# Implementing Second Generation of costing system and its Impact on Costs Behavior Rationalization/ an Applied Study on the General Firm for the Pharmaceutical Industry and Medical Supplies/ Samarra

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**Abstract**

This research aims to verify the possibility of applying the driven-time activity-based cost system as a second generation and one of the modern management accounting methods as an input to determine the unused capacity and rationalize the cost behavior of the economic unity by testing this possibility if it is applied in the local environment. In this paper, the researchers used the practical approach to achieve the objectives of the study and test its hypotheses through the use of implementing a time-driven activity-based costing as a second-generation costing system on costs data in the General Firm for the Pharmaceutical Industry and Medical Supplies/Samarra's to separate unused capacity from the theoretical capacity as a applied aspect of the study. The research came out with many results, the most important of which is the time-driven activity-based costing system (TDABC), which separates the theoretical capacity, practical ability, and actual capacity in the research sample on the one hand, and on the other hand, the unused capacity costs come from the difference between theoretical capacity costs and actual capacity costs.

**Keywords**: Second generation (TDABC), unused capacity, and cost behavior.

## 1: The general framework of the study:

**1-1: Introduction:** Economic units in the modern industrial environment face a set of challenges as a result of intense competitive pressures and the need of decision-makers at all administrative levels for appropriate, acceptable, and timely information to reduce costs. Therefore, the presence of unused capacity in the firm is categorically unacceptable, as firms need appropriate information. This information requires accurate measurement of the cost of unused capacity, which is the difference between the cost of available capacity (theoretical) and the cost of actual capacity (used) (Sebestyén, 1999). Since measuring the cost of unused capacity requires modern cost systems that allocate indirect costs (overheads) that consist of variable costs and fixed costs called cost behavior, which aims how to rationalize them, as it is not possible, according to the traditional method, to accurately estimate the costs behavior on products, therefore Activity-Based Costing (ABC) as the first generation was established in the United States throughout the 1980s and identified by Robert. S. Kaplan and W.Burns in 1987. The ABC method's goal is to assign costs to products based on the activities that go into them and the resources that those activities require. Although the method has proven significant costing granularity gains over standard volume-based overhead cost allocation, it has yet to gain widespread acceptance due to its complexity and cost variances induced by subjective underlying estimations. Because of the criticism that the ABC model received when it was published, Kaplan and Andersson improved it, resulting in a much simpler method called Time-Driven Activity-Based Costing as a second-generation costing system (TDABC), which will be utilized as the basis for this research. TDABC is a method for determining the amount of labor and machine time used in various transactions, items, and consumers. This is achieved in one step by reducing its costs to cost objects based on the number of resources consumed. Although consumption is measured in absolute units of time, there are times when alternative units of measurement, such as length, area, and weight, (to simplify the process of allocating costs using time as a cost driver by dividing the theoretical capacity costs over a while by the processing capacity used in the companies and can be easily updated is more appropriate (Siguenza et al. 2013)). To increase competitiveness, attract customers, and maximize profit, industrial firms should rationalize overhead costs by separating unused capacity costs from theoretical capacity costs and exploited in another field. (Rude & Balicevac, 2019:8)

The purpose of this research is to describe the approach used to identify and treat the problem to achieve the study's objectives. By determining the research problem, its importance, the research goals, hypotheses, and limits, as well as the model. Based on the aforementioned, the study approach can be summarized as follows:

**Research Problem:** In light of the challenges that economic units face as a result of changes in the global environment in general and the manufacturing environment in particular, it has become necessary for industrial economic units to keep up with these changes by focusing on actual capacity rather than the theoretical capacity to reach unused capacity to rationalize cost behavior, and here it can formulating the study problem with the following main question; (could the time-driven activity-based costing system be implemented to measure unused capacity in rationalizing the cost behavior in research sample?).

**Research Importance:** The significance of the research stems from the importance and novelty of using a costing system based on time-driven activity-based costing, as well as its impact on rationalizing the cost behavior of the economic unit, especially in manufacturing firms through the system's ability to allocate costs fairly and simply, allowing the economic unit to achieve the benefits of product quality and cost reduction.

**Research Objective:** This research aims to achieve the main objective, which is to verify the possibility of implementing the costing system based on time-driven activity-based costing as one of the modern managerial accounting methods as an input to assess the unused capacity and rationalize the costs behavior of economic unit with testing this possibility if applied in the local environment. This aim is divided into several sub-objectives, which are:

1. Introducing a costing system based on the time-driven activity-based costing, its importance, as well as benefits, characteristics, what distinguishes it from traditional costs system, and the steps for its implementation?
2. Definition of unused capacity, its types, and causes.
3. Determining cost behavior and its relationship to the cost system based on time-driven activity-based costing.
4. The application of a time-driven activity-based costing system to rationalize the behavior of costs in the local industrial firm (research sample).

**Research Hypothesis**: The research is based on a fundamental hypothesis, which is represented as (the application of the cost system based on time-driven activity-based costing can contribute to the process of evaluating unused capacity to rationalize cost behavior in the industrial economic units of the research sample).

**Research Methodology**: To complete this research, the researcher uses the scientific method, which consists of a set of methods, to attain the research's aims and hypotheses, which are:

1. The inductive approach is to determine the study problem and test hypotheses.
2. The deductive method is to determine the study axes and hypotheses development.
3. The historical approach is to review previous studies, review books, scientific references, and periodicals related to the research subject.

