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A process collection methodology towards managing cost of quality within Saudi Universities: An insight into costs of universities' self-financing activities

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Abstract

This study examines the development of cost and management accounting in higher education institutions, with a focus on the benefits of applying quality-cost management systems to self-funded programs. The researcher proposes the use of a Time Driven Activity-Based Costing (TD-ABC) methodology to achieve this, and applies it to the self-resources department of a Saudi Arabian government university. Structured interviews with top management, section managers, and accountants were conducted to identify relevant activities, resource usage, and time taken for each activity, with the aim of gathering data to implement the TD-ABC technique in the unit. The proposed TD-ABC system would provide more accurate cost information for the university's self-resources, enabling decision makers to improve the efficiency of management decisions and contribute to better educational and investment outcomes.

Keywords: *Quality-Cost Management (QCM); Time Driven Activity-Based Costing (TD-ABC); Higher Educational Institutes (HEIs); Citation Analysis, Self-Funded Program.*

Introduction

Teaching and learning are the most critical activities in the higher education institutions. However, they require substantial financial and monetary considerations, which has led governments to be increasingly concerned over quality and value for money in those institutions. Thus, identifying the educational products that have high priority remains a major challenge facing decision makers within universities. Sources of universities' revenues should be reduced or completely eliminated if they are more than the revenues themselves. Hence, it is necessary to find additional revenue to maintain these products or to identify methods to diminish their costs. A major method to cut costs would be to search the reasons behind not only the high quality, but also the poor one.

The post-secondary academic environment represents the most interesting environment for quality improvements (i.e. TQM), but it encounters, on the other hand, social and economic circumstances that hamper number of colleges and universities to brace TQM as fundamental

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operating practice (Bonvillian & Dennies, 1995). Examples of these circumstances include, but are not limited, to the difficulty to find standardized definition of quality in the academic enterprises (who is the customer?) (Quinn et. al, 2009), the centralized organisational structure of these institutions (Bonvillian & Dennies, 1995), the individualism among academics and the individualistic method of recognizing and rewarding quality performance (Bonvillian & Dennies, 1995; Owlia & Aspinwall, 1997), and lack of interdepartmental trust and lack of confidence in ability of administrators to implement the TQM tools (Ho & Wearn, 1995).

All previous scholars proved the successful application of TQM in the context of higher education. However, they neglected the cost/benefit analysis that would confirm the financial consequences of adopting this technique, and to what extent the results of their research were worth the effort (Koch & Fisher, 1998). It is still unknown whether applying quality improvement methodologies with colleges and universities is worthwhile, or not. Hence, this study focuses on the potential consequences of applying quality-cost management systems to the self-recourses department at University of Tabuk, which is responsible for the university's self-funded programs (i.e., those are funded from outside the appropriation for the University of the State budget). To achieve this objective, the study primarily seek to answer the following questions: (1) what are the potential consequences of applying quality-cost management systems to self-funded programs in Saudi Universities?; (2) how does the Time Driven Activity-based Costing (TD-ABC) methodology work in managing cost of quality?; and (3) what information do the universities' decision makers require to implement this technique in the self-resources department , and how can they systematically gather them?.

The study is structured in the following way. First, the paper provides background information, including a brief citation analysis for the articles addressing TD-ABC in the HEIs. Next, we discuss ABCs as a tool for managing the cost of quality. Then, it presents the argument for applying TD-ABC to the self-resources departments in Saudi universities. Later, the proposed methodology is presented. Finally, the paper concludes with a discussion of our findings and suggestions for further implications.

Background

Very little attention has been paid to the research on ABC practices, as a measure of quality costs, in the academia. A bibliometric analysis approach has been used to prove this through identifying the major articles addressing the implementation of ABC methodology within Higher Educational Institutions (HEIs). The Saudi Digital Library (SDL), which is the largest bibliographic database in the Arab world (SDL, 2020), was used as a primary search engine as it gives access to more than 310,000 scientific references, covering all academic disciplines (SDL, 2023). There are many citations discussing the application of ABC system. However, the citations have been limited to those that only matched the research scope and included the following

search string in their title, ("activity based costing" AND "university" OR "college" OR "higher education"). The results were also filtered to the publication years between 1996 and 2020, and to articles published in academic peer-reviewed journals that are written in English only, so articles published in other sources (e.g., conference materials and reports) and those written in other languages were excluded. The review, duplicated and irrelevant articles, as well as those are not indexed in the Scimago Journal & Country Rank website *(https://www.scimagojr.com)* have been also eliminated to arrive at only 19 hits (i.e. articles) in total. A summary of these papers are presented in Table 1.

