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Integrating Target Costing and Time-Driven Activity-Based Costing to Determine Strategic Product Cost: An Applied Study in the Syrian Pharmaceutical Industry

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ABSTRACT: This study examines how target costing (TC) and time-driven activity-based costing (TDABC) complement each other, and whether their combined use can yield a strategic product cost that supports a firm's competitive position where competition turns on price. It draws on the literature and on an applied study at the Arab Medical Company (Tamico), using 2019 cost data for Cetamol tablets. Tablet cost was measured under the company's traditional costing system and under TDABC, and both figures were compared with a target cost derived from the competing product's price and the set profit margin. The target cost of a tablet was SYP 5.20. Its cost was SYP 5.4909 under the traditional system, 5.6% above the target, and SYP 4.805 under TDABC, about 7.6% below it. The gap between the two measurements arises mainly from the work in process carried into the year and from the different basis of assigning conversion costs, not from an actual reduction in cost. Automatic packaging and manual filling account for about 87% of the conversion cost of a tablet, and about 31% of the conversion resources of the four departments were not consumed by the product. The conclusion holds at a practical capacity of 80%. Combining the two gives management a cost target from the market, a cost measure from the actual consumption of resources, and an indication of where cost can be reduced. It recommends introducing the integration in stages and directing cost reduction at the departments that consume the most time.

1. INTRODUCTION

An industrial firm is no longer free to calculate the cost of its product and then add its profit margin to arrive at a selling price. In markets where products resemble one another and competition is intense, the price becomes a given imposed by the market, and the equation is reversed: the price is known, the required profit is set, and what remains between them is the cost the product must not exceed. This is the logic of target costing (TC), which grew up in Japanese industry and spread from there.

Knowing the allowable cost is not enough, however, unless the firm also knows accurately what its product really costs. Here the limits of traditional costing systems appear. They allocate manufacturing overheads to products on aggregate volume bases, so that a product is charged with a share of costs whose resources it did not consume, and they do not reveal the capacity that remains unused. Time-driven activity-based costing (TDABC) was introduced to deal with this in a simpler way than activity-based costing (ABC), since it needs only two estimates: the cost of a unit of time of resource capacity, and the time each activity consumes.

Hence the idea behind this study: the two approaches complete each other, the first setting what the cost should be and the second measuring what it is and pointing to where it can be reduced. The study tests this idea on a pharmaceutical product in a Syrian public-sector industrial firm, in an environment where price is a decisive factor in competition.

2. RESEARCH PROBLEM

The research problem lies in the failure of traditional systems of cost measurement and management to determine the strategic cost of the product, that is, the cost that strengthens the firm's competitive position and allows its market share to be kept and expanded without harming the profit margin. The problem can be put in two questions:

1. Does the traditional costing system applied in the Syrian industrial firm make it possible to determine a product cost consistent with the cost the market allows?

2. Does combining target costing with TDABC lead to a strategic product cost that supports the firm's competitive position?

3. RESEARCH OBJECTIVES

The study aims to present target costing (TC) and time-driven activity-based costing (TDABC) and the ways in which they complement each other, and to test whether this integration can determine the strategic cost of the product in an environment of price competition such as the Syrian one, by applying it to an actual product and comparing its results with those of the traditional measurement system.

4. RESEARCH HYPOTHESES

The research rests on two hypotheses:

First hypothesis: Given developments in the modern economic environment, traditional systems for managing and measuring product cost are no longer able to determine the optimal strategic product cost for the firm.

Second hypothesis: The integration of target costing (TC) and time-driven activity-based costing (TDABC) allows a strategic product cost to be determined that strengthens the firm's competitive position in the modern business environment.

5. RESEARCH METHODOLOGY

The research methodology relied on two approaches:

- **The theoretical approach**, based on studying and analysing earlier theoretical and applied studies related to the subject, in order to form the theoretical framework.
- **The applied approach**: applying target costing (TC) and TDABC in a Syrian industrial firm, in order to measure the cost of a given product and compare it with its cost as measured by the traditional costing system and with its target cost, and so to reach the results and recommendations of the research. Data were collected from the firm's cost records and from interviews with the financial manager, the production manager and the cost accountant.

6. SIGNIFICANCE OF THE RESEARCH

The importance of the research lies in applying modern cost management approaches and measurement systems to actual data, and in showing what Syrian industrial firms can gain from applying them to determine the strategic cost of their products, in a way that supports their competitive position in a business environment marked by competition on selling price. This matters all the more because, to the best of the authors' knowledge, the integration has not previously been applied in Syrian industrial firms.

