

Integrating Activity Based Costing (ABC) with Enterprise Resource Planning (ERP) for Effective Management: A Literature Review

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Abstract

In the age of a global competition environment, the accurate costing measurement is important for planning and decision-making. To achieve this goal, contemporary costing methods are tested and applied such as the Activity Based Costing (ABC) in conjunction with the use of modern Information Technology (IT). The review study attempts a comparative analysis of both ABC and Traditional Costing Accounting (TCA), examining the main themes emerging from academic research and practitioners concerning the challenges, benefits, and barriers of ABC, analyzing the impact of the integration between ERP and ABC systems and its effect on management performance. A review of the literature generated an initial pool of 322 studies. Upon extensive review, 38 studies were found to be relevant to this topic. It appears from the review and analysis of the academic literature and professional sources that a successful integration among ERP and ABC minimizes the operation costs, enhances competitiveness, improves the management of the enterprise, due to its abilities to provide more accurate costing information for a strategic decision. However, practical implications in adopting ABC under ERP could be very challenging, requires a huge amount of internal resources, commitment among employees, and top management. In closing, additional research studies employing both qualitative and quantitative methods as well as case studies are needed in order to provide insights into the impact of ERP and detailed implications of how the ABC accounting system is adapting to the ERP environment and its effect on firm performance.

Keywords: Activity Based Costing, Traditional Costing Accounting, Enterprise Resource Planning, Management and Information Technology.

JEL, codes: M40, M41, M10, M11, M15

1. Introduction

In today's advanced and competitive manufacturing environment, the need for more accurate cost information for planning and decision-making is crucial. Researchers, such as Mia and Chenhall [1] argue that perceived environmental uncertainty requires the cost system to provide information on the cost of goods or services at the appropriate time and analysis is necessary for planning and decision-making. Copper [2], Ittner et al. [3] claimed that increasing levels of competition in relation to the shorter life cycle of manufactured products require a change in managing costs. Thus, the costs play a crucial role in the growth of corporations, especially in the industrial sector.

Traditional Costing Accounting (TCA) systems were developed to comply with the external financial reporting requirements of large enterprises such as textile mills, railroads, steel companies, and retail companies in the United States [4]. At that time, most companies manufactured a narrow range of products or services, and TCA systems were appropriate because overhead costs were low in comparison to direct costs. Therefore, the use of the TCA systems are specifically beneficial when there are a few similar products that have the same production process and production-related activities. In other words, TCA uses to group all manufacturing overhead costs in one single cost driver or cost pool to units produced such as rent, utilities, direct labor or machine hours or output volume to allocate the overhead costs, systematically distort product costs in a modern manufacturing environment in which overhead cost is a significant portion of product costs.

The growing industrial complexity and product diversity have made the emergence of the Activity Based Costing (ABC) system for growing organizations. ABC is an important tool that ensures accurate product costs as compared to the TCA system. Thus, ABC is explained by numerous authors [5, 6] as a strategic tool that ensures accurate product costs as compared to the TCA system.

However, regardless of the numerous researches and surveys on TCA and ABC, a few studies have examined the integration of ABC within the ERP environment, underlined both the advantages and disadvantages of the two systems. Therefore, this review study is trying to investigate the contingent factors influencing and motivating ABC's implementation success under the ERP system and its organizational performance.

The objective of this study is to provide an overview of the cost accounting systems, both TCA and ABC system. The study analyzes findings of empirical studies and surveys, with an emphasis on ABC's challenges, benefits, adoption, and barriers. Furthermore, this review presents the conceptual and theoretical framework of the ABC system within the ERP environment. In particular, the study aims to analyze, highlight, and address all issues arising in the adoption and implementation of ABC into the ERP environment for effective management.

By reviewing and analyzing empirical research and professional sources, the study provides an overview of emerging themes relevant for future research

and practice. By doing so, this review study makes two major contributions. First, it is one of the very few studies to provide an integration of ERP research in the ABC accounting context, offering an overview of this innovation to practitioners and academics. Second, it provides an overview of how ABC could change and be impacted by ERP improving the management of the enterprise. Thus, this study supports both current and future practitioners in how to approach the fast-moving ERP advancement into ABC accounting.

