Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6, 8347-8367
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v8i6.3801

Using time-driven activity-based costing to measure customer profitability, An applied study in Al Narjis Company for Construction and Building

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Abstract: The purpose of this study is to Measuring Customer Profitability by Using Time-Driven Activity-Based Costing (TDABC) at Al Narjis Construction & Building Company. A case study was conducted in Al Narjis Construction & Building Company, in one of its factories consisting of five production lines for producing pipes of various sizes. Interviews, direct observations, and documentation collection were used to collect the data. The results showed that some customer segments that were profitable in the traditional accounting system used in the factory management were identified as unprofitable using the method (TDABC). Only one factory operating in the company was examined in this research paper. Therefore, further research should focus on implementing customer profitability measurement using TDABC in other factories within the company and abroad. Based on the results of the study, factory management is better able to understand the profitability of different customer segments and implement appropriate strategies. Furthermore, TDABC time equations are seen as providing factory management with an opportunity to achieve a better balance between the capabilities offered in the departments. There is limited research on measuring profitability in industrial companies in general. Therefore, this paper is unique in the sense that it analyses the use of TDABC systems in a real factory case and for the first time in Basra Governorate (Iraq).

Keywords: *Activity based costs, Customers, Profit.*

1. Introduction

With the advancement of technology, implementing a time-driven activity-based costing (TDABC) system has become easier and more efficient. The use of integrated ERP and CRM systems allows decision makers to access timely data, paving the way for improved cost management efficiency. These tools and software simplify tracking time usage for different activities, updating costs, and running scenario analyses. Moreover, the high scalability of TDABC allows for the effective management of a large number of transactions. (Erik, 2023: 23 Erik) In today's business world, competition is one of the features of the modern era, which prompted companies to search for competitive advantages, the most prominent of which was the cost of the product and service, especially indirect costs, as they have become a large part of the product costs. Each company also has activities that can be identified, measured, and thus improved to improve business performance. By using the time-driven activity-based costing system as a method of cost estimation, we can open the way to analyse variance and manage resources to make activities more efficient and effective, thus affecting unit costs, prices, and profits. Therefore, measuring customer profitability is a management accounting method that allows companies to determine the total profit achieved by the customer. A profitable customer is the person who generates a greater flow of acquisition, selling, and service costs. Companies calculate the cost of acquisition at the customer level or for the entire group of customers. The main problem here is that when a company focuses more on products, departments and office locations, it often loses focus on customers. As a result, the company sometimes has to bear the cost of maintaining unprofitable customers, which harms their business. While measuring customer profitability allows the company to

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evaluate its customers and know how beneficial it is to maintain them. Based on this value, they can determine the cost of serving them or even decide whether to continue or leave them. Sometimes the size of customers may not be directly proportional to its profitability, and even large customers can turn into unprofitable customers for the business. Therefore, the company, regardless of its business activities, should rely on time-oriented activity-based costing (TDABC). It is a potential solution for profitability analysis, especially in industries with high overhead costs and a large number of logistics or sales transactions, which makes updating the traditional ABC model expensive. Despite the diversity of TDABC literature, little is known about how a company's customer base affects the way profitability management systems are developed. Accordingly, this study relies on the classification provided by Kubler (Radiol, 2021: 94) and focuses on the use of TDABC to measure customer profitability (CPA), so the purpose of this study is to investigate how companies with different customers use time-driven activity-based costing to measure their customer profitability.

2. Research Methodology and Literature Review

2.1. The Research Problem

Obtaining accurate information about customer profitability requires the use of an appropriate costing system. Customer profitability analysis (CPA) requires allocating revenues and costs to specific customers in a way that can be calculated individually. Given the increasing size and organizational complexity of the service, Kaplan and Narayanan (2001) show that understanding customer profitability analysis is particularly important for service companies. In fact, for service companies, CPA is more important than for production companies because the cost of providing a service is generally determined by customer behaviour. The cost of finding and acquiring a new customer in service companies is five times greater than the cost of retaining existing customers (Saravana. 2022:2). Therefore, the successful implementation of customer profitability measurement and analysis in order to maintain profitable relationships with existing customers is essential for service companies. Furthermore, emphasizes that the effective use of customer profitability analysis enables companies to increase customer satisfaction and enhance profitability.

In light of the above, the research problem can be framed by answering the following question:

- *Does measuring customer profitability using the TDABC system accurately measure and determine customer profitability and provide appropriate information for the cost management process*?

2.2. Importance of the Study

Measuring and analysing customer profitability is important because it allows companies to prioritize their efforts and resources based on the profitability of different customer segments. Therefore, measuring and analysing customer profitability is vital to business success, because CPA allows a company to identify which customers are making it money and which are causing it to spend its resources without much return.

Most companies still use traditional methods of allocating overhead costs to customers, which distorts customer profitability and makes it difficult to distinguish profitable from unprofitable customers. Typical costs of customer retention include things like marketing, customer service, selling expenses, and other operating expenses. Analysing these customer-specific expenses using a time-driven activity-based costing system enables a company to improve its profitability by identifying unprofitable customers and then trying to get rid of them or reduce the cost of servicing them. It is also useful to know the profit (rather than revenue) that a customer generates, and thus measuring customer profitability aims to achieve this.

2.3. Study Objectives

In light of the problem and importance, the current study aims to achieve the following objectives:

- Identify the model used to calculate the cost of customer service and determine profitability in the study sample company.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 8347-8367, 2024
DOI: 10.55214/25768484.v8i6.3801

- Use time-driven activity costing as a more accurate method for estimating the cost of customer service in the sample company.
- Enable the study sample company to improve its profitability by identifying unprofitable customers.
- Diagnose the nature of the true cause-and-effect relationships between time, volume and cost price in the study sample company.
- Enabling cost management to improve its performance by taking appropriate measures to reduce the time required for customer requests.