What is interesting about the results evoked from this table is that the major strategy used in the analysed articles is case study or action research evidence. It can be noted that more than a half of these articles describe how ABC have been applied to a particular university and the benefits that accrue to it from the adoption of such techniques (Goddard & Ooi, 1998; Heaney, 2004; Roy & Goodall, 2005; Pernot et al., 2007; Yereli, 2009; Stouthuysen et al., 2010; Naidoo, 2012; Moradi et al. 2015; Valdivieso-Donoso et al. 2020). As many as half of these case studies were conducted in the library setting. This expected since most of those studies presented thus far provide evidence that both forms of ABC systems (i.e. traditional ABC and TD-ABC) are appropriate for universities libraries, and many library managers have considered them as the best of the existing costing practices for evaluating libraries products and /or services (Kont & Jantson, 2011). Some benefits of using ABC within a university library include: (1) enabling management to identify factors influencing activity costs, which helps in a decision-making process (Stouthuysen et al., 2010); (2) providing more equitable overheads allocation, which results in verified and filtered allocated costs (Goddard & Ooi, 1998); and (3) increasing accountability to the university for building more effective budget (Heaney, 2004). The rest of case studies included in Table 1 were distributed either within the context in which the activities of universities are, at the macro level (e.g., Lutilsky & Dragija, 2012; Naidoo, 2012; Moradi et al. 2015), or among a variety of individual departmental activities at university (Yereli, 2009; Valdivieso-Donoso et al., 2020).

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Table 1. A summary of academic articles addressing the implementation of ABC methodology within Higher Educational Institutions (HEIs).

The article	The author(s)	Journal name	Study aim & setting
Activity-Based Costing in UK Universities	Mitchell (1996)	Public Money & Management	Describing the usage of Activity-Based Costing (ABC) in UK universities
Activity-based costing and central overhead cost allocation in universities: A case study	Goddard & Ooi (1998)	Public Money & Management	A case study on the application of ABC system to library services at the University of Southampton, UK
Activity Based Costing in Universities - Five Years	Copper & Cook (2000)	Public Money & Management	Analysing the progress made by UK universities in implementing activity-based costing (ABC) in the period from 1993 to 1998/99.
Activity based costing in universities - An inappropriate technique?	Broad & Crowther (2001)	Journal of Applied Accounting Research	A review article about the ability of ABC to satisfy the requirements of universities in existence of challenging business circumstances
Easy as ABC? Activity-based costing in Oxford University Library Services	Heaney (2004)	The Bottom Line	Examining the efficiency of developing ABC for Oxford University Library Services (OULS).
Case for Using Activity-Based Costing as a Normative Model in University Housing	Roy & Goodall (2005)	Journal of College & University Student Housing	Examining the use of ABC as a normative model in university and college housing.
Time-Driven Activity-Based Costing for Inter-Library Services: A Case Study in a University	Pernot et al. (2007)	The Journal of Academic Librarianship	A case study on the application of time-driven activity based costing (TDABC) to inter-library loans (ILL) service at Arenberg library of the Catholic University of Leuven (KULeuven)

Activity-Based Costing and Its Application in a Turkish University Hospital	Yereli (2009)	AORN Journal	Comparing traditional costing approach with the activity-based one, using a case study on gall bladder surgeries in the general surgery department of one university hospital in Manisa, Turkey
Time-driven activity-based costing for a library acquisition process: A case study in a Belgian University	Stouthuysen et al. (2010)	Library Collections, Acquisitions, & Technical Services	Showing how to perform time-driven activity-based costing for a library acquisition process in a Belgian university and providing evidence of the benefits of such an analysis, using a case study strategy.
Activity-Based Costing (ABC) and Time-Driven Activity-Based Costing (TDABC): Applicable Methods for University Libraries?	Kont & Jantson (2011)	Evidence Based Library and Information Practice	Reviewing the literature on cost accounting practices of university libraries including the implementation of ABC and TDABC techniques.
Activity based costing as a means to full costing – possibilities and constraints for European universities	Lutilsky & Dragija (2012)	Journal of Contemporary Management Issues	Reviewing the literature on possibilities and constraints for implementation of the ABC within European universities, and proposing guidelines for applying this system to the University of Zagreb, Croatia.
Using activity-based costing to manage private universities in South Africa	Naidoo (2012)	Problems and Perspectives in Management	Implementing ABC as a new approach to manage costs at South African private universities.
Activity based costing of educational services in faculty of medicine in Mazandaran University of medical sciences, Iran	Moradi et al. (2015)	Journal of Mazandaran University of Medical Sciences	Determining activity centres, costing, including direct and indirect costs, and depreciation and construction costs in the faculty of medicine in Mazandaran University of Medical Sciences, Iran, using ABC system.
A process collection methodology towards TDABC costing	Ribadeneira et al., (2019)	RISTI - Revista Iberica de Sistemas e Tecnologias de	Proposing a process collection methodology that contributes to the creation of a costing model