The methods used for this review study were mainly: data collection - grounded theory and comparative analysis. Data collection was done in different ways. For instance, using existing knowledge in the literature collecting and reviewing academic publications on ABC and ERP field. We sourced relevant publications and empirical studies by launching a keyword search on Google Scholar. From this initial pool, only peer-reviewed academic journal articles or book chapters were considered. Upon extensive review, we excluded book chapters and journal articles, whose content was not related to ERP and ABC accounting domain. The employed keyword combinations are listed in Table 1. This search provided an initial pool of 322 academic sources.

Table 1: Initial Google Scholar search results

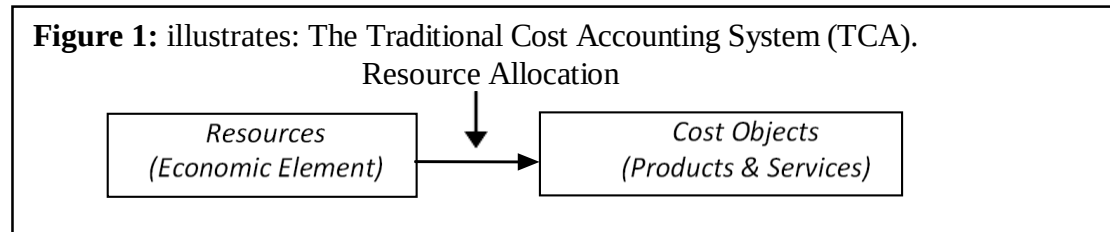
	Key search term combinations	Number of studies
1.	"ERP System" and "Activity Based Costing System"	149
2.	"ABC Costing" and "ERP System"	102
3.	"Activity Based Costing System" and "Enterprise Resource Planning System"	44
4.	"ERP" and "ABC Accounting System"	18
5.	"ABC Accounting System" and "ERP System"	9
	Total	322

Furthermore, after eliminating conference papers, book reviews, and articles, we obtained a total of 38 publications that explicitly address ERP in the ABC accounting system. Hence, the scientific rigor in the conduct of each step is very critical to an analysis of its quality for this review study. Moreover, cooperative analysis is very crucial for this review, since it is the main product of the research as it produces new knowledge based on complete data collection.

The remainder of this review study is organized as follows: in section 2, we present a literature review of both costing accounting systems, TCA and ABC and the impact of ERP on ABC system; in section 3, we present a review of the ABC concept; in subsection 3.1, we review the theoretical frameworks to obtain a holistic picture of the cost accounting systems, both ABC versus TCA systems; in subsection 3.2, we investigate the challenges, the benefits and the barriers of ABC adoption; in section 4, we examine the impact of ERP system on ABC adoption; in section 5, we examine the empirical literature focusing of ABC adoption for effective management; in section 6 and 7, summary-conclusions and suggestions for future research for further study are presented.

2. Literature Review

TCA systems try to assign cost directly to products, rather than to activities first and then from the activities to product units [7]. This approach suffers from several defects that result in distorted costs for decision-making. Thus, the typical cost report gives information on what is spent, but not why it is spent. This can lead to inaccurate determination of product or service costs, figure 1 illustrates the (TCA).



However, the growing industrial complexity, the shorter life cycle of manufactured products, and product diversity have led to the development of the ABC system for growing organizations [8]. The ABC system was formed to solve the problems of TCA management systems; which are often unable to identify correctly the true costs of products and services. ABC was introduced to address the deficiencies of the TCA system since the TCA system leads to cost distortion [9, 10]. The ABC system is required for accurate cost and profit analysis, especially for organizations that have high overhead cost and diversity in their processes and products. ABC is important since it is impossible to manage something if it is not measured accurately. Hence, ABC improves decision making by providing timely and accurate cost-related feedback that extends to all business functions [11].

Specifically, ABC was designed and developed to overcome the following defects and weaknesses found in the TCA system:

- a) lack of accurate measures for assessing the cost of products [12];
- b) failure to handle the production overheads [13];
- c) failure to allocate non-manufacturing costs that are associated with the production, such as administrative expenses [9];
- d) failure to contribute decision making and provide cost precision accurate of costs [14]; and
- e) inability to modify cost behavior patterns and provide relevant long-term variable costs for strategic decisions [14].