4. The practical approach uses the costs data of the General Firm for the Pharmaceutical Industry and Medical Supplies/ Samarra.

**Research limits:** To achieve its goals and verify its hypothesis, the researcher used the year 2018 costs data for General Firms in the Pharmaceutical Industry and Medical Supplies/ Samarra.

**Conceptual Framework of the research:** The independent variable is represented by a Time-Driven activity-based costing system and the dependent variable represents the rationalization of cost behavior.

The research was separated into four sections to achieve the research's overarching goal, which is as follows: The first section covered the research's methodological structure as well as portions of the literature review. The research's theoretical framework was offered in the second section, but the third section is focused on the practical aspect, with (TDABC) being applied to costs data from a study sample to rationalize cost behavior. The final section focuses on the researcher's most important theoretical and practical results and recommendations.

**1-2: Previous research and what it distinguishes from the current research:** According to Zaini & Abu (2019), thire study aims to look into the research gaps of Time-Driven Activity-Based Costing in journals that can be used as a reference for using the system in palm oil plantations. As well as, Time-Driven Activity-Based Costing is a new approach that can be used in a variety of situations to improve the process at each workstation and to ensure that the time spent on each activity or sub-activity of a product is more accurate. Because unused production capacity is counted in this way, it can also help firms enhance profitability. While Gervais et al. (2010) thire research demonstrate the importance of TDABC using standard or actual costs, as well as the measurement of time, which is the method's foundation. Despite their relevance for achieving dependable costs, homogeneity and sustaining it through time have received little attention. Calculating the cost of capacity is nothing new, and the TDABC variance is simply a difference in business volumes. The quality of data processing programs is still a critical aspect in reducing the method's complexity. When it comes down to it, TDABC's true function may be to track labor hours. But Al-Halab & Al-Mnadheh (2017) Their study looked at how using the TDABC (time-driven activity-based cost model) improved performance efficiency in Jordanian industrial firms. TDABC can take advantage of technical improvements based on activity graphs and reflect on pricing decision-making processes in industrial organizations, according to the study, and it is suggested for use in companies whose operations rely on TDABC components that have been demonstrated. The impact on product cost reduction and corporate profitability. Putteman (2009) the goal of this study is to figure out how and when using time-driven activity-based costing information affects the four organizational characteristics of innovativeness, market orientation, organizational learning, and entrepreneurship. These are regarded to be a company's primary capabilities for gaining and maintaining a competitive advantage. In addition, according to Abad (2016), The purpose of this study is to investigate the roles of time-driven activity-based costing (TDABC) in industrial unit cost control. In this regard, it has been attempted to examine activity-based costing from the start, as well as its effects on various components of a unit. The TDABC method is primarily based on the use of time, and unlike activity-based costing (ABC), it does not detect activities at the outset and does not allocate related costs to activities; rather, the required resources are predicted directly for each cost subject based on the required estimated time and cost per time unit. Ganorkar et al. (2018) suggested a Time-Driven Activity-Based Costing (TDABC) approach evaluate the cost of welding for SSI in their study. TDABC calculates the time required for activity using time equations. Because there are so many variables, developing a temporal equation is difficult. As a result, the Maynard Operation Sequence Technique (MOST) is used to establish a new method for developing the time equation. The case study illustrates the model's use. The cost analysis aids in identifying low-cost welding opportunities. Finally, in the study by Merica & Gersilb (2018) that Budget and cost estimates are highlighted, which can be used by small and medium producers (SMEs) that are developing longer-lasting items in today's extremely competitive market. This study focuses on the current approaches to allocating manufacturing overheads utilizing the time-driven activity-based costing (TDABC) method while dealing with the fact that budget and cost accounts are insufficient, notably manufacturing overhead costs. The idle capacity was determined as a consequence of the application study, and the findings of the studies' improvements were acquired.

Following the presentation of some previous studies belonging to the topic of the research, the researchers found out that there is a poor relationship between the previous studies and the title of the research. Previous research focused on the role of (TDABC) in determining unused capacity to reduce production and services costs, while others how effecting (TDABC) on the set price of production for maximization profit and through it for improving performance evaluation. The remaining studies concentrated on using (TDABC) to evaluate the costs of industrial activities through a modern technique. However, the current study is an extension of previous research on implementing a second generation for costing system (TDABC) to rationalize cost behavior that represents variable and fixed costs in manufacturing companies. This research is noteworthy. The current study aimed to rationalize each fixed and variable cost through separate unused capacity from theoretical resources to reduce the price of products and services to achieve the company's goals (which is the strategy of expanding the market base, maintaining existing customers, acquiring new customers and maximizing profitability. To the best of our knowledge, this is the first study at the Iraqi and Kurdistan Region levels.