7. LITERATURE REVIEW

The studies closest to the subject are reviewed below, grouped by topic: studies of TDABC; studies of target costing, alone or with ABC; and studies that combined target costing with a time-driven system.

First: studies of TDABC

Tse (2007), "Adopting time-driven activity-based costing model for IT cost management in e-commerce organizations". Carried out in Australia, the study sought to meet management's need for cost data in e-commerce organisations after the failure of traditional systems, which assume that all available resources are consumed in operations. It concluded that TDABC is easy to apply and highly accurate, and that time equations overcome the complexity of activities and reveal unused capacity.

Everaert et al. (2008), "Cost modeling in logistics using time-driven ABC: Experiences from a wholesaler". The study applied the system in a wholesale distributor and showed that time equations capture a variety of logistics operations that ABC cannot handle, and give management more accurate information on customer profitability.

Öker and Adıgüzel (2010), "Time-driven activity-based costing: An implementation in a manufacturing company". The system was applied in a Turkish manufacturer of sheet metal and plastic parts for the electronics industry. The study showed its ability to overcome the difficulties of ABC, the ease of updating it when production lines are restructured, and its use in analysing how far available capacity is utilised.

Szychta (2010), "Time-driven activity-based costing in service industries". Carried out in Poland, the study explained the principles and structure of the system and the working of time equations with a numerical example, set out its strengths and weaknesses, and concluded that it measures the costs of activities, services and customers easily and quickly in service firms and others.

Kont and Jantson (2011), "Activity-based costing (ABC) and time-driven activity-based costing (TDABC): Applicable methods for university libraries?". The study compared the two systems in university libraries and concluded that TDABC can be applied there at the level of each library department.

Abd Al-Latif (2012), "Customer profitability analysis using time-driven activity-based costing: a case study of a major hotel in the Kingdom". ABC and TDABC were applied to eight groups of customers of a five-star hotel in Saudi Arabia. ABC showed losses for some groups that turned into profits under TDABC, because the former charges customers with the cost of unused capacity while the latter charges them only with the cost of capacity used.

AL Debs (2015), "Raising the competitiveness of the firm by revealing unused production capacity using TDABC: an applied study". The system was applied in a Syrian industrial firm, where it revealed unused capacity in one department and measured its cost, which the firm's existing costing system did not show. The present study extends that work by linking measurement to a cost target that comes from the market.

Second: studies of target costing

Al-Khalaf and Zwaylif (2007), "Pricing using the target costing approach: a field study in the Jordanian veterinary medicines industry". The study held that traditional pricing methods are no longer adequate under competition, and proposed target costing as a system for pricing and profit planning together. It meets the present research in dealing with the pharmaceutical industry.

Abdullah and Mansour (2015), "Integration of target costing (TC) and activity-based costing (ABC) as strategic cost management tools for determining the cost of electricity production". A case study of the Sudanese Thermal Power Generation Company, it showed that the company relies on traditional allocation bases that do not measure cost accurately, and that combining the two approaches gives a more accurate measure of the cost of producing electricity. It is the study closest in idea to the present research, with the difference that it used ABC in its original form and not the time-driven system.

Third: studies combining target costing with a time-driven system

Abd Al-Aziz and Al-Mufarji (2022), "The role of target costing and the time-driven activity-based costing system in cost reduction". Applied research in the General Company for Leather Industries in Iraq, it found that TDABC allocates manufacturing overheads more fairly across activities and gives a more accurate unit cost, and that the company's traditional system does not provide suitable information for pricing. It recommended applying the two together.

Raheef and Al-Mousawi (2023), "The role of the integrative relationship between time-driven activity-based costing and green target costing in cost management". A theoretical study, it concluded that the reliance of most Iraqi economic units on traditional costing systems has pushed their products out of competition, and that combining the two techniques supports cost management and managerial decisions.

Al-Kawaz et al. (2023), "The role of integration between target costing and time-driven activity-based budgeting techniques in managing time and cost and its reflection in achieving competitive advantage". Applied in a men's clothing factory in Najaf, the study showed that combining target costing with time-driven activity-based budgeting lowered unit cost, and that reverse

engineering added a further reduction towards the target cost. The same researchers later extended the idea to green target costing and time-driven product life-cycle budgeting in an electric motors factory (Al-Baldawi et al., 2025).