Moreover, in today's rapidly changing business world, most of the growing corporates and organizations are moving towards Enterprise Resource Planning (ERP) systems, in order to integrate their cross-functional business processes. An ERP system promises more and better information, which can lead to lower costs and improve management performance. It integrates and automates most business processes and shares information enterprise-wide in real-time [15]. Therefore, combining ABC and ERP systems are useful in the following two situations:

- Integrating ABC under ERP environment increases the organization's efficiency and improves cost control and decision-making [16], and

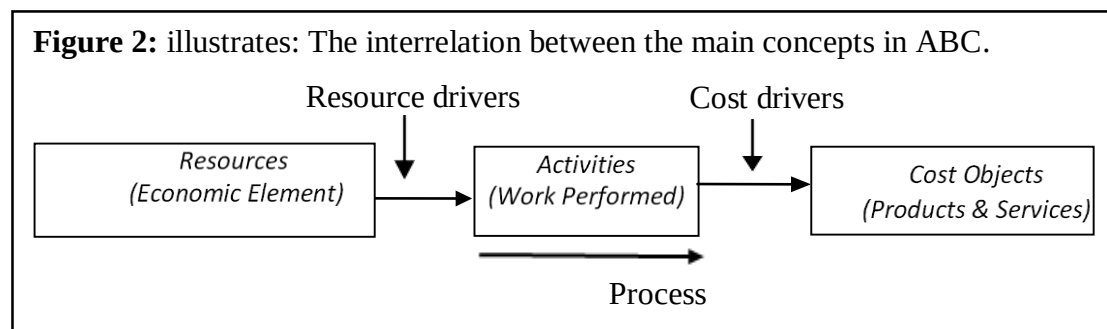
- the use of modern IT technology boosts the adoption of ABC into the ERP system to improve its overall success and performance [17].

Thus, the combination of ABC and ERP management systems will not only improve the accuracy of cost calculation, but also raise the enterprise management level, and enhance the competitive power of the enterprise in the current economic environment.

3. The ABC Concept

Activities consume resources, activities cause costs, whereas outputs consume activities; thus, activities are the core of the ABC concept [18]. The focus of ABC is on identifying the costs of major activities and allocating such costs to objects based on their usage of activities [19]. It is apparent that the ABC system looks for the cause of costs or cost drivers of organizational activities, and traces these activities sequentially to products [20]. By this philosophy, ABC can directly assign manufacturing costs to products and can provide insightful information regarding the authentic costs of an operational process [21]. Therefore, ABC prevents cost distortion. Cost distortion occurs because TCA combines all indirect costs into a single cost pool. Cost distortion is prevented in ABC by adopting multiple cost pools (activities) and cost drivers, figure 2 illustrates the ABC system. Hilton, et al., [22], identified the basic steps of ABC as follows:

- Identify and measure the different levels of resource costs.
- Measure the costs of individual activities.
- Identity cost-driver bases and measure activity cost-driver rates.
- Use cost-driver rates to assign activity costs to products, jobs, and projects.
- Analyze the profitability of products using ABC unit-level and full costing.



3.1. ABC versus TCA systems

Today, companies produce a wide variety of products, and thus the current cost scenario differs from that in previous decades due to the expansion of product lines and marketing methods [13, 23]. Direct labor no longer reflects the primary cost of production but instead now comprises uses only a small portion of it [23]. As a result, the direct labor hours or machine hours of manufacturing do not provide adequate information for cost calculation [24]. At the same time, expenses involving factory support operations, engineering, distribution, marketing, and other overhead functions have increased [13, 25].

Consequently, TCA systems fail to allocate non-manufacturing costs that are associated with production, such as administrative expenses [9]. TCA contributes to poor decision making and distortion of costs [26] resulting in distorted signals about the relative profitability of different products [27] and global competitiveness.

According to Abd [5] stated that TCA is almost obsolete. Research evidence indicates that businesses should intend to change and move to new administrative-accounting practices while exploring ways to reduce costs [28]. As a result of that, ABC has been promoted as the basis for making strategic decisions and improving profitability [24, 29].

However, Sartorius et al. [30] as well as Pavlatos and Paggios [31] accept that TCA systems are even more widely adopted than the ABC costing method. According to Sartorius et al. [30], it is not clear whether companies find the TAC systems appropriate or if businesses simply do not consider the ABC costing method as a better option. Furthermore, a large percentage of enterprises failed to implement ABC successfully [32] with the main problems being identified both at the design, technical and parameterization stages (complexity and compatibility). Further, several problems associated with the high costs of ABC implementation and maintenance [33].