optimization of IT services: a case study in an Ecuadorian university		Informacao (Iberian Journal of Information Systems and Technologies)	with Time-Driven Activity-Based Costing (TDABC) in an IT department in an Ecuadorian University
Costing model based on time invested by activity for technological services in higher education institutions: A case study	Valdivieso-Donoso et al., (2020)		Applying TDABC to the technological services at a public university in Ecuador.
Factors Affecting Activity-Based Costing Adoption in Autonomous Public Universities in Vietnam	Hoang et al., (2020)	Journal of Asian Finance, Economics and Business	Exploring the factors influencing the adoption of ABC in the autonomous public universities in Vietnam
Cost analysis of education for students in the School of Health of Alborz University of Medical Sciences: An application of activity-based costing technique	Pouragha et al. (2020)	Journal of Education and Health Promotion	Determining the financial impact of applying ABC system on the cost of educational services for medical sciences students at Alborz University of Medical Sciences.
Implementing Time-Driven Activity-Based Costing for Unused Capacity Measurement in Local University	Zainin & Abu (2023)	Sustainability	Developing a new costing system using time-driven activity-based costing for academic staff to illustrate the correlation between the supplied resources and the practical capacity in in a local university in Malaysia.
Activity-based costing technology adoption in Australian universities	Abeysekera & Sharma (2023)	Frontiers in Psychology	Evaluating the implementation of ABC among the adopters and non-adopters of this system within the Australian university using Technology Diffusion Framework, Social Cognitive Theory, and Dynamic Theory of Strategy.

Still, some previous scholars identified a number of perceived flaws relating to the application of ABC models, such as agreeing standardized cost drivers, time and cost of the implementation and lack of knowledge (e.g., Innes & Mitchell 1991; Cobb, Innes & Mitchell 1992; Kaplan 1990; and Argyris & Kaplan 1994). These issues are notably set in manufacturing environments, whereas the matter becomes more difficult when the implementation is in the academia (Broad & Crowther, 2001).

Although the concise citation analysis includes influential articles addressing the adoption and/or implementation of ABC techniques within HEIs, it neglects important efforts in this domain. For example, some research endeavours have illustrated the limitations of ABC implementation within HEIs, such as the need for a cultural change in understanding costs and cost drivers, and the difficulty of integrating ABC with existing management systems (Broad & Crowther, 2001; Dugdale & Lyne, 2006). Other research have proposed adjustments to the conventional ABC approach to better match the unique attributes of HEIs, such as incorporating non-financial performance indicators and considering the complexity of academic activities (Cuganesan & Dunford, 2006; Kohlbeck & Warfield, 2017). These efforts highlight the continuing amelioration of ABC methodology within the context of HEIs, and suggest further studies to continue to exploring and addressing the obstacles and prospects of this approach in this context.

ABCs as a tool for managing the cost of quality

In today's challenging and very dynamic business environment, organisations attempt to balance two important objectives: costs and quality. That is, the costs associated with achieving quality should be reduced since the purpose of continuous quality improvements is not only to keep stakeholders satisfied, but also to do this at the lowest cost (Schiffauerova & Thomson, 2006). Reducing quality costs could only possible if they are identified and calculated. Therefore, in many organizations, quality costs are tacitly estimated from an institution's total costs (Giakatis et al., 2001)

Evans & Lindsay (2014, p 483) defined the costs of quality as the "costs associated with avoiding poor quality" and "those incurred as a result of poor quality". That is, the costs of quality include the costs of all resources tapped by organisations to enforce quality standards (Bohan & Horney, 1991).

From traditional ABC to TD-ABC in HEIs

Kaplan and Anderson (2007) summarized seven issues relating to implementing the traditional ABC. The high time and cost to estimate an ABC system and to maintain it (through re-gathering the system-related data) have been main obstacles to widespread ABC adoption (Kaplan & Anderson, 2004; 2007). Based on the experience of a money centre bank's brokerage operation, Kaplan and Anderson (2004) reported that the ABC traditional system requires 70,000 staffs at

more than 100 facilities, only to submit monthly time surveys, and 14 full-time employees to manage the system (collecting the ABC-related data, processing it and reporting the outputs). They added that the high cost of maintaining ABC makes many implementers infrequently update the system (i.e. activity cost driver rates), leading to inaccurate estimates of the overall costs. The expansion of the organisation's activities is another potential challenge might encounter the users of the traditional ABC. The more activities the organisation has, the more data estimates, calculations and computational and storage burden are needed for cost objects (e.g. products and services).

Implementing the model in the HEIs has been also subject to considerable criticisms. For example, Perenot et al. (2011) addressed two significant flaws relating to ABC implementation within universities. First, the cost of setting up the ABC system, especially if the university's current accounting system cannot supply the data involved to process the new system. Second, the need for updating the system regularly, which further increases its costs. Moreover, it also became clear from many case studies in university libraries that the implementation problems of the ABC render it less efficient than theory would suggest.

In general, the traditional version of ABC seems costly and time-consuming, especially in dynamic environments. All the previous limitations actuated the seeking of a new updated model to be developed, which makes Kaplan and Anderson (2004; 2007) to introduce the new version of ABC system, which was officially named: Time-Driven Activity-Based Costing (TD-ABC). The new model represents an answer to the weaknesses of the old one.

Traditional ABC model begins with interviewing managers and the departmental employees in order to identify the relevant "activities" and allocate overheads to these activities, before driving them down to the cost objects (e.g., products or services) (see Figure 1).

However, TDABC skips this step and starts with allocating overheads based on the time consumed by each activity, using time equations that directly and objectively assign resource costs to the cost objects. Only two key inputs needed to calculate time equations: the capacity (i.e. time) required to perform an activity or process a transaction, and the unit cost of supplying capacity or the cost per time unit (see Figure 2).