2.4. Study Hypothesis

In light of the problem and objectives, the research was based on a main hypothesis, which is: *"Measuring customer profitability using TDABC helps to more accurately determine customer profitability and provide relevant information for the cost management process."*

2.5. Study Limitations

First: The spatial boundaries of the study:

Al-Nargis Pipe Production Company, was selected as a sample for the study, specifically the pipe factory in which the research was applied.

Second: Time limits of the study

Data for the year (2023) has been adopted for the pipe factory records.

2.6. Study Method

The study relied on the applied scientific approach in collecting data related to the model of the time-driven activity costing system to measure customer profitability.

2.7. Study Variables

1. Independent variable: Time-driven activity-based costing system.
2. Dependent variable: customer profitability.

2.8. Study Model

Figure 1 shows the hypothetical research plan, which depicts the nature of the relationship between the variables, the independent variable (time-driven activity-based costing system) and the dependent variable (customer profitability), which embodies the problem and importance of the study and the objectives it seeks to achieve, based on previous studies and the ideas they produced for a group of researchers and those interested in this field.

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Vol. 8, No. 6: 8347-8367, 2024
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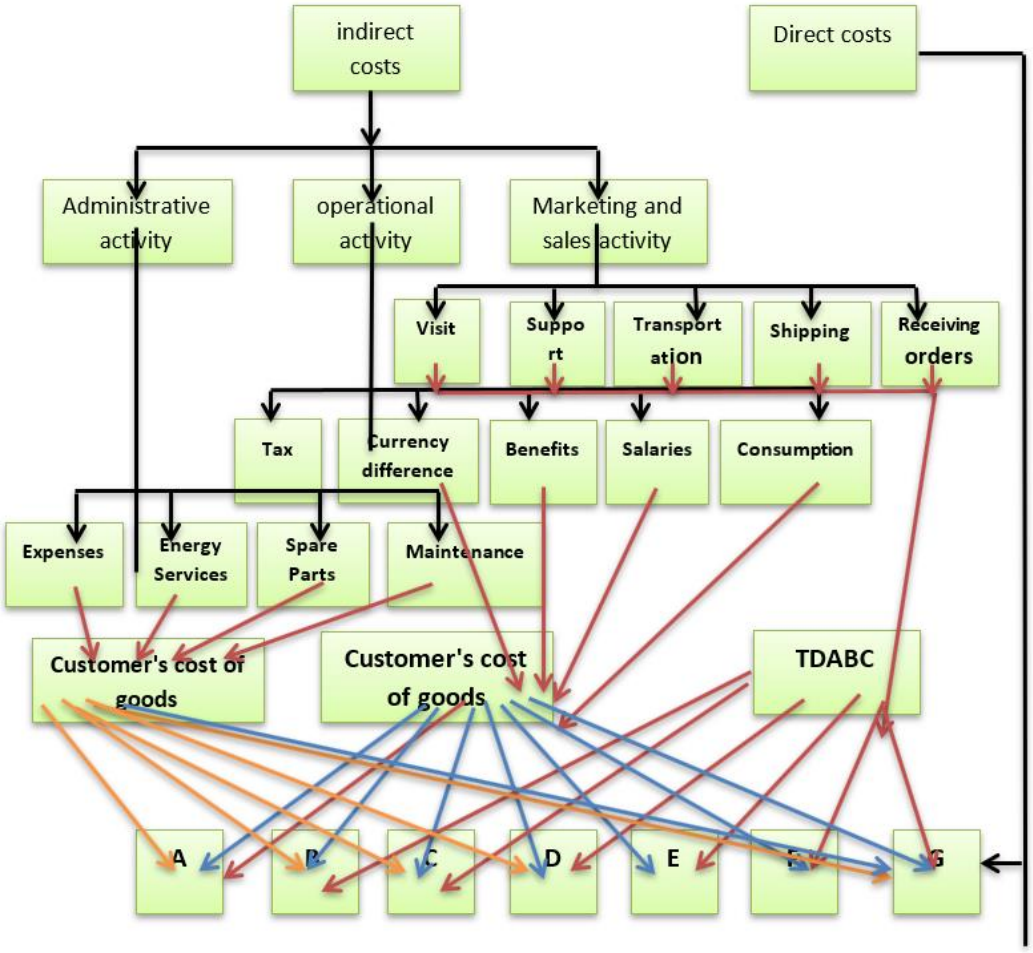

Figure 1.
The hypothetical research plan.

3. Cognitive Foundations

- Measuring customer profitability
- Customer Profitability Measurement Concept and Definition

The idea of tracking revenues and costs at the customer or sector level is not new, as customer profitability has actually been a topic of interest for half a century. During the seventies and early eighties, the advantages of measuring customer profitability were identified by(Dunne, et al, 1977: 75). There are many points of view that have addressed the definition of customer profitability by those interested and researchers, although they differed in points of view, they agreed in terms of content. Among these definitions.

Customer profitability is the profit a company makes from serving a customer or group of customers over a specific period of time, specifically the difference between the revenues earned and the costs associated with the relationship with the customer in a specific period. It provides insight into the total value of the customers it serves, and helps uncover important insights such as: (Devon,et al, 2023: 138).

- Which customer segments are the most (and least) profitable?
- Where to prioritize marketing and sales resources.
- Areas for improvement.
- Long-term trends in customer buying habits.

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- Ideal price points for products and services.

Customer profitability can also be defined as the sales revenue generated by a specific customer or group of customers for a product or service for the customer or group of customers, minus all costs incurred during a specific period of time (Kaplan ,2001:5,).