Nevertheless, according to the literature, ABC method improves the shortcomings of TCA systems by allocating the indirect costs to the products produced and the services provided. The ABC system allocates costs to products or customers, based on the resources they consume, [34]. Hence, the TCA system is irrelevant and create a need for a new costing system such as the ABC system, in order to meet the demands and expectations of the manufacturing, service, and financial sector.

3.2. Challenges, Barriers, and Benefits of ABC

Despite the advantages of ABC over TCA systems, the adoption rate of ABC remains low. Research indicates that the implementation of ABC is difficult and complex, and there are many barriers such as lack of top management support, employee resistance, lack of necessary internal resources, lack of implementation expertise, and satisfaction with current systems [35, 36, 37, 2, 38, 39]. Others found that the major barriers to the adoption and implementation of ABC were resistance from top managers and employees, lack of adequate resources, and lack of experiences [40, 41]. For example, Cohen et al. [35] found that Greek companies encountered ABC implementation difficulties in certain fields, namely software selection, data collection, adequacy of resources, and resistance of employees to ABC. The authors also determined that the adequacy of resources is positively correlated with other variables such as personnel resistance, prolongation of ABC timetable, and lack of top management support.

According to Cobb et al. [42] identified that organizations have difficulties implementing ABC, in selecting suitable activities and cost drivers and linking cost drivers to individual product lines, as well as the uncertainty overusing ABC for stock valuation for external financial reporting. Sartorius et al. [30]

interviewed 10 consultants, 5 ABC companies, and 5 non-ABC companies in South Africa. The authors found that the main obstacles and difficulties in implementing ABC application were lack of top management support, too expensive to implement ABC, difficulty with data collecting, lack of skills, lack of adequate IT systems, satisfaction with the existed cost management system and problems identifying activities and selecting suitable cost drivers.

Likewise, Pierce and Brown, [43] conducted a study to determine the main barriers that certain companies in certain industries face in the implementation of ABC. They found several obstacles, including lack of support by top management, employee training, lack of human resource availability, complexity in establishing and selecting cost drivers, lack of knowledge and experience of consultants, satisfaction with the current system that organizations might have adopted, the simplicity of the manufacturing process that organizations could have and the irrelevance of ABC to the nature of the business. In addition, some organizations have not adopted ABC because they believe ABC is a temporary fad whose appeal, like that of all fads, will eventually pass [44, 45]. The following table 2 summarizes the main reasons (surveys and case studies), that companies reject the adoption of ABC include:

	Main Challenges and Difficulties implementing ABC	Authors
1.	Technical issues - identifying Activities and Cost drivers	[46, 47, 36, 35, 30, 43].
2.	Lack of Top Management	[35, 48, 49].
3.	Inadequate Computer Software	[48, 49, 42, 35].
4.	Resistance to Change	[47, 36, 30, 50, 35].
5.	Internal Resources	[47, 36, 41].
6.	Time Consuming	[48, 49, 43, 51, 52]
7.	Cost Structure (Level of Overhead)	[12, 53, 26, 54, 49]
8.	Satisfied with the Current system	[48, 49, 35, 30].

Table 2: The main Challenges and Difficulties in implementing the ABC system.

Numerous research studies reported the benefits of ABC adoption that facilitate cost management, cost reduction and process improvement of an organization. Dubihlela & Rundora [55] and Ittner, Lanen & Larcker [56] found that ABC is significantly associated with higher product quality and a decrease in cycle time. Majid and Sulaiman [57] found that ABC implementation contributes significantly to companies, especially in the manufacturing sector, and enables firms to differentiate the value-added and non-value added activities.

ABC is providing a decent basis to appraise stock value for financial reporting [46] and provide more accurate cost information for decision-making on product

mix [19]. According to Cagwin and Bouwman [58], ABC not only improves the accuracy of product and service costing but also helps managers comprehend how resources are used through financial performance, such as return on investment and bottom-line statements. Cagwin and Bouwman [58] also investigated the impact of ABC on 205 companies and found a significant and positive association between ABC and financial performance as measured by 3 and 5-year return on investment. The authors found that ABC can be linked to the organizational and financial performance of an organization as a modern cost accounting.