## 2: Theoretical side of the research:

**2-1: Concept and importance of the second generation (TDABC):** Time-Driven Activity-Based Costing (TDABC) was put forward by Kaplan and Anderson, and was the first introduced at Harvard Business Schoo in 2004 to improve Activity-Based Costing (ABC) (Choudhery et al. 2020). TDABC was designed to be simpler and more powerful than ABC, using better modeling of processes thanks to time equations (Sharan & Schroeder, 2016). TDABC streamlines the costing process by removing the need for employees to be interviewed and surveyed to allocate resource costs to activities before driving them down to cost objects (orders, products, and customers). The new model uses an intuitive framework to directly assign resource costs to cost objects, requiring only two sets of estimates, neither of which are difficult to come by. The cost of supplying resource capacity is first calculated. Second, TDABC applies the capacity cost rate to departmental resource costs by calculating the demand for resource capacity (usually time, thus the name of the new technique) that each cost object necessitates. (Kaplan & Andrrson, 2007). In addition, (TDABC) is a simpler, less costly, and more accurate alternative to conventional ABC because it only requires two parameters: (Yonpae et al. 2019) 1) the cost per hour (or minute) to supply the practical capacity of the resources, and 2) the number of hours (or minutes) to perform the activities related to the cost objects. To put it another way, each cost object's capacity cost rate and time duration must be determined. TDABC is defined as a system that can be quickly adapted to fluctuating conditions and provides more detailed information to decision-makers to obtain administrative and financial results. In addition, the time-oriented activity-based costing system can be considered a tool for developing and improving performance in enterprises (Tarzibashi & Hasan, 2019). The following are the six steps to creating a TDABB model that has been identified: (Ozyürek & Ulutürk, 2016) (1) The TDABC model must be built using the most recent data, (2) It is necessary to calculate the profitability of products, services, and customers, (3) For the company's future development, administrative decisions must be made, (4) It is necessary to calculate the company's production and sales forecasts for the coming periods, (5) It is necessary to determine the need for resource capacity to satisfy the needs of the future forecast period and (6) It should consist of the costs necessary to determine how to provide resources capacity in the future.

For calculating TDABC, there are six steps to reach it, as follows: (Santana et al. 2014)

(1) Identify the various resource groups (departments) (2) Estimate the total cost of each resource group, (3) Estimate the practical capacity of each resource group (e.g available working hours, excluding vacation, meeting, and training hours), (4) Calculate the unit cost of each resource group by dividing the total cost of the resource group by the practical capacity, (5) Determine the time estimation for each event, based upon the time equation for the activity and the characteristics of the event and (6) Multiply the unit cost of each resource group by the time estimate for the event. (Sabir Jaf, 2020).

**2-2: Concept of unused capacity and types of capacity:** One of the most important measures of production resources is capacity. As a result, one of the most important aspects of production management is its definition and examination. Using traditional metrics frequently leads to erroneous decisions. (Sebestyen, 2003Therefore, there are several types of capacity in manufacturing companies, but in our study, we focused on three primary types of capacity:

1) Theoretical capacity: Theoretical capacity refers to the theoretical maximum production that can be achieved if a resource is used to its full potential. With time as the usual measuring unit, this translates to 24 hours a day, 365 days a year for equipment, and 8 hours a day, 365 days a year for employees. (Balanchandran et al. 2007).
2) Practical capacity: It is the level of capacity that reduces theoretical capacity by considering unavoidable operating interruptions, such as scheduled maintenance time and shutdowns for holidays. (Datar & Rajan, 2018).
3) Actual capacity: The amount to which a company or a country uses its installed production capacity is known as capacity utilization. It is the link between the actual output produced by installed equipment and the prospective output that could be produced if capacity were completely used. The formula is the actual output per period, expressed as a percentage of full capacity per period. (Rimo & Tin, 2017)

   Then, there are two capacities are derived from previous capacities,

4) Unused capacity: After productive capacity and protective capacity have been taken into account, the remaining capacity of a company is referred to as unused capacity. (www.accountingtools.com, 2022). Unused Capacity’ is the difference between theoretical capacity and the actual capacity utilization when actual capacity utilization is less than theoretical capacity. Therefore classified unused capacity into three: (Bates & Bradshaw, 2011) (1) Productive unused capacity: Breakdowns and power failures are two possible reasons for unused, (2) Administrative idle capacity: Building a larger company than necessary and maintaining highly competent employees when they are not needed to avoid losing them to competition are two probable causes of unused and (3) Economic idle capacity: Seasonal businesses, cyclical business cycles, and wide changes in demand that caused over-or under-capacity were all conceivable reasons for unused capacity.
5) Abnormal unused capacity: It is that capacity that is extracted through the difference between practical capacity and actual capacity

**2-3: Concept of cost behavior:** Cost is a term that is frequently used in all types of companies. (Mohammed & Sadeq, 2022), and almost every decision managers make is influenced by cost behavior, or how cost responds to changes in volume or activity. When managers plan, perform, evaluate, and communicate, they frequently use it to analyze multiple courses of action to choose the one that will best create income for a company's owners, use resources efficiently, and retain liquidity for its creditors. (Maryam & Abbas, 2019). Costs behavior can be classified into (Datar & Rajan, 2018) (1) Variable Costs: The total cost of a variable cost changes in proportion to the degree of total activity or volume of output produced, (2) Fixed Costs: A fixed cost remains unchanged in total for a given period, despite wide changes in the related level of total activity or volume of output produced. It's worth noting that costs are classified as variable or fixed for a given activity and period. Identifying whether a cost is variable or fixed is useful information for many management choices, as well as a significant input for evaluating performance.

