABC on the quality of the administrative decisions": It was conducted at the faculty of sciences and technology and found out that the application of TD-ABC has an effect on providing exact information that helps take quality administrative decisions, reduce the costs, and increase the efficiency of the controls.
The study of Amir Akid Khadhem al Ardawi (2020) titled "TD-ABC and its effect on the organization of the earnings of the economic unit": It was conducted at a cement factory and found out that TD-ABC is based on the policy of reducing the operational costs and ending the waste of the resources in the operational processes.

2. The theoretical chapter:
1.2 The concept of TD-ABC:
Definition one: Guzman defines it a system that identifies the direct costs of the resources on the cost goal using a fast and easy frame that just requires the costs[i] of the resources that equip the unit and the estimation of the duration of the activity.

Definition two: It is an emerging alternative system of costs that treats most of the problems and deficits of ABC system[ii].
These definitions show that TD-ABC aims at treating the deficits of ABC. Thus, we can define it as a mathematical system based on a temporal basis in the process of allocating the resources for activities with an added value, and excluding the activities with no added value to increase the earnings.

2.2 The importance of TD-ABC:
The system provides advantages for the users of the financial statements, mainly the administrative decision makers, as follows[iii]:

- This system is easily applied and flexible in update and development, what makes it respond to the changes in the company activities and businesses.
- It provides exact estimation of all the costs and resources, and information on how to allocate them using time.
- It is less costly and can be used even in the businesses with complicated activities.
- It redresses the deficits of ABC and exactly focuses on determining the time needed and cost allocated for each unit of the company[iv].
- It is necessary for analyzing the financial statements for the decision makers to foster competitiveness between the companies[v].

2.3 The practical steps to apply TD-ABC:
To apply the system, we follow these steps[vi]:

- Identifying the different sets of financial resources that consume costs.
- Identifying the cost of each set.
- Identifying the time needed for each set.
- Identifying the marginal costs of each set by dividing the aggregate costs of the resources by the size of the available operational energy.
- Identifying the time needed for each event starting from the time drivers based on time averages.
- Calculating the aggregate cost by multiplying the unit cost by the time needed.

4. The pillars of TD-ABC:
TD-ABC is based on some concepts, as follows[vii]:

- ABC: It is a set of accounting procedures that work in correlation and complementarity to measure the profitability of a product.
- The cost drivers: They are a set of variables that identify the time needed for each activity.
- Time equations: They are one of the main steps to express the time needed for making a given activity.
  In this regard, we can mathematically express the time equations as follows[viii]:

$TJK = B0 + B1X1 + B2X2 + B3X3 + ... + BpXp$
Where
TJK: is the time needed to end the event K in the activity J.
B0: is the steady time in activity J.
B1: is the time taken for a unit of cost driver in time 1 when the variables X1 + X2 + X3 + ... + Xp are all steady.
P: is the number of drivers that estimate the time needed to end activity J.
Thus, the aggregate cost of the product and service delivered is as follows[ix]:
$CT = \sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{p} T_{ijk} C_i$

Where:
CT: is the aggregate cost

Ci: is the unit of time cost of the set of resources i.
TJK: is the time needed for the process K in time J.
n: is the number of resources, M: is the number of activities, i: is the number of the times of activity J.

2.5 The advantages of applying TD-ABC:
This system is characterized with:

- The ability to predict the resources needed for the company activities and the amount of demand that helps the company prepare budgets and make good planning[x].
- The ability to build special cost systems when there are many activities, mainly for the service company[xi].
- Helping in finding the activities that add value and those that do not, and in showing the value and costs of the unused resources[xii].
- Speed and easiness in use and application, what fosters flexibility and dynamicity in application in due time[xiii].

6. Criticism to TD-ABC:
Despite its advantages in the process of resources allocation according to the needed time, TD-ABC faces criticism, as follows[xiv]:

- The problem of unexploited energy is not a new discovery for the method. Practically speaking, the cost of the unexploited energy is excluded from the production cost.
- The problematic of measuring the time needed in the services due to the fluctuation of services and their temporal unsteadiness.
- The success of TD-ABC depends on the relation with the financial and operational information system, which is a system for planning all the resources of the company and its relations with the customers to increase earnings and competitiveness.

The practical chapter:
7.1 Introduction to Athmani diary in Khenchla:
It is a general partnership with a social capital of 31495000 DZD specialized in producing milk and some of its derivatives, like Yogurt, cheese, and juice. During the field visit and the interview with the accountancy and finance executive, we had access to the information on the accountancy of producing milk cases in January 2025.