Contribution of this study

It is clear from the above that the studies of TDABC were occupied with comparing it with ABC or with revealing unused capacity, without linking measurement to a cost target that comes from the market; and that the studies combining target costing with a time-driven system are recent, were almost all carried out in Iraq, and dealt with the leather, clothing and motors industries. This study differs in three respects. To the best of the authors' knowledge, it is the first to apply this integration in the Syrian industrial environment. It deals with the pharmaceutical industry, which earlier integration studies did not cover. And it does not stop at measuring cost under the two systems, but compares both figures with a target cost derived from the competitor's price, and identifies from the measurement data themselves the departments to which cost reduction should be directed.

8. THEORETICAL FRAMEWORK

First: target costing (TC)

Concept. Sakurai defined target costing as a cost management tool for reducing the overall cost of a product over its entire life cycle with the help of the production, engineering, research and development, marketing and accounting departments (Sakurai, 1989). Kato sees it less as a costing method than as an activity of profit planning and cost management that starts from the market (Kato, 1993). Two things are common to the various definitions: the starting point is the price the customer accepts, not the cost the firm bears; and the work centres on the stage of product design and development, where the greater part of the product's cost is settled before production begins (Cooper and Chew, 1996). The approach therefore rests on the following equation:

$$\textit{Target (allowable) cost} = \textit{Target selling price} - \textit{Desired profit margin}$$

The target price is the estimated price the consumer is prepared to pay for the product. It is determined by studying the market: the characteristics and quality of the product, the prices of competing products and the expected reaction of competitors (Kato, 1993).

Steps. Cooper and Slagmulder distinguish three successive stages. In market-driven costing, the allowable cost is derived from the target price and the profit margin. In product-level target costing, the allowable cost is compared with the estimated cost of the product as it stands, to identify the cost gap and close it through value engineering and other means of reduction. In component-level target costing, the target is distributed over the parts and functions of the product and cost pressure is passed on to suppliers (Cooper and Slagmulder, 1997). Whereas target costing works before production, kaizen costing completes it after production starts, through continuous reduction (Monden and Hamada, 1991).

Objectives. The approach aims mainly at reducing costs and developing products. From this follow meeting customers' wishes with products of suitable quality and price, achieving management's long-term profit goals despite changing market conditions, and balancing cost, price and invested capital (Ansari et al., 1997).

Characteristics. The approach differs from traditional methods of cost management in that it is applied at the design and development stage and not at the production stage, that it is a means of reducing costs and not of controlling them, and that it requires cooperation between the firm's departments (Kwah, 2004). Survey studies show that its adoption increases with the intensity of the competition a firm faces (Dekker and Smidt, 2003; Ax et al., 2008).

Difficulties. Applying the approach meets several difficulties. Most of what has been written about it analyses the experience of particular Japanese companies, so that its findings are specific to them and no general framework of implementation steps has taken shape. Selling prices and profit margins, and hence the target cost, are hard to determine accurately where suitable databases are lacking, especially in developing countries. It is not clear how the required reduction should be distributed over the firm's operations. And the target cost plan is hard to maintain under rapid technological change and the entry of new competitors. The second and third of these difficulties bear directly on the cost measurement system, which is where the case for integration, discussed below, begins.

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Second: time-driven activity-based costing (TDABC)

Concept. Kaplan and Anderson introduced this system to overcome the practical difficulties met by ABC, chief among them the reliance on interviews and surveys to determine how employees' time is divided among activities, and the cost of updating the model whenever operations change (Kaplan and Anderson, 2004). In TDABC there are no activity cost pools; resource cost pools are linked directly to cost objects through one or more time-based cost drivers (Tse and Gong, 2009), and the rates of these drivers are built on the practical capacity of the resources (Antić and Georgijevski, 2010). The system needs only two estimates (Kaplan and Anderson, 2007):

• The capacity cost rate, that is, the cost of a unit of time of the resource capacity available to the department.

• The time needed to perform each operation or activity within the department.

Capacity cost rate. It is calculated by dividing the total cost of the resources available to the department by the practical capacity of those resources (Szychta, 2010):

$$\textit{Capacity cost rate} = \textit{Cost of capacity supplied} \div \textit{Practical capacity of the resources supplied}$$

Practical capacity is theoretical capacity less rest time, maintenance and customary stoppages; Kaplan and Anderson usually put it at about 80% to 85% of theoretical capacity. Neither its estimation nor the estimation of activity times calls for absolute precision. Approximate accuracy, taken from direct observation or from interviewing those who do the work, is enough (Kaplan and Anderson, 2007).