At the end of theoretical research industrial company management should try to rationalize their industrial costs, particularly through cost behavior that is allocated to products and services based on total capacity, which includes both actual and unused capacity, given the growing interest in unused capacity due to increased competition and the lack of cost systems that work to determine unused capacity. As a result, the Time Driven-Activity Based Costing system, which is a technique for analyzing unused capacity in industrial facilities to cut the prices of their products and services, was adopted.

## 3: Practical side of the research: Implementing time-driven activities-based costing on research sample (Samarra Pharmaceutical Factory):

**3-1: A brief description of the research sample and manufacturing stages:** It is a governmental pharmaceutical factory founded in 1965 in Iraq under Public Institutions Law No. 66 of 1965 based on the Treaty on Economic and Technical Cooperation between Iraq and the Soviet Union in 1959, and actual production began in 1971 with a capital of 271,644,000) million dinars, which was later modified to (1,771,644000) billion dinars on 12/26/1999. Administratively, this company has a set of factories that are represented by (Samarra Pharmaceutical Factory, Nineveh Pharmaceutical Factory, Baghdad Factory for the Production of Medical Gases, and Babel Factory for the production of wine syringes and medical gases).

The research applies the second generation of the costing system, which is the time-driven activity-based costing system, to reduce the price of the research sample products by rationalizing their behavior costs from fixed costs and variables on the list of costs of the research sample (in the stages of manufacturing the products of the public factory industry, pharmaceuticals, and medical supplies in Samarra), and the following is a brief explanation of the manufacturing activities:

1. Raw material initialization stage: To prepare the raw materials for each production department, it must draw up a plan showing the quantity of production for a month, based on which the necessary raw materials are prepared for the officials of units, divisions, and sections according to original documents for each of its types.
2. Fragmentation stage: This stage comes after receiving the raw materials from the main stores and entering them into the stores of the production department. These materials are divided according to their types. Each product has its materials with specifications, weights, and preparation methods that differ from other preparations.
3. Preparation stage: It is determined by the specific weights, after which each preparation is placed in its device and the process of mixing the raw materials and adding the active materials begins, after which they are placed in special ovens at specific temperatures, and finally, complementary materials are added to arrive at the final product.

**3-2: Implementing second-generation (TDABC) on data of research sample:**

1. Data collected for the factory under investigation: The costs of the resource set are determined by the costs of all the materials, labor, depreciation, and other indirect

expenses in this set. The overall annual manufacturing costs of the manufacturing stages of the firm in the year 2018 under investigation are shown in Table 1.

**Table 1: The annual total manufacturing cost of the manufacturing stages**

| manufacturing stages | The raw material initialization stage | fragmentation stage | preparation stage | Total costs |
|---|---|---|---|---|
| **Manufacturing Costs** | 1,366,888,000 | 1,088,825,000 | 889,086,000 | 3,344,799,000 |

The costs behavior has been determined into a variable and fixed costs based on information collected from their financial statements and lists for the study sample, and the following is table No. (2) illustrating the manufacturing costs behavior for the year 2018:

**Table 2: The annual total manufacturing costs behavior of the manufacturing stages**

| manufacturing stages | The raw material initialization stage | fragmentation stage | preparation stage | Total costs |
|---|---|---|---|---|
| **Variable Costs** | 919,211,550 | 591,369,700 | 338,087,435 | 1,848,668,685 |
| **Fixed Costs** | 447،676,450 | 497,455,300 | 550,998,565 | 1,496,130,315 |
| **Manufacturing Costs** | 1,366,888,000 | 1,088,825,000 | 889,086,000 | 3,344,799,000 |

**2.** Identifying the practical capacity under study: As the nature of the resources is determined, and all theoretical capacities that are not reached to reach the practical capacity are assessed, the practical capacity in the factory under study is expected to be around 85% of the available theoretical capacity, according to prior studies. Based on the number of workers in each manufacturing stage and the following steps:

A) Daily working hours are seven hours.

B) Weekly working hours are seven hours × five days = 35 hours/week.

C). Annual theoretical working hours are thirty-five hours × fifty-two week=1820 hours/year (theoretical capacity).

D) Annual practical working hours are 1820 hours/year × eighty-five percent=1547 hours/year (practical capacity).

The number of annual theoretical and practical working hours and minutes for the three manufacturing stages is shown in table No. (3, 4).

**Table 3: Annual theoretical working hours and minutes for the three manufacturing stages**

| Manufacturing stages / Details | Raw material initialization Stage | Fragmentation stage | Preparation Stage | Total |
|---|---|---|---|---|
| **No. of workers** | 22 | 28 | 34 | 84 |
| **Theoretical working hour per worker** | 1820 | 1820 | 1820 | 1820 |
| **Theoretical working hours for all workers** | 40040 | 50960 | 61880 | 152880 |
| **Theoretical work minutes for all workers** | 2402400 | 3057600 | 3712800 | 9172800 |

**Table (4): Annual practical working hours and minutes for the three manufacturing stages**

| Manufacturing stages / Details | Raw material initialization Stage | Fragmentation stage | Preparation Stage | Total |
|---|---|---|---|---|
| **No. of worker** | 22 | 28 | 34 | 84 |
| **Practical working hours per worker** | 1547 | 1547 | 1547 | 1547 |
| **Practical working hours for all workers** | 34034 | 43316 | 52598 | 129948 |
| **Practical work minutes for all workers** | 2042040 | 2598960 | 3155880 | 7796880 |