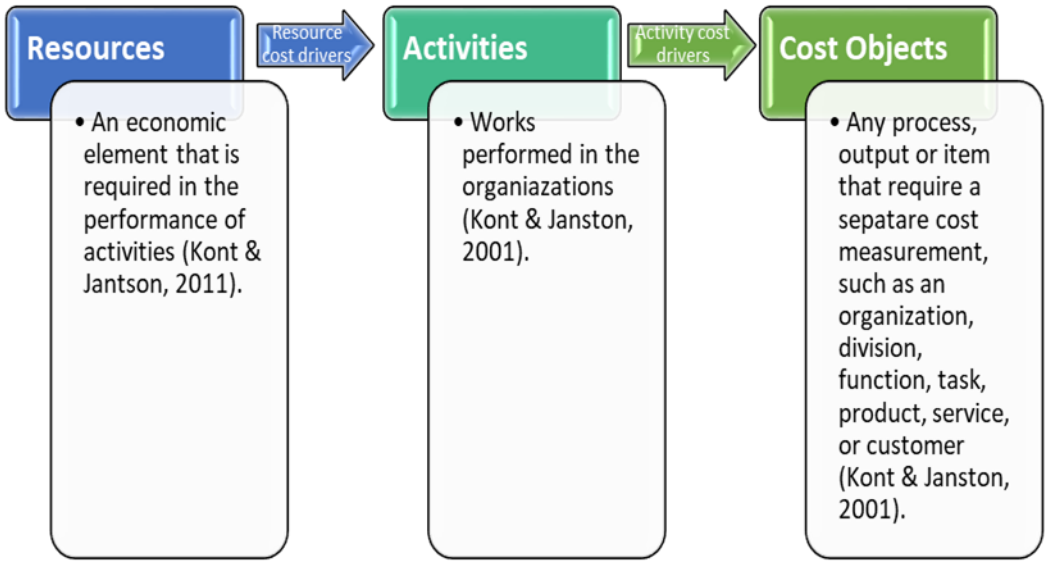

Figure 1. The structure of traditional ABC

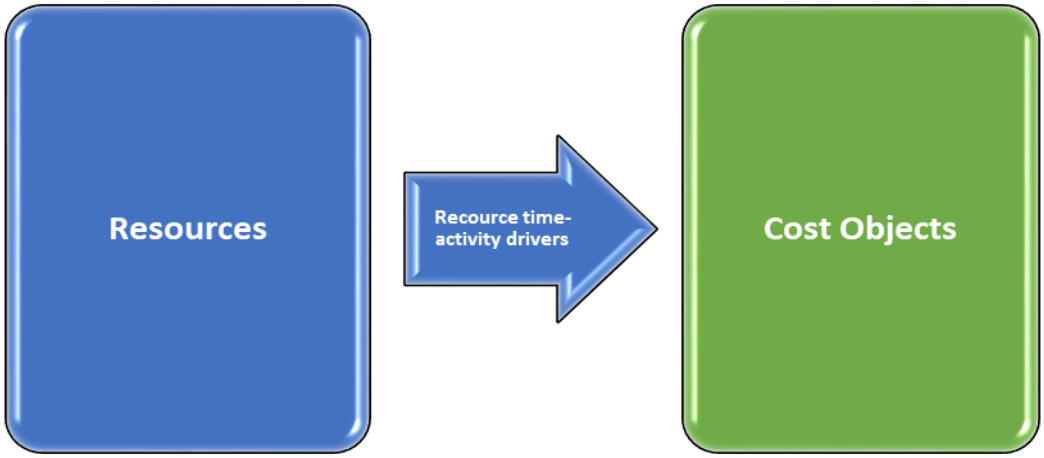

Figure 2. The structure of TD- ABC

Since the TD-ABC model uses labour time to measure the capacity of resources and to formulate time equations assigning the cost of these resources to the cost objects (discussed in later in this paper), it is particularly useful in service organizations (e.g., universities) or departments (e.g., finance), as capacities of such objects depend on the number of personnel and their efficiency. This usefulness of implementing TD-ABC in service sector has been confirmed by a number of

case studied successfully conducted organizations engaged in insurance, financial, intermediation, retail, IT and education (i.e., Jack State University) (Kaplan & Anderson, 2007).

The argument for applying TD-ABC to the self-resources departments

Saudi Arabia has a dual support system for funding universities activities. The two components of this system are: (1) governmental fund, such as those items included in the universities appropriations of the State Budget; and (2) self-funding sources such as grants, endowments, bequests, rent(s) from university properties, paid academic programs, paid training services, and self-funded research projects/consultancies. Although this dual funding model promotes diversity in activities and initiatives sponsored by Saudi universities through flexible financing mechanisms, most of these activities are mainly funded by government (Alshehey, 2017).

On the other hand, the Saudi Ministry of Finance's recent initiatives on its accounting system to move from cash to accrual-based accounting has led to greater transparency and accountability in spending on items included in Budget Statement, including spending on universities activities (Albattal, 2019).