2.7 The direct costs of producing milk in January 2025

Table 01: The direct costs of producing milk in January 2025 (Unit: 01 DZD)

Costs	Sums
Wages	1263600
Plastic package	160000
Conservatives	350.000
Milk powder	12852000
Total	14625600

Source: By the authors based on the information submitted by the head of the department of accountancy and finance

The table shows that the cost of the milk powder is 87.87% of the aggregate costs because it is imported in hard currency. Besides, the diary gets its share, 160.000Kg, once per week and uses the zero inventory method, i.e., the final stock is monthly null.

7 The indirect costs of producing milk in January 2025

Table 01: The indirect costs of producing milk in January 2025 (Unit: 01 DZD)

Costs	Sums
Transportation	80.000
Gas and electricity	420.000
Fuel	156.000
Water	350.000
Detergents	150.000
Wages+ devaluation	1850.000
Total	3006.000

Source: By the authors based on the information submitted by the head of the department of accounting and finance

7.3 Identifying the indirect cost according to ABC:

7.3.1 Identifying the activities and their costs:

After identifying the indirect costs in table 02, we distribute the resources on the activities of the company, as follows:

Table 03: The activities that drive the costs of producing milk in January 2025 (Unit: 01 DZD)

	Main activities							
Costs	**Sums**	**Supply**	**Mixing**	**Preparation**	**Filtering**	**Pasteurization**	**Packaging**	**Distribution**
Transportation	80.000	68000	12000	-	-	-	-	-
Gas and electricity	420.000	60000	60000	60000	60000	60000	60000	60000
Fuel	156.000	132600	23400	-	-	-	-	-
Water	350.000	-	322000	7000	7000	7000	7000	-
Detergents	150.000	-	40000	10000	20000	30000	40000	10000
Wages+ devaluation	1850.000	92500	370000	462500	185000	370000	277540	92500
Total	3006.000	353100	827400	539500	272000	467000	384500	162500

Source: By the authors based on the information submitted by the head of the department of accountancy and finance

The table shows that the activity of mixing the milk powder represents 27.52% of the aggregate indirect costs, followed by the activity of preparation with a rate of 17.94%. This explains the main importance of these activities in the process of producing milk at Athmani diary in Khenchla.

7.3.2 Calculating the overhead rate and the indirect costs of each activity:

The overhead rate = the indirect costs of the activities/ the number of sales.

- The number of working days in January= the number of days - days off
  26 days= 31-5
- The number of working hours= the number of the shift hours- the break hours
  10 hours- 01 hour= 09 hours.

The daily production of the diary is 36.000 cases of 01 liter.

Table 04: The activities' overhead rate and the indirect costs of each activity (Unit: 01 DZD)

	Sums	Cost driver	Number of drivers	Overhead rate	Total sum
Supply	353100	Purchased substance	105000	3.37	353850
Mixing	827400	Used substance	105000	7.88	827400
Preparation	539500	Produced unit	936000	0.57	533520
Filtering	272000	Produced unit	936000	0.29	271440
Pasteurization	467000	Produced unit	936000	0.5	468000
Packaging	384500	Produced unit	936000	0.41	383760
Distribution	162500	Produced unit	936000	0.17	159120
Total	3006000	-	-	-	2997090

Source: By the authors based on the information submitted by the head of the department of accountancy and finance

The table shows that the overhead rate of costs on activities through ABC is high in the activity of mixing with a rate of 7.88% for each driver while the least overhead rate for costs and resources allocation is the activity of distribution with a rate of 17%. Thus, we can say that the activity of distribution is a high cost activity with no added value.

7.3.3 Calculating the cost of one liter using ABC method:

The cost price= the direct costs+ the indirect costs

Table 05: The price of the cost of one liter using ABC method (Unit: 01 DZD)

Statement	Sums
Direct costs	14625600
Indirect costs	2997090
Price of the cost	17622690
Number of the productive units	936000
Price of the cost of one liter of milk	18.83

Source: By the authors based on tables 01 and 04.

7.4 Identifying the indirect cost using TD-ABC:

According to TD-ABC, time is the main factor in identifying the costs of activities because all the activities are related with time. The following table shows the labor force available in Athmani diary in January 2025 and the time needed for the activities.