**3.** Determining the average cost of manufacturing capacity: Divide the total costs of the resource pools by the practical capacity of the resource pools to get the average cost of production capacity in hours. The average cost of a unit of manufacturing capacity in minutes is shown in Table (5):

**Table (5): Average cost of production capacity**

| Manufacturing Stages | Raw material initialization Stage | | Fragmentation Stage | | Preparation Stage | |
|---|---|---|---|---|---|---|
| **Costs Behaviour** | **VC** | **FC** | **VC** | **FC** | **VC** | **FC** |
| **The total cost of resource pools** | 919,211,550 | 447،676,450 | 591,369,700 | 497,455,300 | 338,087,435 | 550,998,565 |
| **No. of theoretical working hours** | 40040 | 40040 | 50960 | 50960 | 61880 | 61880 |
| **The average cost of capacity by hours** | 22957 | 11181 | 11605 | 9762 | 5464 | 8904 |
| **The average cost of capacity by minutes** | 383 | 186 | 193 | 163 | 91 | 148 |

**4.** Recognize the activities' events and select the relevant cost driver: The events of the logistical activities and the causes of each event of the factory under study are identified through personal interviews or contact with officials. Figure (1) shows the events of the logistical activities and their causes as follows:

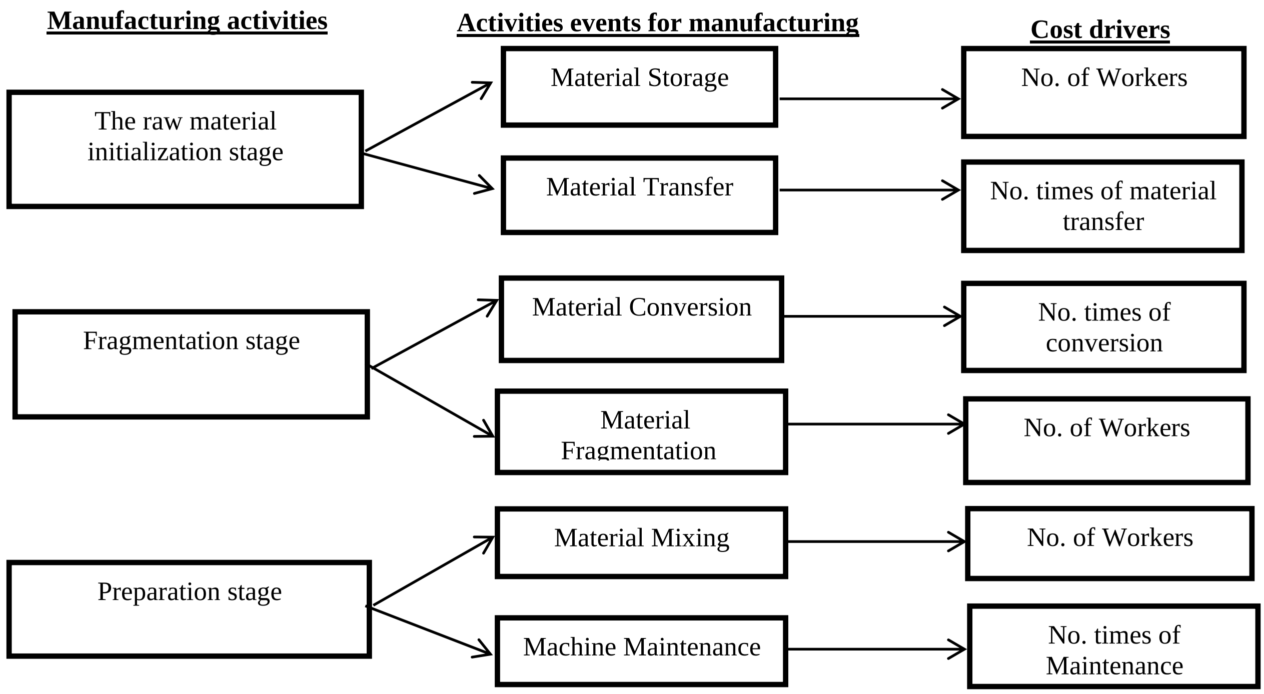


Figure (1) Events of the logistical activities and their causes

**7.** Time equation formulation: The following is a review of how to formulate time equations and calculate the estimated time for the various manufacturing activities, by presenting the stages (activities), below in Table No. (6) in the name of the estimated time for the manufacturing stages:

**Table (6): Actual time of manufacturing stages**

| Date | The raw material initialization stage | | | Fragmentation stage | | | Preparation stage | | |
|---|---|---|---|---|---|---|---|---|---|
| | Activity time/hours | No. of workers | No. times of transfer | Activity time/hours | No. of workers | No. times of conversion | Activity time/hours | No. of workers | No. times of Maintenance |
| 1 | 129 | 18 | 11 | 165 | 22 | 24 | 185 | 30 | 1 |
| 2 | 138 | 20 | 12 | 164 | 20 | 23 | 200 | 32 | 0 |
| 3 | 129 | 18 | 11 | 133 | 18 | 19 | 200 | 33 | 0 |
| 4 | 119 | 16 | 9 | 186 | 24 | 27 | 200 | 33 | 2 |
| 5 | 116 | 15 | 8 | 150 | 20 | 22 | 206 | 34 | 3 |
| 6 | 131 | 19 | 11 | 139 | 20 | 20 | 185 | 30 | 1 |
| 7 | 130 | 18 | 12 | 180 | 23 | 26 | 185 | 30 | 2 |
| 8 | 122 | 17 | 10 | 139 | 20 | 20 | 179 | 29 | 1 |
| 9 | 124 | 18 | 11 | 139 | 20 | 20 | 179 | 29 | 0 |
| 10 | 120 | 16 | 10 | 133 | 18 | 19 | 195 | 32 | 0 |
| 11 | 138 | 20 | 12 | 164 | 20 | 23 | 195 | 32 | 0 |
| 12 | 142 | 21 | 14 | 164 | 20 | 23 | 195 | 21 | 2 |
| 13 | 141 | 21 | 13 | 119 | 15 | 17 | 179 | 29 | 4 |
| 14 | 116 | 15 | 8 | 150 | 20 | 22 | 177 | 28 | 4 |
| 15 | 131 | 19 | 11 | 165 | 22 | 24 | 173 | 27 | 2 |
| 16 | 115 | 15 | 7 | 173 | 26 | 25 | 179 | 29 | 1 |
| 17 | 128 | 17 | 12 | 186 | 24 | 27 | 185 | 30 | 1 |
| 18 | 129 | 18 | 11 | 139 | 20 | 20 | 185 | 30 | 0 |
| 10 | 120 | 17 | 9 | 133 | 18 | 19 | 206 | 34 | 0 |
| 20 | 140 | 20 | 13 | 133 | 18 | 19 | 200 | 33 | 0 |
| 21 | 129 | 18 | 11 | 150 | 20 | 22 | 213 | 35 | 2 |
| 22 | 128 | 17 | 12 | 150 | 20 | 22 | 213 | 35 | 2 |
| Total | 2815 | 393 | 238 | 3354 | 378 | 483 | 4214 | 674 | 28 |

Then,

- The time of stage or activity of material initialization in hours = 2815 hours.
  The time of stage or activity of material initialization in minutes;
  2815 × 60 minute = 168900 minute
- The time of stage or activity of material Fragmentation in hours = 3354 hours.
  The time of stage or activity of material Fragmentation in minutes;
  3354 × 60 minute = 201240 minute.
- The time of stage or activity of material Preparation in hours = 4214 hours.
  The time of stage or activity of material Preparation in minutes;
  4214 × 60 minute = 252840 minute.

**8.** Calculating the annual cost of each activity: The actual total cost of the stages or manufacturing activities can be calculated after identifying the actual time for each stage of the manufacturing activity. Table (7) shows the actual annual cost and the actual annual time for all manufacturing stages as follows:

**Table (7): Actual annual cost & Actual annual actual time**

| Stages (Activities) | Costs behavior | Actual Time (1) | Average cost per minute (2) | Actual monthly cost (3=1×2) | Months of the year (4) | Actual annual cost (5=3×4) | Actual annual time (6=1×4) |
|---|---|---|---|---|---|---|---|
| **The raw material initialization** | **VC** | 168900 | 383 | 64688700 | 12 | 776264400 | 2026800 |
| | **FC** | 168900 | 186 | 31415400 | 12 | 376984800 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| stage | Total | | | 96,104,100 | | 1,153,249,200 | |
| Fragmentation Stage | VC | 201240 | 193 | 38839320 | 12 | 466071840 | 2414880 |
| | FC | 201240 | 163 | 32802120 | 12 | 393625440 | |
| | Total | | | 71,641,440 | | 859,697,280 | |
| Preparation Stage | VC | 252840 | 91 | 22755600 | 12 | 273,067,200 | 3034080 |
| | FC | 252840 | 148 | 37420320 | 12 | 449,043,840 | |
| | Total | | | 60,175,920 | | 722,111,040 | |

Thus, it is possible to find the exploited capacity and the percentage of its utilization using the actual annual time and table (8) the costs of the capacity used and the percentage of utilization of the available capacity as follows:

**Table (8): The capacity utilized and the rate of capacity utilization**

| Stages (Activities) | The raw material initialization stage | Fragmentation Stage | Preparation Stage |
|---|---|---|---|
| **Annual theoretical time (table 3)** | 2402400 | 3057600 | 3712800 |
| **Annual actual time (table 7)** | 2026800 | 2414880 | 3034080 |
| **Capacity utilization ratio** | %84.4 | %79 | %81.7 |

The researcher noticed from Table (8) that the study sample factory utilized the actual capacity satisfactorily, especially in the materials initialization stage by 84.4%, followed by the preparation stage by 81.7%, while it exploited the fragmentation stage by 79%.