Time equations. The system expresses the variety of operations in an equation that adds to the basic time of the activity the additional times imposed by the characteristics of each order or product (Kaplan and Anderson, 2007; Dejnega, 2011). Its general form is:

$$t = \beta 0 + \beta 1 \cdot X1 + \beta 2 \cdot X2 + \ldots + \beta p \cdot Xp$$

where t is the time needed to perform the event within the activity, β0 the fixed basic time of the activity, β1 the time consumed per unit of time driver X1, and p the number of time drivers. The cost of the event is the resulting time multiplied by the capacity cost rate of the resource group concerned. With these equations the system takes in varied and complex operations without separating each activity into its own pool (Lelkes, 2009), and if the efficiency of an operation changes, the time set for it is adjusted while all the other links in the model remain as they are (Balakrishnan et al., 2012).

Unused capacity. One of the most important features of the system is that it charges products only with the cost of the capacity they have consumed. The difference between practical capacity and the time actually consumed represents unused capacity, whose cost appears separately. It is assigned to the management level that decided to acquire it and not spread arbitrarily over products and customers, and it can be treated in the income statement as a period cost (Szychta, 2010; Tse, 2007).

Advantages and limits. The system is simple to build and maintain, can be linked to enterprise resource planning (ERP) systems so that time equations are updated periodically without personal surveys (Stout and Propri, 2011), and adapts readily to changes in operations. It is not without limits. Later studies pointed out that its accuracy depends on the accuracy of the time estimates and on the homogeneity of resources within a department, and that measuring times can itself be costly in non-standard operations (Gervais et al., 2010; Hoozée and Hansen, 2018). In the authors' view these limits weigh less in industries with standard, repetitive operations such as pharmaceuticals, where processing times are set by machine speeds and batch records.

Third: the integration of target costing and TDABC

Each of the two answers a different question. Target costing asks what the product should cost if it is to be sold at the price the market accepts while earning the required profit. TDABC asks what the product actually consumes of the firm's resources. Neither answer does away with the need for the other: a cost target without reliable measurement remains a number whose distance cannot be known, and accurate measurement without a target does not tell management whether its cost is acceptable. Table 1 summarises the place of each.

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Table 1. Comparison between target costing and TDABC

Aspect	Target costing	TDABC
Main purpose	Planning price and profit and setting the allowable cost	Measuring and assigning costs accurately
Starting point	The market: the price the customer accepts and competitors' prices	The firm: departmental resources and their practical capacity
Focus	The customer, product design and product functions	Activities, their duration and time equations
Question answered	What should the product cost?	What does the product actually consume?
Capacity management	Does not measure available capacity in detail	Reveals unused capacity and measures its cost
What it lacks	A measurement system that estimates the cost of the product and of its design alternatives	An external target against which the level of cost is judged

Source: authors' elaboration.

Target costing needs a developed measurement system at each of its stages. It requires information on the cost of each feature of the product, each of its functions and each design alternative, and a system that allocates overheads at a single overall rate cannot supply this. TDABC can serve it at four points:

1. Estimating current cost. Time equations and capacity cost rates are used to estimate the cost of the product in light of present production capabilities and the initial design. This is the cost that is compared with the allowable cost to determine the cost gap.

2. Locating reductions. Time equations show clearly which departments and operations take more of the product's time than others and are therefore more costly, and it is to these that value engineering and process simplification are directed. This deals with the difficulty of distributing the required reduction over the firm's operations.

3. Testing alternatives. Since the equation is changed by adding or removing a term, the effect on time and cost of any proposed change in design or manufacturing method can be calculated before it is carried out, much as cost tables do (Blocher et al., 2010), and the effect of decisions on the capacity required can be forecast (Kaplan and Anderson, 2007).

4. Using capacity. The system reveals unused capacity in each department. Using it for additional production, or shedding the surplus resources, is a route to the target cost that does not touch the specifications of the product.

In the other direction, target costing gives the measurement system a feed-forward. It lends it a future and external orientation, since the figures it produces now have a standard against which they are measured. Figure 1 sets out this relationship.



Figure 1. Integration of target costing and TDABC

Source: authors' elaboration.

The strategic cost of the product is taken here to mean the cost that meets two conditions together: it is measured on the basis of what the product actually consumes of resources, and it falls within what the market allows. In this sense it is the outcome of the integration of the two approaches and not of either alone.

9. APPLIED STUDY

This section applies target costing (TC) and TDABC in a Syrian industrial firm by measuring the cost of a given product under TDABC, comparing it with its cost as measured by the traditional costing system, and determining which of the two measurements is consistent with the target cost set for the product.

The firm studied

The firm is the Arab Medical Company (Tamico), a public-sector industrial firm established in 1956 in the Ghouta area near Damascus. It produces and sells human and veterinary medicines, infant foods and serums of various kinds (Arab Medical Company, company guide).