- **The importance of measuring customer profitability**

Customer satisfaction is directly related to measuring customer profitability, and management's success in achieving this strategic goal lies in achieving the necessary balance between customer satisfaction and maintaining and increasing this competitive advantage in the long term. Measuring customer profitability is vital to business success because the cost of acquisition allows identifying customers who make the economic unit money and who make the economic unit spend its resources without a significant return to the customer after measuring customer profitability for the sector that the economic unit believes generates the most profits for it. [Ashraf, 2015: 3] In light of the above, the results of measuring customer profitability can have three important and positive results (Feimster, 2022: 1).

1. Gives a clear picture of the best ways to allocate resources.
2. Reducing resources allocated to low-profit customers creates capacity for new customers.
3. Measuring customer profitability helps the economic unit distinguish between profitable customers and unprofitable customers.

- **Profitability measurement objectives**

The most important objectives that customer profitability measurement seeks to achieve can be identified as follows: (Muhammad, 2021: 78) Enabling economic units to determine the profitability of their customers by subtracting the cost from the revenues generated by each customer. In this way, economic units can determine the cost of acquiring and retaining them and develop strategies accordingly.

1. An important step towards enhancing dealing with the most profitable customers by providing services that economic units can maintain their customers.
2. Reviewing unprofitable customers will enable economic units to redirect resources and make appropriate decisions to avoid loss and gain a competitive advantage that will enable them to reduce the size of losses and increase their profits.
3. Measuring customer profitability also aims to determine the methods that help improve customer profitability and thus achieve the return that the economic unit aspires to achieve.

- **Accounting methods and treatment for measuring customer profitability**

There are three methods for measuring customer profitability that provide useful insights into measuring customer profitability, as follows:(Erik, 2003:373).

3.1. Calculate Customer Profitability at the Individual Level

Customer profitability is measured at the individual customer level in the form of numbers and figures that provide a clear picture of buyer behaviour in terms of services requested, purchasing behaviour, etc., and supplier behaviour (service delivery, purchasing behaviour, discounts, services, packaging, shipping the product to customer stores, etc.) and comparing its costs to the revenues and sales profit margins achieved by the unit.

3.2. Calculating Customer Profitability at the Aggregate Level (Customer Group):

At the aggregate level, customer profitability figures and figures provide a picture of the distribution and concentration of profits within a group of customers. There are two common methods for measuring customer profitability at the aggregate level: the customer profitability pyramid method, which shows a large group of customers with low revenues at the base of the pyramid and a small group of customers with very high revenues at the top of the pyramid (Zeitmal et al, 2001, 124-125), and the Stobachoff curve, which was presented by Storbeck in (1998). This curve defines two sets of data on its axes, the first on the horizontal axis and shows the most profitable customers to the least profitable

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ones, while the second set of data shows the accumulated profitability on the vertical axis. (Storbacka,2000:4).

3.3. Calculating Customer Profitability from A Strategic Perspective

Accounting thought and its contemporary trends focus on the importance of providing financial and non-financial information to support the process of building a correct strategy and implementing it accurately. This in turn depends on placing customer requirements and market needs within the company's strategic plan, while building its own information base. The philosophy of the economic unit's relationship with its customers is in fact the linking channel for value events activities. The economic unit achieves profits not through its customers, but through value events activities for customers. Management in the economic unit can also use the activity-based costing method to analyse different aspects of operational activities in the company, such as the possibility of measuring the profitability achieved for various customers or on the basis of products, production lines, or geographical areas. In this case, management can display a picture of the achieved profits. (Soder et al , 1999; 5).

4. Time-Driven Activity Based Costing

Time-driven activity-based costing gives small, medium, and large business owners alike a clear understanding of the actual cost of producing a product, delivering a service offering, and the individual tasks performed within their company. To do this, TDABC focuses on the relationship between time and cost to determine the costs of the products or services a company produces. Time-driven activity-based costing also shows the actual resources on the activity that these offerings consume. Using TDABC, business owners can calculate the cost of a single unit of time for an activity in the business, whatever that unit may be. A unit of time can be as small as one minute of conducting a credit check on a customer. However, for most service businesses and non-profits, this unit is typically defined as a customer or a job (David: 2019: 8).

- **The emergence of time-driven activity-based costing (TDABC)**

Time-Driven Activity-Based Costing (TDABC) is an innovative cost management methodology that enables organizations to better understand their financial performance by tracking customers or patients throughout a service, using process maps and recording time for each step. Compared to traditional activity-based costing (ABC) methods, TDABC calculates costs based on the time spent on each activity, generating a more accurate reflection of the cost of services provided (Erik ,2023:1).

Originally, TDABC was proposed as a solution for activity-based costing users in cases where the model has become too slow to update, and collecting cost driver information would be too expensive, especially if the purpose is to enable detailed costing, and transaction-based activities (Järvinen el at,2018: 33), and from a cost-benefit perspective, Kaplan and Andersson (2007) suggest that model building should start from what are seen as the most expensive services, and refrain from collecting information from sources other than existing IT systems, to achieve cost effectiveness, and consider it necessary to create a tool that can predict whether a TDABC model can be implemented at low cost and with reasonable accuracy (Pernot ,2007: 33).

- **Time Driven Activity Based Costing (TDABC) Concept**

(Henderson 2014) defined the (TDABC) system as a cost analysis method that examines the resources used in a specific process based on the time taken by the resources themselves. Therefore, it requires accurate knowledge of both the process and the resources used to accomplish it. (Shekush: 2020: 29) also defined it as a new system for allocating additional costs that is flexible and fast to meet any changes in the specifications of production processes. It also facilitates the preparation of interim reports. In addition, its operating and maintenance costs are low. It is a complementary method to the traditional cost method (ABC) by calculating unused energy and simplifying the allocation of costs. This process is based on the idea of the TDABC system by estimating the use of resources through time equations to determine the time required to perform each activity (Hoozée et al,2010: 85) and TDABC also assigns resource costs directly to cost components using only two parameters:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 8347-8367, 2024
DOI: 10.55214/25768484.v8i6.3801

1. The cost per unit of time to provide energy resources.
2. Estimating the time units required to implement a process, activity or service.