Moreover, ABC improves profitability measurements and strategic decisions about pricing, product lines and market segments [59, 60, 55]. While others emphasize that ABC provides accurate allocation of overhead costs and identification of areas of waste [55, 61]. Hence, the following is a summary of the previous research studies conducted between 1989 through 2015 that examined the main benefits of the ABC method:

1. Accurate allocation of overhead costs and identification of areas of waste, [55, 61].
2. More accurate product costing and a meaningful financial and non-financial measure that aids in cost management and performance assessment, [59, 62, 55, 46].
3. Facilitating the elimination of waste by providing visibility of non-value added activities and linking corporate strategy to operational decision making [63].
4. Better profitability measurements and better-informed strategic decisions about pricing, product lines and market segments, [59, 60, 55].
5. Management ability to target cost reduction, manage and control budgets, measure performance, and increase efficiency, [59, 55, 64, 65].
6. Positive impact on business performance, [66, 67].
7. Facilitation of decision making, increase in productivity, and identification of activities that don't add value, [64, 61].
8. ABC not only improves the accuracy of product- and service-costing but also helps managers comprehend how resources are used through financial performance, such as return on investment and bottom-line statements [58].
9. The basis for strategic decision making and measure continuous improvement and performance, [68, 64].
10. Alleviation of managers' concerns about the accuracy of cost allocations, cause-effect relationship between allocations and resources consumed, timeliness of cost/profit info, and ability to update systems, [59, 64].

4. The impact of ERP system on ABC

ERP system is an Information Technology (IT) infrastructure that facilitates the flow of information within the organization [69] and requires investments and significant organizational changes [70], whose implementation demands special care to avoid further losses [71]. Therefore, ERP combines business processes in both the organization and IT into one integrated solution and is a way of doing business, not just a software package [72, 73]. ERP systems are

information systems that integrate all the activities and functions of an organization to standardize its data and streamline its business processes. An ERP system promises more and better information, which can lead to lower costs. It integrates and automates most business processes and shares information enterprise-wide in real-time [15].

It has been stated that IT has played a vital role in ABC adoption and implementation, which has reduced the implementation costs and enhanced activity-based analysis process [14]. Therefore, the need for integration between ABC modules with other IT systems became popular in an attempt to develop and implement it. The study by Shaw [74] discussed the move by giant ERP vendors like SAP, Oracle, and PeopleSoft of investing in ABC Technologies towards this path.

ERP and ABC have different management subjects, nevertheless, they still have the basis for integration, such as the same costing objects ideas for cost management and management purposes. Several researchers such as Kim [75], Xihui and Zhenwei, [76] claimed that the ABC model is supported and implemented more effectively using ERP technology. Vazakidis et al. [77] examined the relevance of ABC in the Greek public sector. The authors revealed that when combined with new technologies and new methods of management, ABC can resolve most of the deficiencies of the public sector and help produce services at a minimal cost.

Xihui etc al. [76] stated that the development of IT technology has further promoted the improvement and enhancement of the ABC system. The adaptability of ABC improved considerably through the use of modern IT systems and under the ERP environment. Further, the modern IT systems within the ERP environment reduced the difficulty of integration and influenced effectively and positively to improve the cost management of enterprises [76].

Integrating the ABC within the ERP system can provide the ABC module with data, contained in the ERP system efficiently and economically. Therefore, the data that is crucial input for the ABC system, could remain within the ERP system to minimize cost, as a data source to the ABC module. Shaw [74] mentioned that the partnerships between ABC and ERP mean that operational managers will have access to ABC data in real-time. Management accountants and financial managers can conduct "what-if analysis" business solutions in an online application such as ABC under the ERP environment.

Similarly, Huijuan et al. [78] have suggested that a dedicated ABC module in an existing ERP system may save time and resources. Hence, manufacturing organizations may also need to consider their available resources when considering ABC software, as this may impact the efficiency of the ABC costing model, and therefore be a factor in achieving ABC implementation success.

Thus, combining the ABC and ERP systems can be efficient and successful as ERP makes it possible to determine the concept of the work center more broadly. Baxendale & Jama [16], stated that ERP systems can significantly provide the availability and reliability of activity cost-driver information by

integrating financial accounting, managerial accounting, cost accounting, and production planning using a relational database. The following table 3 displays a synopsis of the aforementioned research studies, which examines the main factors for implementing ABC within the ERP environment.