**9.** Calculating the unused capacity of the company under study: The unused capacity costs represent a burden on the total costs of the drug manufacturing stages in the study sample, which can be clarified in the following table:

**Table (9): Unused capacity costs and their ratio**

| Stages (Activities) / Details | Costs behavior | The raw material initialization stage | Fragmentation Stage | Preparation Stage | Total |
|---|---|---|---|---|---|
| **Theoretical capacity costs (Table 2)** | **VC** | 919,211,550 | 591,369,700 | 338,087,435 | 1,848,668,685 |
| | **FC** | 447‹676,450 | 497,455,300 | 550,998,565 | 1,496,130,315 |
| | **Total** | 1,366,888,000 | 1,088,825,000 | 889,086,000 | 3,344,799,000 |
| **Actual capacity costs (Table 7)** | **VC** | 776264400 | 466071840 | 273067200 | 1,515,403,440 |
| | **FC** | 376984800 | 393625440 | 449043840 | 1,219,654,080 |
| | **Total** | 1,153,249,200 | 859,697,280 | 722,111,040 | 2,735,057,520 |
| **Unused capacity costs** | **VC** | 142,947,150 | 125,297,860 | 65,020,235 | 333,265,245 |
| | **FC** | 70,691,650 | 103,829,860 | 101,954,725 | 276,476,235 |
| | **Total** | 213,638,800 | 229,127,720 | 166,974,960 | 609,741,480 |
| **Unused capacity ration** | **VC** | %15.5 | %21 | %19 | %18 |
| | **FC** | %15.8 | %21 | %18.5 | %18.4. |
| | **Total** | %15.6 | %21 | %18.7 | %18.2 |

The research sample factory was able to use the majority of its actual capacity, which indicates the factory's efficiency in utilizing its available resources. As a result, the percentage of unused capacity costs for the fragmentation stage increased by %21 when compared to the two stages (material initialization stage and preparation), and the factory must work to exploit the costs of unused capacities to increase the factory's production capacity on one hand. On the other hand, there are three types of capacities in a factory (theoretical, practical, and actual capacity), with theoretical capacity accounting for 100%, practical capacity for 85%, and actual capacity accounting for 81.5%. As a result, the company must work hard to close the gap between actual and theoretical capacity in the three stages of manufacturing. The following table No. (10) shows the comparison among the three capacities of the research sample;

**Table (10) Comparison of the three capacities for manufacturing stages**

| Stages / Capacities | The raw material initialization stage | Fragmentation Stage | Preparation Stage | Total |
|---|---|---|---|---|
| **Theoretical (1)** | 2402400 | 3057600 | 3712800 | 9172800 |
| **Practical (2)** | 2042040 | 2598960 | 3155880 | 7796880 |
| **Ratio (3=2/1)** | 85% | 85% | 85% | 85% |
| **Actual (4)** | 2026800 | 2414880 | 3034080 | 7475760 |
| **Ratio (5=4/1)** | 84% | 79% | 82% | 81.5% |

According to the previous tables, there are five types of capacities, and we may identify abnormal unused capacity by comparing the difference between practical capacity and actual capacity for manufacturing stages, as shown in the table below:

**Table (11) shows the abnormal unused capacity and other capacities for the manufacturing stages**

| Stages / Capacities/minutes | | The raw material initialization stage | Fragmentation Stage | Preparation Stage |
|---|---|---|---|---|
| **Theoretical (1)** | **Table (3)** | 2402400 | 3057600 | 3712800 |
| **Practical (2)** | **Table (4)** | 2042040 | 2598960 | 3155880 |
| **Actual (3)** | **Table (7)** | 2026800 | 2414880 | 3034080 |
| **Unused capacity (4=1-2)** | | 360360 | 458640 | 556920 |
| **The ratio of unused capacity ( 4/1)** | | 15% | 15% | 15% |
| **Abnormal unused capacity (5=2-3)** | | 15240 | 184080 | 121800 |
| **The ratio of abnormal unused capacity( 5/1)** | | 1% | 6% | 3% |

We notice from the previous table (11) that when we add the ratio of abnormal unused capacity and unused capacity and actual capacity, we reach 100%.is the theoretical capacity ratio for manufacturing stages.

At the end of our research, which is concerned with the practical aspect, the research reached to prove its hypothesis, which is represented by (the second generation of the costing system can be applied, which contributes to the process of evaluating unused capacity to rationalize the behavior of costs in industrial economic units, including the research sample).

## 4: Results:

**4-1: Conclusions:** From a theoretical and practical aspect, the research has reached the following conclusions:

1. The second generation, represented by the time-driven activity-based costing system (TDABC), was created to overcome the flaws in the activity-based costing system that accounts for time.
2. The time-driven activity-based costing system (TDABC) separates the theoretical capacity, practical capacity, and actual capacity in the research sample.
3. The unused capacity costs come from the difference between theoretical capacity costs and actual capacity costs.
4. According to prior experiences, the research sample predicted the practical capacity percentage to be about 85% of the available theoretical capacity, whereas the actual capacity percentage was around 81.7% for the three manufacturing activities.
5. The results showed that in the raw material initialization stage, the expected annual variable costs exceed about 90% of the estimated annual fixed costs, however, in the preparation stage, the fixed costs are around 40% higher than the variable costs.
6. In practice, the researchers noticed that the study sample firm used the actual capacity satisfactorily, especially in the material initialization stage which is about 84.4% larger compared to the two stages (81.7% preparation and 79% fragmentation).

7. The fragmentation stage has the highest percentage of unused capacity costs (21%) compared to two other stages (initialization of materials (a preparation (18.7%), (15.7%)), and one of the disadvantages of this system is that it only measures the costs of unused capacity and does not treat it or exploit it in other ways, but it tries to reduce it.
8. In practice, the lowest ratio of abnormal unused capacity belongs to the material initialization stage, with a rate of around 1%, followed by the preparation stage and fragmentation stage, with rates of approximately 3% and 6%, respectively.