- **Importance of Time Driven Activity Based Costing (TDABC**)

Every company and organization has activities that can be identified, measured and thus improved to improve business performance. By using time-driven activity-based costing as a costing method, the way can be opened for variance analysis and capacity management to make activities more efficient and effective, thus impacting unit costs, cost prices and profits.

1. Revealing its effective role in increasing the competitive advantage of many economic units.
2. The importance of applying the time-driven activity-based costing system lies in its role in supporting competitive advantage by increasing product quality.
3. The contribution of the TDABC system to the process of cost control in economic units.
4. Making a fundamental difference in the process of cost control and the accuracy of measuring and allocating indirect costs between products.

- **Benefits and Challenges of Time-Driven Activity-Based Costing**

1) Benefits

a) Simplicity

Simplicity is the most important characteristic according to Kaplan and Anderson (2007), of the TDABC system and this was also confirmed by (Somapa et al ,2018: 308), and because of the use of two simple parameters, which are the cost per unit time of the activity, and the time required to perform the activity, and thanks to this simplicity, TDABC allows the accounting process to be approached by people who have no experience in accounting, business or finance.

b) Complex operations

TDABC allows the design of cost models for complex processes thanks to the use of multiple time drivers. This system captures the variability of activities by including all possible subtasks in the time equation. In contrast, time equations can include multiple time drivers without increasing the number of activities. By using multiple time drivers, TDABC also allows the classification of the costs of each transaction and thus the identification of costly, wasteful and inefficient processes (: Stouthuysen et al., 2013 : 83).

c) Energy exploitation

TDABC allows for a good estimate of resource consumption and energy use and reveals activities, resources and costs that are excluded in traditional accounting attempts. It also provides insight into the causes of excess time or costs occupied by resources. Managers can review the time and cost of unused or overused capacities and consider actions to improve them. They may also reserve resources for future growth rather than reducing currently unused capacities (Demeere et al., 2009 : 296).

2) Challenges

a) Measurement error

Cardinaels and Labro (2008) reported through an empirical analysis that employee estimates may not be as accurate as the authors claim, and a significant degree of subjectivity still exists. Although Kaplan and Anderson (2007) stated that time consumption data can be estimated or directly observed, it still requires a series of interviews with employees, and these interviews may negatively affect the work done by those responsible for implementing the TDABC approach. Cardinaels and Labro (2008) also found a strong overestimation bias when employees provide their time estimates in minutes. In fact, if the minute-based model is compared to the percentage-based model (ABC approach), the results are certainly more accurate. The reason for this is that few employees tend to report the percentage of their free time. However, the authors state that more than 77% of participants consistently overestimate the time they spend on all activities. Accuracy is debatable if employees report their time when it is not possible to directly observe it: (Jarvas et al., 2010.: 20).

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Vol. 8, No. 6: 8347-8367, 2024
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b) Data

A large amount of data is required to satisfactorily estimate time equations, which suggests that data collection for TDABC appears to be complex and must be carefully managed because the quality of the results depends on the quality of the available data as(Gervais et al,2010:3) (that TDABC requires careful and detailed analysis, which makes the start-up longer and more expensive, and they also emphasize the need for regular maintenance over time, in addition, TDABC relies on robust and reliable data to provide an acceptable level of accuracy, if the data comes from automated programs and is updated regularly, the results are likely to be accurate, however, if the information is outdate, or if it is based on estimates, the resulting cost information may contain significant errors,

5. Cost Management

- **Cost management concept**

Cost management is the process of planning and controlling a company's budget. In other words, cost management is the process of planning and controlling costs associated with running a business. It involves collecting, analysing, and reporting cost information in order to budget, forecast, and control costs more effectively. Cost management practices can be applied to specific projects or to a company's overall operating model. Cost management typically focuses on generating savings and maximizing profits over the long term. Having a good cost management system makes it easier for an organization to estimate and allocate its budget. It is also a form of management accounting that helps a company reduce the chance of budget overruns through more accurate forecasting of impending expenses. Many companies use cost management techniques for specific projects and for the business in general. (Lutkevich, 2023 : 2).

- **Benefits of Cost Management**

The benefits of cost management include: (Sandeep, 2021:15)

a. **Reduce overspending:** Cost controls help business managers keep their budget on track and not let costs get out of control.
b. **Encourages planning:** Cost management helps determine what works and what doesn't, and provides insight into resources and processes that helps managers make faster and better decisions about the current project and future projects.
c. **Facilitates financial health**: Continuous monitoring, cost control and cost reporting contribute to the long-term financial health of the company. These efforts provide the data needed to make good decisions. Implementing a cost management structure helps the company's projects keep their overall budget under control.
d. **Mitigate risk:** Cost management typically involves setting a risk allowance for unexpected costs, a useful step to prevent overspending.
e. **Supports standards**: Consistent cost monitoring, analysis and reporting helps organizations adopt standards to evaluate future cost data and productivity levels.
f. **Improved visibility:** Many service cost management tools provide real-time visibility into cost management metrics, such as savings.

- **The importance of cost management**

The sustainable growth of any business is closely linked to good cost management practices that are able to provide managers with all relevant information about the business, and thus all the necessary financial support is available to make the right strategic decisions, so cost management requires special attention. Ultimately, comprehensive monitoring of all company expenses is essential for effective financial planning, including controlling cash flow and identifying resources available for new investments. Although cost management is critical to the sustainable growth of the company, many managers still neglect it, especially because they do not fully realize its benefits. Therefore, it is necessary to realize the importance of cost management and how to do it efficiently (Lutkevich, 2023: 23).