Table 06: the available labor force and the total needed time (Unit: 01 DZD)

Activities	Number of employees	Operational energy per minute	Total energy
Supply	03	14040	42120
Mixing	05	14040	70200
Preparation	04	14040	56160
Filtering	03	14040	42120
Pasteurization	04	14040	56160
Packaging	04	14040	56160
Distribution	04	14040	56160

Source: By the authors based on the information submitted by the head of the department of accountancy and finance

The workers in the main activities are 27, the real working hours are 09, and the real working days are 26 in January 2025. The following table shows the time needed for each activity in January 2025.

Table 06: The common time in January 2025

Activities	Time needed (hours)	Total time (minute)
Supply	0.5	780
Mixing	02	3120
Preparation	01	1560
Filtering	01	1560
Pasteurization	01.5	2340
Packaging	01.5	2340
Distribution	01.5	2340
Total	09	14040

Source: By the authors based on the information submitted by the head of the department of accountancy and finance

The table shows that the real energy in January 2025 was 14040 minutes, and that the activity of mixing takes 22% of the total time. The following table shows the overhead rate of activities costs using TD-ABC method in January 2025.

Table 08: the overhead rate of activities costs using TD-ABC method in January 2025

Activities	Indirect costs	Working energy (hour)	Costs rate
Supply	353100	42120	8.38
Mixing	827400	70200	11.78
Preparation	539500	56160	9.61
Filtering	272000	42120	6.46
Pasteurization	467000	56160	8.31
Packaging	384500	56160	6.85
Distribution	162500	56160	2.89

Source: By the authors based on the information submitted by the head of the department of accountancy and finance, and tables 03 and 06

After calculating the costs rate of the productive unit in minutes, we shall calculate the indirect costs of each activity using TD-ABC, as shown in the following table:

Table 09: the indirect costs of each activity using TD-ABC in January 2025

Activities	Indirect costs	Working energy (hour)	Costs rate
Supply	780	8.38	6536.4
Mixing	3120	11.78	36753.6
Preparation	1560	9.61	14991.6
Filtering	1560	6.46	1007.6
Pasteurization	2340	8.31	19445.4
Packaging	2340	6.85	16029
Distribution	2340	2.89	6762.6
Total	14040	Total	110601.7

Source: By the authors based on tables 08 and 07

The table shows the independent real costs of each activity in accordance with the monthly time needed. This is a mirror for the higher administration to know the size of the exploited and unexploited energies. The following table shows the price of the cost of one liter of milk using TD-ABC method.

Table 10: the price of the cost of one liter of milk using TD-ABC in January 2025

Statement	Sum
Direct costs	14625600
Indirect costs	110601.7
Price of the cost	14736201.7
Number of productive units	936000
Price of the cost of one liter	15.74

Source: By the authors based on tables 01 and 09

The table shows that the cost price of one liter of milk in Athmani diary decreased when using TD-ABC method to 15.74 DZD, unlike when using ABC method, where the price was 18.83; i.e., with a decrease of 09.09 DZD per liter. This makes an extra gain and an additional resource for the company. Thus, we can confirm that the use of TD-ABC helps decrease the cost and increase competitiveness.

8. Results:

Based on the theoretical and practical chapters, our findings show that:

- The main hypothesis is confirmed, as the application of TD-ABC helps identify the activities that add a value and increase earnings thanks to the use of the time needed for producing milk. Besides, it helps know the activities with no added value, mainly in funding and distribution activities.
- The application of TD-ABC decreases the cost of one liter of milk with more than 03 DZD; thus, it increases earnings.
- The mathematical use of the time equations according to TD-ABC allows identifying the cost of one liter of milk in an exact way. In addition, the mathematical model can fit the extra activities.
- It is possible to use the mathematical method to identify the cost of the activities using TD-ABC to predict the costs and earnings.
- TD-ABC is easily applied in the field because it relies on time and cost drivers.
- TD-ABC allows knowing the size of the unexploited energy that adds no value and, thus, excluding it.
- TD-ABC provides exact information on the real time of conducting the activities. This information makes a database for the higher administration.
- TD-ABC is the most flexible and exact method compared to ABC.
- TD-ABC contributes to building mechanisms to estimate the costs in a more exact way, and to supporting the different decisions of the higher administration, mainly pricing.

Recommendations:

- It is necessary to use the modern methods in Athmani diary to identify the costs, mainly TD-ABC method since the diary uses no modern method in cost accounting.
- The diary has to modernize its accounting system, mainly the cost accounting.
- It is necessary to exploit the unexploited energy in the diary to produce other profitable products.

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