The company produces many pharmaceutical items. The most important is the Cetamol preparation, which makes up the largest share of the plant's output and is the best-selling of the company's items on the Syrian market, and it was therefore chosen for the applied study. The number of Cetamol tablets produced in 2019 was 101,194,000, against a planned 110,000,000, so that the plan was 92% achieved.

Production of the preparation passes through four successive departments:

1. **Preparation**, where the batch is prepared and its main ingredients blended; it has a mixer, an oven and a kneader.
2. **Compression**, where the tablets are formed on the tablet press.
3. **Automatic packaging**, where the tablets are packed into strips on the packaging machine.
4. **Manual filling**, where the strips are put into cartons and the cartons into shipping boxes; it relies on labour and simple equipment.

Product cost under the traditional costing system

The finance department assigns the costs of the production and service departments to products and gathers the costs of each product in its own cost statement. Annual depreciation is distributed over products in proportion to each item's share of the plant's total output. Table 2 shows the cost statement of Cetamol for 2019.

Table 2. Cost statement of Cetamol for 2019 under the traditional system (SYP)

Item	Partial amount	Total amount
Direct materials used		284,745,545
Direct wages		20,883,520
Prime cost		**305,629,065**
Indirect materials	8,331,104	
Indirect wages	114,702,411	
Maintenance and repair	9,623,373	
Fuel and oils	3,714,781	
Depreciation of machinery and equipment	13,061,211	
Depreciation of factory building, offices and administrative fittings	15,673,455	
Electricity, water and other manufacturing overheads	1,760,788	
Total manufacturing overheads		**166,867,122**
Total manufacturing costs		**472,496,187**

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Item	Partial amount	Total amount
+ Opening work in process		106,985,300
− Closing work in process		23,836,440
Cost of finished production		**555,645,047**

Source: the company's finance department. Figures rounded to the nearest pound.

The cost of producing a Cetamol tablet under the traditional system is therefore:

$$555{,}645{,}047 \div 101{,}194{,}000 = \text{SYP } 5.4909$$

Product cost under TDABC

Each of the four production departments is a manufacturing cell with its own resources and represents an organisational unit. The system was applied to them in the following steps.

1. Identifying the conversion costs of each organisational unit. Table 3 shows the annual conversion costs of each department. Wages, the department's own indirect materials and the depreciation of its machinery and equipment are traced to it directly. Maintenance, fuel and oils, the depreciation of buildings and administrative fittings, and electricity, water and other overheads are common to the plant, and the amounts shown are the departmental shares recorded in the company's cost accounts. The figures cover all the resources of each department, not only those used for Cetamol, since the capacity cost rate must reflect the whole capacity supplied.

Table 3. Annual conversion costs of each organisational unit (SYP)

Item	Preparation	Compression	Automatic packaging	Manual filling
Indirect materials of the department	396,719	2,380,315	6,347,508	4,760,631
Departmental wages (direct and indirect)	6,456,473	38,738,837	103,303,567	77,477,675
Share of maintenance and repair	458,256	2,749,535	7,332,093	5,499,070
Share of fuel and oils	176,894	1,061,366	2,830,309	2,122,732
Depreciation of the department's machinery and equipment	2,612,242	9,142,848	1,306,121	0
Share of depreciation of building, offices and administrative fittings	3,918,364	3,918,364	3,918,364	1,306,121
Share of electricity, water and other overheads	83,847	503,082	1,341,553	1,006,165
Total conversion costs of the department	**14,102,795**	**58,494,348**	**126,379,514**	**92,172,393**

Source: authors' elaboration from the company's cost accounting data.

2. Estimating practical capacity. Time capacity was used as the basis for the cost rate in all four departments, and it is the same in each. Work runs on two shifts, that is, sixteen hours a day, five days a week, fifty-two weeks a year, so that theoretical capacity is:

$$16 \text{ hours} \times 5 \text{ days} \times 52 \text{ weeks} = 4{,}160 \text{ hours}$$

After deducting rest time, maintenance and other lost time, the production engineer estimated practical capacity at 3,744 working hours, or 224,640 minutes, which is 90% of theoretical capacity. This is above the 80% to 85% that Kaplan and Anderson (2007) suggest as a rule of thumb. The higher figure reflects the engineer's knowledge of the stoppages actually recorded on these lines, and its effect on the results is tested at the end of this section.

3. Calculating the capacity cost rate, by dividing each department's total conversion costs by its practical capacity. For automatic packaging, for example:

$$126{,}379{,}514 \div 224{,}640 = \text{SYP } 562.59 \text{ per minute}$$

4. Determining the time drivers. Since the capacity used in all departments is time, the cost drivers are time-based as well. The time a single tablet consumes in each department was estimated from the experience of the engineers and production managers and from the batch time records of previous years.