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Advantages of cost management Cost management is indeed one of the basic requirements for the success of any project or any business in this regard, and there are a number of advantages that can be achieved if cost management is efficient and effective. The most important of these advantages are the following: (Edupristine, 2015: 5)

- **Advantages of cost management**

Cost management is indeed one of the basic requirements for the success of any project or any business in this regard, and there are a number of advantages that can be achieved if cost management is efficient and effective. The most important of these advantages are the following: (EduPristine, 2015: 5)

1. Cost management helps in controlling the overall business cost.
2. Future expenses and costs can be predicted and thus work towards achieving the expected revenues.
3. Pre-determined costs can be kept as business records.
4. Cost management helps in taking those necessary actions to ensure that business resources and processes are aimed at achieving the specified goals and objectives.
5. Helps in analysing long-term business trends.

6. The Practical Side

- **Description of the study sample**
- **Historical overview of Al-Narjis Contracting and General Trading Company:**

Al-Narjis Company is one of the Iraqi private sector companies that was established after 2003 in Basra Governorate. It is a newly established company that includes a group of engineering, technical, administrative and service staff practicing contracting and general trade and providing products with specifications characterized by high quality through its use of modern technologies. The incorporation contract was issued in accordance with Companies Law No. (21) of 1997 (amended), and it was registered with the Registrar of Companies under the name (Al-Narjis Contracting and General Trade and Design and Project Management Limited Liability) with multiple activities with incorporation certificate number (1709) dated 5/11/2005 with a capital of (15,000,000,000) fifteen billion Iraqi dinars. Thus, it had a prominent role in the field of construction and manufacturing, as it was distinguished by its efficiency and excellence compared to competing companies, which contributed to increasing its capital to (25,000,000,000) Twenty-five billion Iraqi dinars, in addition to owning machinery, equipment, infrastructure, logistics, and production plants for various products that have contributed significantly to saving time instead of importing high-quality construction and electrical materials in Al-Nargis Pipe Production Company Limited Liability and other factories and companies that fall under the parent company, Al-Nargis Contracting and General Trading Company.

6.1. Selecting and Identifying Customers:-

In order to carry out the application process, we had data from the company's records represented by the sales, marketing and accounting departments and for each customer. This sample was selected based on the relative importance of the achieved sales volume. This data was specific to the year 2023 and according to the following Table 1.

Table 1.
Company customer name and code for 2023 for polyethylene pipes.

	Customer name	Company customer code	Study customer code
1	Golden Corner Company	CUST 8	A
2	Anwar Al-Ibtisama Company	CUST 20	B
3	Promise Mohsen Hamel	CUST 18	C
4	Sky Water International Company	CUST 5	D
5	Hussein Mohammed	CUST 3	E
6	Hiba Al Basra Company	CUST 40	F

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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6.2. Calculating The Customer Cost According to the Time-Driven Activity-Based Costing System:

6.2.1. Applying the time-driven activity-based costing (TDABC) technique in determining customer profitability:

Using this technique provides the possibility of direct monitoring of activities to determine the activities that constitute the production stages one by one and creating time equations based on each product. In the company in which the case study was conducted, data was obtained through interviews conducted with business managers and employees and through monitoring production processes.

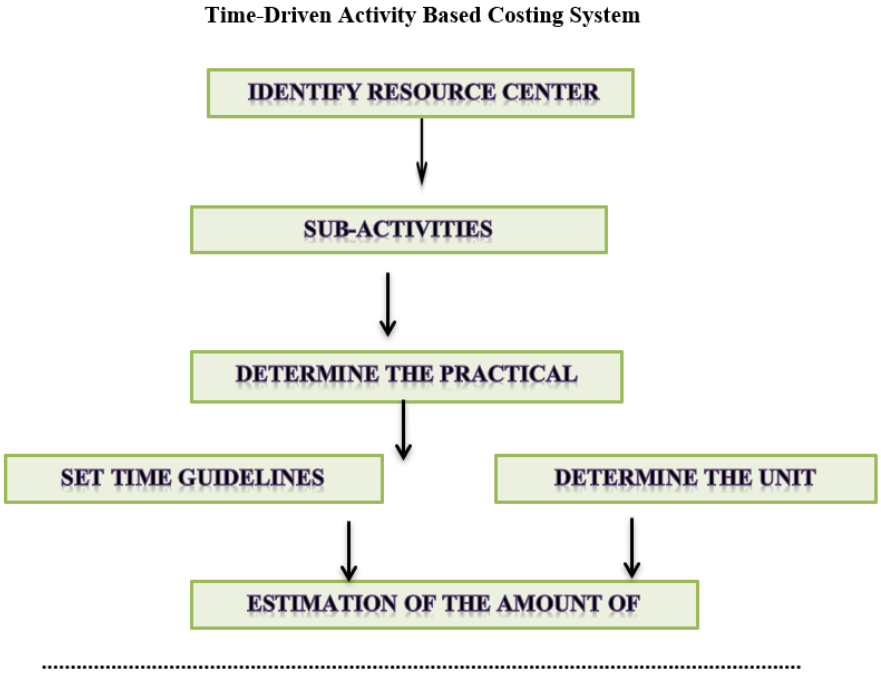

Figure 2.
TDABC systems application Model F.