Still, this future modification in the criteria of the state revenues and expenditures recognition has not motivated the universities' funders (i.e. government and universities themselves) yet to distinguish between the direct and indirect costs of universities activities. Indirect costs that support universities activities are often neglected in Saudi universities' costing systems, and these costs are not explicitly covered by universities (Hamad et al. 2019). This incomplete costing system may cause universities' internal control (auditing) system to be weaken, and make them unable to protect their public assets and vulnerable to fraud and manipulation. This is contrary to what was stated in Article 38 of the Statute Governing Financial Affairs in Saudi universities (Council of Universities' Affairs, 2021, Chapter 6), which reads: *"The University shall have an accounting system that complies with the financial instructions regarding budget and accounts, and in which all the elements of internal control are available, so as to provide the necessary reports to the administration and concerned parties"*. Therefore, universities and other HEIs need to establish and implement a full costing system, such as ABC models, to help management with information for strategic decisions, and thus to sustain the inputs and outputs of these institutions.

The basic argument in favour of looking forward to future full application of the full costing system in the self-resources department is as it takes the form of a state-owned enterprise (SOE) that operates on a profit-and-loss principal, and thus its current financial and accounting system should be similar to that used in business enterprises. However, the unit's current accounting system (i.e. before conducting this study) is neither governmental accounting system, nor business one. According to this system, there is no discrimination between the capital expenses and the current revenue expenditures (e.g., only direct labour costs that are considered as

operating expenditures). This is clearly stated in the subparagraph (l) of the second paragraph of Article 47 of the Statute Governing Financial Affairs in Saudi universities (Council of Universities' Affairs, 2021, Chapter 8), which is related to the Purposes and Rules of Expenditure of University Revenues for University Revenues Earned from Conducting Research, Studies, and Academic Services, which reads:

"The *estimated costs stated in the project budget, remunerations for consultants, researchers and other participants in performing the work from University affiliates or others are disbursed according to the costs stated in the agreements that the institute or the center concludes internally with the consultants, researchers, and others, and within the scope of the costs of contracts with the beneficiaries.*"

Therefore, the current accounting practices in the department under study are incomplete, and the need for designing a new financial system that evaluate the costs of the activities managed by the department is very important. This successfully can be accomplished by employing techniques such as TD-ABC and migrate them to the whole university's activities in the future.

The Proposed Methodology

The proposed methodology is consist of three stages: preparation, data collection, and TD-ABC model development (See Figure 3).

Stage 1: Preparation

In order to replace the current incomplete costing system used in the self-resources department at the University of Tabuk with TD-ABC system, effective team formation requires careful planning and coordination. According to Tarricone and Luca (2002), a key element for successful teamwork is a joint pledge on the success to achieve team's objectives.

Therefore, it is crucial to secure the endorsement of the university's top management and the cooperation of the employees in the pertinent department when applying this methodology. Moreover, it is important to engage the managers of the relevant departments in regular meetings, where they can share their perception (e.g., their knowledge, experience, and skills) on the activities under consideration. Cooperating with specialists from various fields can also increase the quality of the process collection. By doing so, the researchers or participants can address any difficulties or challenges that they may have neglected while collecting the relevant data.

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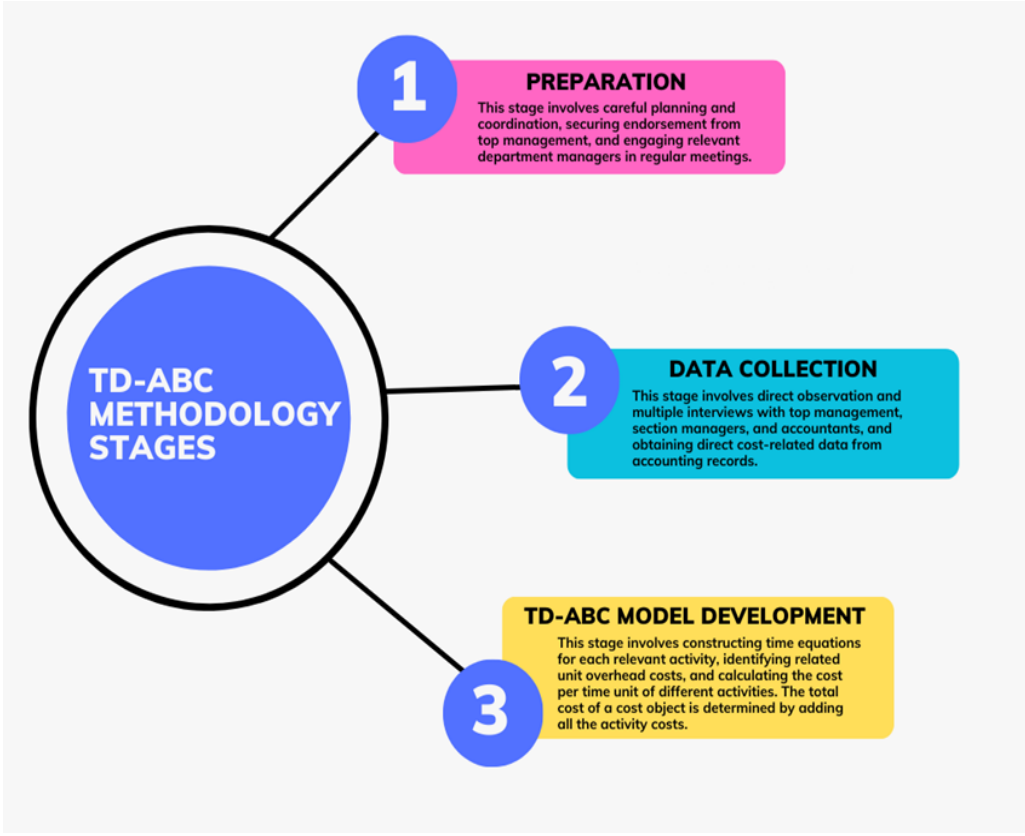