**4-2: Recommendations:** From a practical side, the study came up with the following recommendations:

1. The need for industrial companies to implement the time-driven activity-based costing system to minimize product and service selling prices through lowering costs.
2. The need to reduce the activities that do not add value by reducing the gap between the theoretical capacity, practical capacity, and actual capacity.
3. The need for industrial companies to work on expanding their market base by paying attention to activities that add value to the customer.
4. The study sample has to focus on exploiting the costs of unused capabilities to boost the production capacity of the three stages of manufacturing, or it can be exploited in another stage.
5. The necessity for the establishment under study to conduct training courses for the accounting staff to get acquainted with modern cost systems to solve the problem of allocating indirect costs in a better and more fair manner and to the rest of the establishment's departments, especially the cost system based on time-driven activity-based costing. (TDABC).

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**تطبيق الجيل الثاني من نظام التكاليف وأثره على ترشيد سلوك التكاليف / دراسة تطبيقية على الشركة العامة للصناعات الأدوية والمستلزمات الطبية / سامراء**

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**ملخص**

يهدف هذا البحث إلى تحقيق الهدف الرئيسي وهو التحقق من إمكانية تطبيق نظام التكاليف على أساس أنشطة الموجة بالوقت كجيل الثاني وأحد أساليب المحاسبة الإدارية الحديثة كمدخل لتقييم الطاقة غير المستخدمة وترشيد سلوك التكلفة للوحدات الاقتصادية مع اختبار إمكانية تطبيقه في البيئة المحلية. تم تطبيق هذا النظام على بيانات التكلفة لفصل الطاقة غير المستخدمة عن الطاقة النظرية لغرض ترشيد سلوك التكاليف في عينة البحث. تناول هذا البحث على إمكانية تطبيق نظام التكاليف على أساس أنشطة الموجه بالوقت في المجالات الاستراتيجية مثل إداره تكاليف الإنتاج، والطاقة غير المستخدمة، والاختلافات بين الطاقة النظرية والطاقة العملية والطاقة الفعلية. توصل البحث إلى العديد من النتائج أهمها، نظام التكاليف على أساس أنشطة الموجه بالوقت (TDABC) والذي يفصل بين الطاقة النظرية والطاقة العملية والطاقة الفعلية في عينة البحث هذا من جهة، ومن جهة أخرى، إيجاد تكاليف الطاقة غير المستخدمة من الفرق بين تكاليف الطاقة النظرية وتكاليف الطاقة الفعلية.

**الكلمات المفتاحية:** الجيل الثاني (TDABC) ، الطاقة غير المستخدمة ، وسلوك التكلفة.

**جێ بەجێکردنی نەوەی دووەم لە سیستەمی تێچون وکاریگەریکەی لە سەر باشکردنی (کەمکردن) هەلسوکەوتی تێچون – لێکۆلینەوەیەکی پراکتیکیە لەسەر کامپانیای گشتی بۆ بەرهەم هێنانی کەلوپەل وپێداویستیەکانی پزیشکی لە سامەرا**

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**پوختە**

ئامانج لە توێژینەوەیەکە بریتیە لە بەدەستهێنانی ئامانجی سەرەکی ئەویش دلنیابوون لە توانایی جێ بەجێکردنی سیستەمی تێچون لەسەر بنەمای چالاکی ئاراستەکراو بەکات کەوەك نەوەی دووەم ویەکێك لە ئامرازەکانی ژمێریاری بەرێوەبردنی نوێ کە رێرەوێکە بۆ هەڵسەنگاندنی توانای بەکارنەهاتوو وباشکردنی هەلسوکەوتی تێچون بۆ یەکە ئابووریەکان لەگەڵ دیایکردنی توانای جێ بەجێکردنەکەی لە ژینگەی ناوەخۆیی. ئەم سیستەمە جێ بەجێکرا لەسەر داتاکانی تێچون بۆ لێکردنەوەی توانای بەکارنەهاتوو لە توانای گشتی بە مەبەستی چاکردنی هەلسوکەوتی تێچون لە سەمپلی توێژینەوەکە. وە ئەم توێژینەوەیە باس لە توانایی جێ بەجێکردنی سیستەمی تێچون لەسەر بنەمای چالاکی ئاراستەکراو بەکات لە لایەنەکانی ئیستراتیجی وەك بەرێوەبردنی تێچوی بەرهەم، وتوانای بەکارنەهاتوو، وە جیاوازی لە نێوان توانای گشتی وتوانای پراکتیکی وتوانای کارایی. توێژینەوەکە گەیشتە کۆمەڵێك لە دەرئەنجام گرینگترینیان ئەوەیە کە سیستەمی تێچون لەسەر بنەمای چالاکی ئاراستەکراو بەکات کە هەڵدەستێت بە لێکردنەوەی توانای گشتی وتوانای پراکتیکی وتوانای کارایی لە سەمپلی توێژینەوەکە ئەمە لەلایەك لەلایەکی ترەوە هەڵدەستێت بە دۆزینەوەی تێچوی توانای بەکارنەهاتوو کە لەرێگای جیاوازی نێوان تێچوی توانای گشتی وتێچوی توانای کارایی.

**وشەی کردنەوەکان**: نەوەی دووەم، توانای بەکارنەهاتوو، هەلسوکەوتی تێچون.