To implement this model for calculating the costs of time-driven activities, it was necessary to conduct interviews and survey employees to allocate resources to activities, before allocating them to cost elements (orders, products, customers) (Kaplan and Anderson, 2007: 266). This approach is implemented gradually and according to the following steps: (el, Ashwin et al : 2018:5)

- Identify the different main activities (resource groups, departments).
- Estimate the total cost of each activity.
- Estimate the working capacity of each resource group.
- Calculate the unit cost of each activity.
- Determine the time required each time the activity is implemented.
- Determine the unit cost of each activity

6.2.1.1. Step One: Identify the Different Main Activities (Resource Groups, Departments).

The researcher made many field visits to the company in order to obtain the necessary data and information from the company's records, in addition to conducting unstructured interviews with officials within the company, as well as following up on the activities and operations of the sales and marketing department and the production department related to marketing, administrative and operational activities in order to reach a clear and detailed vision of the activities and thus find the relationship in determining the company's The following activities were selected from a group of activities to illustrate

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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the mechanism for distributing costs to customers according to the time-driven activity-based costing system:

6.2.1.2. The Second Step: - Estimating the Total Cost of Each Activity

1- **Marketing and sales activity:**

This activity includes a group of sub-activities specific to the company, and we will discuss the details of the sub-activities as follows:

A- Receiving purchase orders from the customer:

This activity includes the cost of receiving purchase orders and all related activities, starting from preparing the customer's purchase list, preparing the order, and all other accounting work, as the cost guidelines for this activity depend on the size of customer orders, and the cost of this activity amounted to (27,039,750) dinars, as the number of company customer orders amounted to (648) orders.

B- Shipping and preparing orders:

This activity includes preparing the goods for each customer starting after receiving purchase orders from the sales department, as this activity includes sorting, packaging, preparing the goods, and transporting the goods from the warehouses to the cars designated for transporting the goods to the customer. The cost of this activity amounted to (38,558,250) dinars, and the cost guides for this activity are the number of customer orders (648) orders.

C- Transporting goods :

This activity includes the cost of loading and unloading the required products according to the size and quality of the product and transporting them to the customer's site in order to implement the order required by the company towards the customer according to the specified date, and the distance traveled and the size of the orders have a direct impact on the cost. The cost of this activity amounted to (116,545,500) dinars, and the cost guides for this activity are the number of purchase orders (648) orders.

d- Technical and marketing support :

According to this activity, the company carries out a set of activities to develop and improve the relationship with customers, such as meeting and presenting gifts, receiving and providing the facilities that customers may need before and after the sale process, as well as collecting debts owed by customers. It also includes marketing costs through advertising and publicizing the company's products. The cost of this activity amounted to (27,819,000) dinars, where the cost guidelines for this activity are the number of customer requests (648) requests.

e- Visiting the company's representative to customers :

This activity includes the company contracting with some representatives to visit customers and promote the goods and inform customers about the types and sizes of products and the quality and warranty of the product. This activity aims to achieve customer satisfaction and then maximize customer profitability and the value of the company. The cost of this activity amounted to (45,016,500) dinars, and the cost guidelines for this activity are the number of visits by representatives to customers, and the total number of visits made by representatives during the year is (50) visits.

Table 2 shows the distribution of costs specific to each of the main activities and the cost guides for those activities.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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Table 2.
Distribution of costs for each of the basic activities and the directions of those activities.

	Main activities	Sub-activities	Costs (in dinars)
1	Marketing and sales activity	Receiving purchase orders from customers	27,039,750
		Shipping and preparing orders	38,558,250
		Transporting goods	116,545,500
		Technical and marketing support	27,819,000
		Visiting the company representative to customers	45,016,500
Total			254,979,000

6.2.1.3. Step Three: Estimating the Practical Energy for Each Resource Group: -

In this step, the practical energy is calculated for the available working hours of employees in the departments, which are directly affected by the sub-activities within those departments, and the practical energy is extracted as follows: -

- Regarding the theoretical energy, after interviews with officials and supervisors and reviewing the workflow during the day within the company, it was found that the theoretical energy for each department of the company is calculated on the basis of the daily working time, which is (12) hours per day, in addition to the working days during the month, which are (26) days.
- As for the practical energy, after calculating the rest periods, as well as the employee training periods, holidays and meeting days, the percentage reaches 20% of the working hours, and from this it is clear that the available practical energy is 80% of the theoretical energy according to what was mentioned by Kaplan and Anderson, followed by the operations below explaining the calculation method.
- **Calculating the practical and unused energy:**
- Theoretical energy (for workers) = Number of workers * (number of monthly working days * 12 hours / day) * 60 minutes * 12 months.
- Practical energy (utilized) = Available energy * 80%.
- **Marketing and sales activity:**
- **Receiving purchase orders from customers**:
- Theoretical energy = 4 * (26 * 12) 60 * 12 = 898560
- Utilized energy = 898560 * 80% = 718848 minutes (annually).

Table 3 shows the remaining practical energy for each activity, where the practical and unused energy is calculated as follows:

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Table 3.
The practical energy available for each activity.

	Main activities	Sub-activities	Number of days (1)	Number of workers (2)	Theoretical energy (3)=(1)*(2)*12 hours*60 minutes*12 months (annually)	Working energy (4) 80% =(3)*80% (annually)
1	Marketing and sales	Receiving purchase orders from customers	4	26	898560	718848
		Shipping and preparing orders	8	26	1797120	1437696
		Transporting goods	8	26	1797120	1437696
		Technical and marketing support	3	26	673920	539136
		Visiting the company representative to customers Visiting the company representative to customers	2	26	449280	368410
Total (minutes)						4501786

6.2.1.4. Step Four: Calculating the Unit Cost for Each Activity

In this step, the single time cost for each activity is calculated by dividing the total activity costs shown in the second step by the annual operational capacity used shown in the third step. The following equation explains the calculation method:

$$\text{Energy cost rate} = \frac{\text{Total activity costs}}{\text{Practical energy of resources (min)}}$$

Table 4 shows the details of the method of calculating the rate for activities.