Figure 3. An overview of the proposed methodology

Before the field study starts, an analysis of the department's organisational structure must be conducted. This includes analysing its strategic directions (i.e., its vision, mission, and objectives). Moreover, it is important to deeply delve into the types of services and activities provided/undertaken by the department using a suitable instruments (e.g., a structured interview and/or observation) in order to execute the process of data collection. According to Ribadeneira et al., (2019),

It is also imperative that the levels of activities are identified in terms of a condition chart that would be devised by the specialists and department's team. For example, Ribadeneira et al., (2019) applied the following condition chart: (1) the activity lasts for 20 min or more; (2) the detail level needed; and (3) the amount of basic activities are 3 tasks or more. Therefore, the activities are assigned to a specific level based on the previous conditions. Since the activities included in the targeted department are not excessively complex or overly simplified, there is no need to classify them into different levels for the purpose of implementing TD-ABC system. This is acceptable

since this approach is designed to be easily updated to reflect changes in processes, order variety, and resource costs (Kaplan and Anderson, 2004; 2007). This suggests that the decision to classify services into levels may depend on the specific needs and goals of the unit. Looking at the department's organisational structure presented in figure 4, it can be said that the department is actively supervised by the 'top of the pyramid' in the university (i.e., the President and his Vice-President).

This can support the prior suggestion for the importance of obtaining the approval and support of the university' top management for initiating the real application of the proposed costing system and implementing its recommendations. Figure 4 shows that the targeted department has two main operative service lines (units): (1) Human Resources Unit; and (2) Financial Affairs Unit. The first unit include three human resources-related operations, whereas the second one has six accounting and financial operations. All operations include multi-activities that represents specific actions or steps that are performed within an operation. The department's activities ,in general, are not directly visible or tangible to the final beneficiaries, but are necessary for the functionality and quality of the services provided.

Stage 2: Data Collection

As for data collection methods, data for relevant activities, resources and times should be collected through direct observation and multiple interviews with the directors of the self-revenue department at University of Tabuk, and their accountants who are involved in the unit under study. Interviewees have to understand the aim of the interview.

Thus, concepts such as activities, resources, times and frequencies of the activities should be clearly defined to them. An matrix were used to collect data during the structured interview with the targeted interviewees. The matrix includes the steps and data involved in implementing TD-ABC within the self-resources department at University of Tabuk. A summary of the matrix's findings and conclusions is presented in Appendix A.

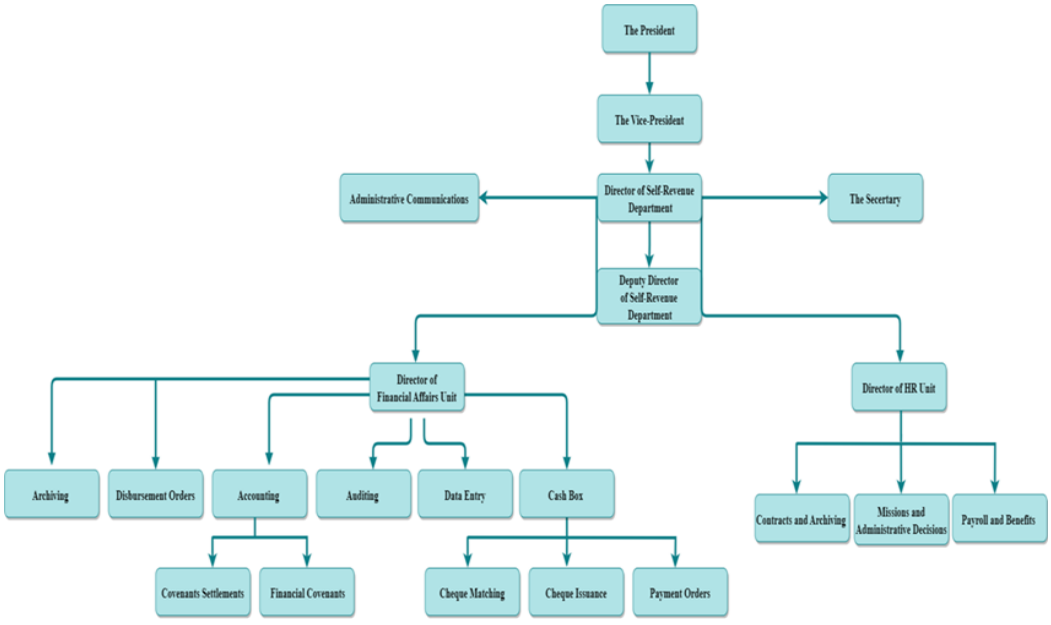

Figure 4. The organisational structure of the self-resources department at the University of Tabuk

On the other hand, the direct cost-related data (i.e., direct material and direct labour costs) required to complete the implementation of the system should be primarily obtained from the unit's accounting records.