5. Calculating the conversion cost per tablet, by multiplying each department's capacity cost rate by the time a tablet consumes in it. For automatic packaging, 562.59 × 0.001632 = SYP 0.9181 per tablet. Table 4 brings together the results of the last three steps.

Table 4. Capacity cost rates and conversion cost per tablet under TDABC

Organisational unit	Total conversion costs (SYP)	Practical capacity (minutes)	Capacity cost rate (SYP per minute)	Estimated time per tablet (minutes)	Conversion cost per tablet (SYP)	Share
Preparation	14,102,795	224,640	62.78	0.000164	0.0103	0.52%
Compression	58,494,348	224,640	260.39	0.000987	0.2570	12.88%
Automatic packaging	126,379,514	224,640	562.59	0.001632	0.9181	46.01%
Manual filling	92,172,393	224,640	410.31	0.001974	0.8100	40.59%
Total	**291,149,050**			**0.004757**	**1.995**	**100%**

Source: authors' elaboration.

6. Adding direct materials. Direct materials are added at the preparation, automatic packaging and manual filling stages. Their total cost is SYP 284,745,545, so that the share of a tablet is:

$$284{,}745{,}545 \div 101{,}194{,}000 = SYP\ 2.81$$

The cost of a Cetamol tablet under TDABC is therefore:

$$1.995 + 2.81 = SYP\ 4.805$$

7. Capacity consumed by the product. Multiplying the time per tablet by the year's output of 101,194,000 tablets gives the time Cetamol consumed in each department, and multiplying that time by the capacity cost rate gives the cost of the capacity it consumed. The remainder of each department's cost is the cost of capacity that Cetamol did not consume (Table 5).

Table 5. Capacity consumed by Cetamol in each department, 2019

Organisational unit	Time consumed by Cetamol (minutes)	Share of practical capacity	Cost of capacity consumed (SYP)	Cost of capacity not consumed by Cetamol (SYP)	Share of department's cost not consumed
Preparation	16,596	7.4%	1,041,878	13,060,917	92.6%
Compression	99,878	44.5%	26,007,507	32,486,841	55.5%
Automatic packaging	165,149	73.5%	92,910,438	33,469,076	26.5%
Manual filling	199,757	88.9%	81,962,592	10,209,801	11.1%
Total			**201,922,415**	**89,226,635**	**30.6%**

Source: authors' elaboration from Tables 3 and 4.

Of the SYP 291.1 million of conversion resources supplied to the four departments, Cetamol consumed SYP 201.9 million. The remaining SYP 89.2 million is the cost of capacity that the product did not use. Part of it was used by the plant's other products and part was left idle; the two can be separated only when the time equations are extended to all products. Preparation and compression carry most of this remainder, whereas manual filling is close to full use.

8. Sensitivity to the estimates. The two estimates on which the system rests are practical capacity and the time per tablet. If practical capacity were 85% of theoretical capacity (212,160 minutes) instead of 90%, all capacity cost rates would rise in proportion, the conversion cost of a tablet would become SYP 2.112 and its total cost SYP 4.922, still 5.3% below the target cost. At 80% (199,680 minutes) the total cost would be SYP 5.054, 2.8% below the target. Similarly, the conversion cost of a

tablet could rise to SYP 2.39 (5.20 − 2.81) before the target was exceeded, so that the estimated times could be understated by up to about 20% without changing the conclusion.

Determining the target cost of Cetamol

The target cost was determined by the three familiar steps of the approach.

1. Target price. According to market studies in 2019, the product competing with Cetamol was sold on the local market at SYP 500 for a pack of 24 tablets, so that the price of one tablet was:

$$500 \div 24 = SYP\ 20.8333$$

For the company's product to have the advantage over the competing product on price, the selling price of a tablet must be below this amount.

2. Profit margin. The profit margin set for this product is 300% of its production cost, that is, the selling price represents 400% of production cost.

3. Allowable cost. The cost that the price and the margin allow is:

$$20.8333 \div 4 = SYP\ 5.2083$$

Since the price is required to be below the competitor's, the target cost of a Cetamol tablet was set at SYP 5.20 at most.

Three assumptions underlie this figure. First, the competitor's price is taken as given for the year studied, and the company's price must stay below it. Second, the margin is the one the company sets for this product and is expressed on production cost, so the target cost is compared with production cost and not with full cost including selling and administrative expenses. Third, the allowable cost is rounded down to SYP 5.20 so that the resulting price stays below that of the competitor. In general form, target cost = target price ÷ (1 + required margin on cost).