Table 4.
Average energy cost.

	Main activities	Sub-activities	Activity costs (1)	Practical energy (2)	Unit cost of energy (3) = (1)/(2)
1	Marketing and sales	Receiving purchase orders from customers	27,039,750	718848	38
		Shipping and preparing orders	38,558,250	1437696	27
		Transporting goods	116,545,500	1437696	81
		Technical and marketing support	27,819,000	539136	52
		Company representative visit to customers	45,016,500	368410	122

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6.2.1.5. Fifth Step: - Determine the Time Required Each Time the Activity is Implemented and Determine the Time Directors

In this step, the time required to perform each activity is calculated according to the time directors causing those activities (main and sub-activities) and based on the time information obtained in the third step and the time directors that were reached from the company's records with the unstructured interview with the concerned employees and following up on the workflow during the day, as Table 5 shows the amounts of time directors taken for each activity.

Table 5.
The amounts of time directors and the time consumed for each activity.

	Main activities	**Sub-activities**	**Time manager**	**Quantity (1)**	**Actual time per activity per year (operating energy/minute) (2)**	**Actual time consumed per unit (minute) (3)=(2)/(1)**
1	Marketing and sales activity	Receiving purchase orders from customers	Number of purchase requests	648	718848	1109
		Shipping and preparing orders	Number of purchase requests	648	1437696	2219
		Transporting goods	Number of purchase requests	648	1437696	2219
		Technical and marketing support	Number of purchase requests	648	539136	832
		Visiting the company representative to customers	Number of purchase requests	648	368410	569
		Other operating expenses				

- After determining the activities and their directions, these activities must be applied to the factory's customers in order to know the extent of the company's resource consumption for each customer, as we determine the quantities of time directions that each customer consumed. Information about the quantities that each customer consumed was obtained through the company's records, as shown in the table below.

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Table 6.
Time guide quantities for each customer.

	Main activities	**Sub- activities** / **Customer code**	**Quantities and time trends specific to each customer**					
			A	**B**	**C**	**D**	**E**	**F**
1	Marketing and sales activity	Receiving purchase orders from customers	10	20	15	8	14	15
2		Shipping and preparing orders	10	20	15	8	14	15
3		Transporting goods	10	20	15	8	14	15
4		Technical and marketing support	10	20	15	8	14	15
5		Company representative visit to customers	3	2	1	1	2	3

The table above shows the share of each customer in the activities measured by the (TDABC) technique, while the rest of the activities are extracted based on the cost of goods sold.

6.2.1.6. Step Six: - Determine the Unit Cost for Each Activity

In this step, the cost of one unit for each activity is calculated according to the actual time extracted by the (TDABC) technique for each customer, where we allocate the unit cost for each activity by dividing the total costs of the activity by the cost vector (quantity) according to the following mathematical formula:

$$\text{Allocate unit cost to each activity} = \frac{\text{Total cost of activity}}{\text{Time (quantity) directors}}$$

Table 7 shows the remaining details of allocating the unit cost for each activity.

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Table 7.
Allocation of unit cost to each activity.

	Main activities	Sub-activities	Quantity (1)	Time required for each activity (2)	Average cost of the activity (3)	Total cost of the activity (4)	Allocate unit cost for each activity (dinar) = (4)/(1)
1	Marketing and sales activity	Receiving purchase orders from customers	648	718848	38	27,039,750	41,728
		Shipping and preparing orders	648	1437696	27	38,558,250	59,503
		Transporting goods	648	1437696	81	116,545,500	179,854
		Technical and marketing support	648	539136	52	27,819,000	42,930
		Company representative visit to customers	648	368410	122	45,016,500	69,470

6.2.2. Allocating and Distributing Indirect Costs (Marketing and Sales,) to Each Customer:

- In this step, indirect costs are allocated to customers who consumed and benefited from the company's resources. This is done by relying on the activities (receiving purchase orders from customers, shipping and preparing orders, transporting goods, technical and marketing support, company representative's visit to customers, maintenance and repair of transport wheels, purchasing spare parts) whose cost has been allocated on the basis of time-driven activities (TDABC) according to Tables (7) and (8).
- To extract each customer's share of the indirect costs of the activities (receiving purchase orders from customers, shipping and preparing orders, transporting goods, technical and marketing support, company representative's visit to customers, maintenance and repair of transport wheels, purchasing spare parts), it is done according to the following mathematical formula:

  Activity cost = Amount of time spent per customer * Activity unit cos
- The quantity of cost waves is obtained from Table (6) and the cost of the activity unit from Table 7

Table 8 shows the remaining distribution of activity costs among customers.

Table 8.
Distribution of activity costs Receiving purchase orders from customers

	Customer code	Quantity (1)	Activity unit cost (2)	Activity cost = (1) * (2)
1	A	10	41,728	417,280
2	B	20	41,728	834,560
3	C	15	41,728	625,920
4	D	8	41,728	333,824
5	E	14	41,728	584,192
6	F	15	41,728	625,920

6.2.3. Shipping and Preparing Orders

Table 9 shows the allocation of costs to the remaining customers.

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Table 9.
Distribution of costs of order preparation and shipping activity.

	Customer code	Quantity (1)	Activity unit cost (2)	Activity cost = (1) * (2)
1	A	10	59,503	595,030
2	B	20	59,503	1,190,060
3	C	15	59,503	892,545
4	D	8	59,503	476,024
5	E	14	59,503	833,042
6	F	15	59,503	892,545

- **Transport of goods:**

Table 10 shows the allocation of costs to the remaining customers.