The completed matrix can simplify the data validation process (i.e., its structure, completeness, consistency, and reliability). The matrix shows the activities, times, and resources (events) in an understandable method. The manager of the targeted unit can verify and provide feedback on the data provided by the interviewees. A peer review by accounting or financial specialists is also required to ascertain the validity of the data. The goal is to represent the activities-based data accurately and realistically. Since the unit is within the organisational structure of the university, it is advisable to benefit from the accounting and finance academic departments for this purpose.

Stage 3: Developing TD-ABC model

The TD-ABC mechanism can be described mathematically, as outlined by Homburg (2005) and Everaert and Bruggeman (2007):

$$TC = DMC + DLC + OHC \qquad (1)$$

where:

TC = Total cost of a cost object.

DMC = Direct Materials costs.

DLC = Direct labour costs.

OHC = Overhead costs.

Direct material costs and direct labour costs are traceable, and thus can be attributed directly to the object costs (e.g., products or services). However, overheads are untraceable costs and must be allocated.

TDABC attempts to constructs different time equations for each relevant activity. Therefore, the relevant activities administrated by the self-resources department are firstly identified. Secondly, the time exerted (t) to perform an event (e) of activity (i) can be mathematically calculated as follows (Everaert and Bruggeman, 2007):

Process time = sum of individual activity times

$$t = \beta_0 x_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots\ldots + \beta_p x_p \qquad (2)$$

where:

$t_{i,e}$ = process time required to perform event (e) of activity (i)

β_0 = the standard (constant) time required to perform an activity (i)

β_n = the estimated time for the incremental activity (p)

x_p = the quantity of incremental activity (p).

Thirdly, the related unit overhead costs are identified and the cost per time unit of the different activities is calculated, where the overhead cost of an individual activity (i) is mathematically calculated as follows:

$$C_{e,i} = t_{e,k}\, c_n \qquad (3)$$

where:

$t_{i,k}$ = the time consumed by event (k) of activity (i).

c_n = the cost per time unit of resource pool (group) (n), which can be calculated as follows:

c_n = the total cost of the resources group ÷ practical capacity (time) of resources supplied.

If the process time required to perform an event (i.e., resource) of the activity is Zero (i.e, not calculated by the unit under investigation), as in our case, and it has only the time required to complete the whole activity, the practical capacity of the resource(s) required to perform the activity still can be estimated. The process time required to perform the activity, in this case, can

subtracted from the total available time of the resource(s). This will give you the practical capacity of the resource(s) for that activity.

Once the practical capacity of the resource(s) is calculated, It can be then multiplied by the cost rate of the resource(s) to calculate the overhead cost of the activity to arrive at a more accurate measure of the cost of performing the activity, based on the actual time required to complete it.

For example, let's say the activity is "preparing and printing checks", and the total process time required to perform this activity is 10 minutes. The resources required to perform this activity have a total available time of 480 minutes per day.

To calculate the practical capacity of resources for the activity, the 10 minutes of process time would be subtracted from the 480 minutes of total available time, which gives you 470 minutes of practical capacity for the resources used for this activity (i.e., preparing and printing checks).

If the cost rate of the resources is SAR 50 per hour, or SAR 0.83 per minute, then the practical capacity of 470 minutes can be multiplied by the cost rate of $0.83 per minute to get an overhead cost of SAR 389.10 for this activity.

Finally, the total cost of a cost object is determined by adding all the activity costs as follows:

$$TC = DMC + DLC + \sum_{i=1}^{I} \sum_{n=1}^{N} \sum_{k=1}^{M} + t_i c_n \quad (4)$$

where:

I = number of activities.

M = number of resource pools.

Discussion and Conclusion

The present study delineates a systematic methodology for the implementation of Time-Driven Activity-Based Costing (TDABC). This methodology can be visually represented through diagrams or flowcharts, thereby facilitating the collection of requisite data in an organized and consistent manner. Furthermore, the methodology enables the verification of its validity and reproducibility within real-world contexts.

The methodology comprises three stages: preparation, data collection, and TD-ABC model development. The preparation stage entails meticulous planning and coordination, obtaining endorsement from top management, and engaging relevant department managers in regular meetings. The data collection stage encompasses direct observation, multiple interviews with top management, section managers, and accountants, and the acquisition of direct cost-related data from accounting records. The TD-ABC model development stage involves the construction of time equations for each pertinent activity, the identification of related unit overhead costs, and

the calculation of the cost per time unit of different activities. The total cost of a cost object is ascertained by aggregating all activity costs.