10. RESULTS AND DISCUSSION

Table 6 brings the two measured costs together, compares them with the target cost, and shows the price to which each leads when the set profit margin is applied.

Table 6. Measured cost of a Cetamol tablet compared with the target cost

Item	Traditional system	TDABC
Cost per tablet (SYP)	5.4909	4.805
Target cost (SYP)	5.20	5.20
Difference from target cost (SYP)	0.2909 above	0.3950 below
Difference as a percentage of target cost	5.6% above	7.6% below
Price per tablet at a 300% margin (SYP)	21.96	19.22
Price per pack of 24 tablets at the same margin (SYP)	527.1	461.3
Price of the competitor's pack (SYP)	500	500
Position against the target cost	**Not met**	**Met**

Source: authors' elaboration.

First, the traditional system. The cost of a tablet under the traditional system was SYP 5.4909, which exceeds the target cost by SYP 0.2909, or 5.6%. The gap matters for the decision. If management took this cost as the basis for pricing at the set margin, a pack would be priced at SYP 527.1, about SYP 27 above the competitor; and if it chose instead to match the competitor's price, it would believe it was giving up part of its margin. Either way the cost figure leads to a decision that weakens the firm's competitive position, or to a distorted picture of the product's profitability. Moreover, the traditional cost statement gives management no picture of how this cost is distributed inside the plant: it presents overheads by nature and not by the departments that consume them, and it spreads depreciation in proportion to output volume. This supports the first hypothesis within the limits of the case studied.

Second, TDABC. The cost of a tablet under TDABC was SYP 4.805, which is SYP 0.395, or about 7.6%, below the target cost. Adopting it at the same margin gives a pack price of SYP 461.3, about SYP 38.7 below the competitor's. The cost measured on the basis of the time a tablet actually consumes in each department thus falls within what the market allows. This is the meaning of strategic cost adopted in this study, and it supports the second hypothesis.

Third, the difference between the two measurements. The two costs differ by SYP 0.6859 per tablet, which is 12.5% of the traditional cost and about SYP 69.4 million on the year's output. The difference stems from the basis of measurement and not from any actual reduction in costs, and it should not be read as a measure of unused capacity. Its main source is the work in process. The traditional figure is the cost of finished production, which includes the net work in process carried into the year (SYP 106,985,300 at the beginning less SYP 23,836,440 at the end, or SYP 83.1 million). This amounts to SYP 0.8217 per tablet. Without it, the manufacturing cost of the year's production is SYP 472,496,187, or SYP 4.6692 per tablet. TDABC, on the other hand, prices only the time the tablets consume, at the rate of each department's practical capacity, and gives SYP 4.805, which is SYP 0.1358 higher than the traditional cost of the year. This smaller gap comes from the different basis of assigning conversion costs: the traditional system spreads overheads by output volume, whereas TDABC charges each department's resources according to the time the product takes in it. Unused capacity is therefore not measured by the gap between the two figures. It is measured department by department, as the cost of practical capacity that products do not consume (Table 5), and TDABC leaves it out of product cost. This is why the TDABC figure, built only on the resources the product consumes, is the one that can properly be compared with the target cost.

Fourth, where the cost lies. Tables 4 and 5 show what the traditional statement does not: the conversion cost of a tablet is concentrated in two departments, automatic packaging with 46% and manual filling with 40.6%, or about 87% between them, against 12.9% for compression and less than 1% for preparation. This is the information target costing needs at its second stage. If the target were tightened, shortening the time a tablet spends in these two departments, or lowering their capacity cost rate, would be the most direct route to it, whereas no effort in the preparation department would have any appreciable effect. Table 5 adds a second point: manual filling is used at almost 89% of its practical capacity by Cetamol alone, so any growth in the product's output would soon meet a bottleneck there, while preparation and compression have considerable room.

Fifth, the safety margin. The margin between the cost measured under TDABC and the target cost is 7.6%, which gives management room for manoeuvre. It can sell a pack for up to SYP 38.7 less than the competitor while keeping the set profit margin, or absorb a rise in costs of that order without exceeding the target. The margin would disappear only if the competitor cut the price of its pack by more than 7.7%, to below SYP 461.3. This does not mean that the comparison is made once and for all. The integration of the two approaches assumes that it is repeated whenever the market price or departmental costs change, and that work on reducing cost in the two departments identified above continues.