Table 10.
Distribution of costs of goods transportation activity.

	Customer code	Quantity (1)	Activity unit cost (2)	Activity cost = (1) * (2)
1	A	10	179,854	1,798,540
2	B	20	179,854	3,597,080
3	C	15	179,854	2,697,810
4	D	8	179,854	1,438,832
5	E	14	179,854	2,517,956
6	F	15	179,854	2,697,810

- **Technical and marketing support:**

Table (11) shows the allocation of costs to the remaining customers.

Table 11.
Distribution of costs of technical and marketing support activities.

	Customer code	Quantity (1)	Activity unit cost (2)	Activity cost = (1) * (2)
1	A	10	42,930	429,300
2	B	20	42,930	858,600
3	C	15	42,930	643,950
4	D	8	42,930	343,440
5	E	14	42,930	601,020
6	F	15	42,930	643,950

- **The company representative visits the customers:**

Table 12 shows the allocation of costs to the remaining customers.

Table 12.
Distribution of costs of the company representative's visit to customers.

	Customer code	Quantity (1)	Activity unit cost (2)	Activity cost = (1) * (2)
1	A	3	69,470	208,410
2	B	2	69,470	138,940
3	C	1	69,470	69,470
4	D	1	69,470	69,470
5	E	2	69,470	138,940
6	F	3	69,470	208,410

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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DOI: 10.55214/25768484.v8i6.3801

- In the next step, we extract the total indirect costs for each customer by relying on tables (7), (8), (9), (10), (11),
- **Total indirect costs for customer A**
- Total indirect costs = Receiving purchase orders from customers + Shipping and preparing orders + Transporting goods + Technical and marketing support + Visit of the company representative to customers + Total indirect costs = 417,280 + 595,030 + 1,798,540 + 429,300 + 694,700 + = 3934850dinars.

Table 13 below shows the allocation of indirect costs to each customer.

Table 13.
Detailed and total customer costs in 2023.

	Sub-activities / Customer code	A	B	C	D	E	F
1	Receiving purchase orders	417,280	834,560	625,920	333,824	584,192	625,920
2	Shipping and preparing orders	595,030	1,190,060	892,545	476,024	833,042	892,545
3	Transporting goods	1,798,540	3,597,080	2,697,810	1,438,832	2,517,956	2,697,810
4	Technical and marketing support	429,300	858,600	643,950	343,440	601,020	643,950
5	Visiting the company representative to customers	208,410	138,940	69,470	69,470	138,940	208,410
Total indirect costs per customer		3,448,560	6,619,240	4,929,695	2,661,590	4,675,150	5,068,635

6.2.4. Determining the Operating Profit for Each Customer:-

In this step, the net operating profit for each customer is determined through the data extracted in the previous tables in the second section regarding the customer's net revenue and the cost of goods sold. Table (21) shows the distribution of indirect costs according to the (TDABC) technique. The following mathematical formula shows the extraction of the net operating profit for each customer.

Operating profit per customer (customer profitability)= Gross Profit (Net Revenue - Cost of Goods Sold) - Indirect costs.

- Customer profitability A = 459,264,884-348,697,734 -3,448,560 = 107,118,590 dinars.

Table 14 shows the remaining results of net profit per customer.

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Table 14.
Operating profit per customer during the year 2023 according to the time-driven activity-based costing technique.

The details	A	B	C	D	E	F	Total
Net sales revenue	459,264,884	1,301,165,794	777,747,426	690,140,308	30,363,614	54,692,696	3,313,374,722
(Cost of goods sold)	348,697,734	1,036,177,590	508,791,003	471,663,420	28,041,775	52,063,240	(2,445,434,762)
Gross profit per customer	152,317,328	384,037,764	268,956,423	218,476,888	2,321,839	2,629,456	1,028,739,698
Total indirect costs	3,448,560	6,619,240	4,929,695	2,661,590	4,675,150	5,068,635	(27,402,870)
Net operating profit per customer	107,118,590	258,368,964	195,461,839	215,815,298	-2,353,311	-2,439,179	1,001,336,828
Customer operating profit to customer operating profit ratio	15%	38%	26%	22%	-0.24%	-0.24%	100%

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 8347-8367, 2024
DOI: 10.55214/25768484.v8i6.3801

7. Conclusion

Based on the information obtained through the operating profit table, which describes the profitability of each customer, it has become possible to classify customers into two types:

7.1. Profitable Customers

Through the information in Table (14) for measuring the net operating profit for each customer, it is clear that there are a number of profitable customers, but there is a noticeable difference in their profitability ratio, namely (A,B,C,D), as these customers achieve the highest profitability for the company with a profit of (1,006,129,318) dinars, so these customers cover the loss of the rest of the customers, namely customer (K, M), which amounts to (-4792490) dinars, so the company must build the best relationship with the welcoming customers, especially customer (B), because he achieves the highest profitability compared to the rest of the customers, as there is a noticeable difference from the rest of the profitable customers.

- The reason for the difference in customer profitability is due to the following reasons:
  a. The volume of sales purchased by the customer
  b. The costs allocated to each customer

Through these reasons, the company must pay attention to profitable customers and build a strong relationship with them through customer relationship management. In addition, the company must also study the rest of the profitable customers and improve their profitability by reviewing the above reasons. The reason for the difference in customer costs is due to the difference in quantities and ratios of time and cost drivers. For example, there are some customers whose required product size does not match the cost price, preparation, transportation and shipping.

7.2. Unprofitable Customers

Through the information reached in Table (14) about the operating profit for each customer, we find that there are unprofitable customers (K, M) with a loss of(-4792490) dinars, so the company must take the appropriate action for unprofitable customers.

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Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 8347-8367, 2024
DOI: 10.55214/25768484.v8i6.3801