The paper yields several significant implications. Firstly, it can enhance the accuracy and reliability of the costing system employed by the department, thereby facilitating improved decision-making with regards to resource allocation and cost management. This can ultimately contribute to augmenting the department's overall efficiency and effectiveness. Secondly, the study can serve as a template for other departments or organizations seeking to implement a TD-ABC system. The methodology delineated in the study can be adapted and applied to disparate contexts and situations with appropriate modifications and adjustments. Thirdly, the study can contribute to advancing academic and theoretical knowledge within the field of management accounting by providing a conduit to empirical evidence on the practical application and effectiveness of the TD-ABC system. This can serve to enrich and validate extant theories and models while generating novel insights and perspectives. Overall, the study possesses conceptual, managerial, and academic significance and can provide valuable contributions to relevant fields.One limitation of this study is the lack of access to the direct cost records of the department under investigation. However, this information is expected to become accessible once the university adopts an accrual accounting basis. This limitation may impact the accuracy and reliability of the cost data used in the study, and consequently, hinder the complete implementation of the system. Therefore, suggestions for further studies include revisiting the implementation of TDABC once such financial information are available. This would facilitate a more comprehensive and precise analysis of the costs associated with the department being examined, and enable a more rigorous evaluation of the effectiveness of TDABC within this context.

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Appendix A. . The outcomes of the interviews with the manager/duty managers of the department under investigation and their accountants

Unit	Operations	Activities and the estimated time for each activity	Resources	Estimated costs
Human Resources Unit	Payroll and benefit	Reviewing and verifying the accuracy of payroll records received from the Information Technology Department. (1 hour per pay period) Ensuring that deductions are applied in accordance with the decisions made. (30 minutes per pay period) Ensuring that the salaries of suspended contractors are stopped. (30 minutes per pay period) Preparing individual payroll and allowance records for employees of entities that do not have payroll units. (2 hours per pay period) Periodically reviewing and verifying job information data and making necessary adjustments. (1 hour per month)	Accounting software, payroll software, IT department, HR staff	Salaries and benefits of HR staff, software and system licensing fees, office supplies and equipment
	Missions and administrative decisions:	Preparing administrative decisions. (2 hours per decision) Ensuring the implementation of decisions related to renewing contracts, sick leave, regular leave, and emergency leave for contractors on self-generated revenue. (30 minutes per decision) Preparing letters related to employees. (1 hour per letter)	Administrative software, HR staff, legal staff	Salaries and benefits of HR and legal staff, software licensing fees, office supplies and equipment

		Preparing service certificates. (30 minutes per certificate) Monitoring the registration of leaves in the electronic management system for employees. (30 minutes per day)		
	Contracts and Archiving:	Preparing employment contracts. (2 hours per contract) Opening a file for each employee. (30 minutes per employee) Saving employee documents in a file for each employee in the general archives. (1 hour per employee) Monitoring the classification of employees in self-financing programs according to their academic qualifications, in accordance with regulations and rules. (30 minutes per month) Entering and saving each administrative transaction in specific files for easy reference. (30 minutes per transaction)	Administrative software, HR staff, general archives	Salaries and benefits of HR and legal staff, software licensing fees, office supplies and equipment
Financial Affairs Unit	Cash box	Preparing and printing checks. (1 hour per check run) Delivering financial entitlements to their recipients. (1 hour per pay period) Preparing a statement of the contents of the box of financial transactions automatically. (30 minutes per statement) Preparing a statement of company addresses and phone numbers automatically for future reference. (30 minutes per year) Contacting entitled individuals to receive their entitlements. (30 minutes per pay period)	Accounting software, cash box, financial staff	Salaries and benefits of financial staff, software licensing fees, office supplies and equipment

		Preparing periodic statements about expenditure activity. (2 hours per statement) Conducting periodic inventory of the contents of the box to ensure the safety of the checks. (1 hour per month) Reporting on checks that have not been cashed by their recipients and have been outstanding for a long period of time. (30 minutes per month) Monitoring transactions handed over to representatives of entities and urging them to return them promptly. (1 hour per month) Referring completed transactions to the general archive for preservation. (30 minutes per transaction)		
	Data Entry	Entering data for each financial transaction into the computer system to facilitate retrieval. (30 minutes per transaction)	Accounting software, data entry staff	Salaries and benefits of data entry staff, software licensing fees, office supplies and equipment
	Auditing	Auditing financial transactions and ensuring the accuracy of accounting processes. (2 hours per month) Claiming ineligible or mistakenly disbursed amounts. (1 hour per occurrence) Signing financial transactions and payment orders after verifying their accuracy. (5 minutes per document) Recording notes on transactions that do not meet the criteria for proper and legitimate disbursement, both from a regulatory and	Accounting software, audit staff	Salaries and benefits of audit staff, software licensing fees, office supplies and equipment

		accounting perspective. (30 minutes per transaction)		
	Accounting	Recording daily financial transactions that are related to financial covenants. (1 hour per day) Recording all financial revenues. (4 hours per month) Preparing financial covenant settlements. (1 hour per settlement)	Accounting software, accounting staff	Salaries and benefits of accounting staff, software licensing fees, office supplies and equipment
	Disbursement orders	Preparing disbursement orders. (1 hour per order)	Accounting software, financial staff	Salaries and benefits of financial staff, software licensing fees, office supplies and equipment
	Archiving	Saving all financial documents and reports in secure place/files. (30 minutes per document)	General archive, financial staff	Salaries and benefits of financial staff, office supplies and equipment