Sixth, requirements for implementation. The case also shows what the integration requires in practice. The first requirement is data: TDABC needs departmental costs separated by organisational unit, and target costing needs regular information on competitors' prices. In the company studied the former existed in the cost accounts, but the latter came from occasional market studies. The second is time estimation. Times taken from engineers' estimates and batch records were sufficient for an initial model, as Kaplan and Anderson (2007) suggest, but they should be replaced in time by direct measurement or by data drawn from production records. The third is the involvement of employees. Times and capacity can only be estimated with production engineers and line supervisors, and cost reduction in the departments identified depends on their cooperation, so the work cannot be done from the accounting department alone. The fourth is periodic review. The model has to be updated whenever prices, wages, machines or production methods change, and the comparison with the target cost repeated, otherwise the information it gives loses its value.

Limits of the study. These results are confined to one company, one product and one year, and they cannot be generalised statistically to the Syrian pharmaceutical industry. Other manufacturers differ in size, ownership, product range, degree of automation and cost systems, and the relative weight of departments, the level of unused capacity and the size of the gap from the target cost may well differ with them. Cetamol is a high-volume product with standard, repetitive operations, which suits TDABC; the method would require more complex time equations for products with many variants or small batches. Departmental times rest on the estimates of engineers and on batch records, not on direct measurement, although the sensitivity test shows that the conclusion holds within a wide range of these estimates. The traditional cost was affected by the movement of work in process in the year studied. TDABC was not applied to the plant's other products, so that the capacity not consumed

by Cetamol could not be divided between other products and idle capacity. The results should therefore be read as evidence that the integration is workable in a specific case, not as a general verdict, and its application to other products and firms is left for further research.

11. RESULTS AND RECOMMENDATIONS

Results

1. Target costing and TDABC complete each other. The first determines from the market what the product should cost; the second measures what the product consumes of the firm's resources and points to where cost can be reduced. Neither takes the place of the other.

2. The target cost of a Cetamol tablet was SYP 5.20. Its cost under the traditional costing system applied in the company was SYP 5.4909, 5.6% above the target, which at the set margin leads to a price higher than the competitor's.

3. The cost of a tablet under TDABC was SYP 4.805, about 7.6% below the target, which allows a price below the competitor's while preserving the set margin. The difference between the two measurements, 12.5% of the traditional cost, results from the basis of measurement and not from an actual reduction in costs. It arises mainly from the work in process carried into the year, which the traditional cost of finished production includes, and from the different basis of assigning conversion costs. The conclusion remains valid if practical capacity is taken at 80% or 85% of theoretical capacity, or if the estimated times are understated by up to about 20%.

4. Applying TDABC showed that about 87% of the conversion cost of a tablet is concentrated in the automatic packaging and manual filling departments, information the traditional cost statement does not provide. It also showed that Cetamol consumed SYP 201.9 million of the SYP 291.1 million of conversion resources supplied to the four departments; the remaining 30.6%, concentrated in preparation and compression, is capacity used by other products or left idle.

5. Between the cost measured under TDABC and the target cost there is a safety margin of 7.6%. It allows the firm to price below the competitor or to absorb a rise in costs of that order, and it would disappear only if the competitor's price fell by more than 7.7%. Keeping it depends on following the market and repeating the comparison whenever prices or costs change.

6. The results of the case support both hypotheses. The traditional system provided neither a cost consistent with what the market allows nor a picture of how that cost is distributed inside the plant, whereas the integration of TC and TDABC provided a strategic product cost and a guide to managing it.

Recommendations

1. The company studied, and similar Syrian industrial firms, should take target cost as the starting point in pricing products that face price competition, and review it periodically as competitors' prices change.

2. TDABC should be applied alongside the existing costing system in stages, starting with the products of largest volume and then extending to the plant's other products, so that unused capacity in each department and its cost can be measured.

3. Cost reduction efforts for Cetamol should be directed to the automatic packaging and manual filling departments, by studying the time of a tablet in them and how far it can be shortened, and whether their capacity can be used for additional production.

4. Direct measurement of processing times should replace estimates wherever possible, and time equations should be documented and updated whenever production lines change.

5. Staff in finance and in production management should be trained for the joint work the two approaches require, since neither can be applied from inside the accounting department alone.

6. Further studies should apply this integration to other products and industries in Syria, and extend it to the product design stage and to the measurement of unused capacity.

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AUTHOR CONTRIBUTIONS

Mohamad Haytham AL Debs: Conceptualization, methodology, writing – original draft, writing – review and editing.

Osama Mohamad Bitar: Investigation (data collection), data curation, formal analysis.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

The study is based on company cost records and did not involve human participants or personal data; ethical approval was not required.

DATA AVAILABILITY STATEMENT

The cost data were provided by the company for research purposes and cannot be shared publicly.

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