	<i>The Main Factors for Implementing ABC within ERP Environment</i>	<i>Authors</i>
1.	ABC within IT technology reduces the implementation costs and enhances activity based analysis process	[14, 77, 76, 78].
2.	ABC method is supported and implemented more effectively using ERP technology	. [75, 76, 16].
3.	ERP resolves most of the deficiencies and minimizes costs for ABC	[77, 76].
4.	IT technology enhances ABC system	[77, 76].
5.	ERP can provide data in real-time on ABC system	[16, 74].

Table 3: *The main factors for implementing ABC within the ERP environment*

Therefore, ERP systems can significantly increase the availability and reliability of activity cost-driver information and improve the ABC system. The integration among ABC and ERP means that managers will have access to ABC data in real-time. Having a single integrated environment, ABC under ERP increases the organization's efficiency and competitive advantage while eliminating many redundant activities which are essential to keep different systems synchronized and this leads to a great reduction in the operating costs. Thus, ERP and ABC systems will improve the organization's cost information while preserving the quality of the services in a timely and effective way.

5. The Adoption of ABC for Effective Management

ABC is claimed as one of the two or three most important management accounting innovations of the twentieth century [79]. Krumwiede [39]; Cooper and Kaplan [80]; Cooper [2]; Groot [50], stated that ABC is useful for organizations with large and growing expenses, increasing overheads, a large variety in products, complex operations, and customer processes. Several studies claimed that larger firms are more likely to adopt ABC, and they argue that larger firms have the required resources and thus, they are more capable of adopting ABC method [39, 32, 81]. Gosselin [82] indicated that the organizational structure and its strategy affect the adoption and implementation of ABC. Ahmed [83] stated that ABC is a strategic tool that ensures accurate product costs and production planning. Booth & Giacobbe [84] found a significant positive association between the overhead level and ABC adoption.

Numerous researchers stated that organizations implement ABC as a method of measuring accurate cost information for product costing. Cooper and Kaplan, [13] stated that the growing costs and product diversity are also a major reason for the adoption of ABC. Ahmadzadeh et al. [8] found a positive association between cost structure and the importance of cost information, products, services, and ABC implementation. The research also revealed that many companies proceed to the implementation of ABC because they want to modernize their cost accounting system in order to better depict costs or to improve their business processes. Other reasons that justify ABC adoption are the allocation of indirect costs, managerial decision making, planning, and organizational performance. Moreover, the decision to adopt ABC is often driven by the need to improve customer profitability analysis and to gain more accurate cost information for pricing or to prepare relevant budgets [55].

Several research studies argued that ABC is a modern costing methodology developed to meet the demand of businesses to provide critical information for decision-making [85] improving management performance. Managing an organization requires accurate and timely information on the cost of processes, activities, customers, and cost objects. ABC is a costing information system that has emerged and been introduced as an alternative to address the weakness of TCA accounting systems for organizations that need more accurate and reliable costing information [13, 54, 10].

According to Ruan et al. [86] ABC is a scientific management accounting tool, and thus it is bound to occupy an important position in the cost control of Chinese organizations. ABC can provide more accurate and useful cost information for performance measurement, cost control as well as strategic and operational decision-making [87, 48, 88]. Thus, the implementation of ABC offers valuable information for performance measurement, cost control, strategic decision-making, and planning.

Haroun [89] indicated that ABC can assist manufacturing firms to allocate indirect costs accurately and improve all levels of organization cost control. Wen Subin [90] examined the application conditions of ABC and emphasized its positive effect on the establishment of the cost accounting system. Hence, when cost information derived from the ABC method, it can support pricing, product mix, and decisions. Further, it can be effectively used for the development of cost-effective product design and process improvement [91], such as lower costs, improved quality, and decreased manufacturing cycle time [56, 92].

ABC is a generally accepted costing application that provides significant support in operating financial, strategic decision-making for effective management [59]. The ABC system can identify problems in the business process and solve bottlenecks, provide opportunities to redesign and develop new products and services. Therefore, ABC is not only a costing tool but a way of managing a modern enterprise [58].

6. Summary & Conclusion

This review revealed that adopting the ABC method could be very challenging. ABC requires a huge amount of adequate resources and commitment among employees and top management support. Further, several problems are encountered in identifying activities and cost drivers and it is costly to implement and time-consuming. Regardless of the above limitations, ABC has been widely identified as a sophisticated cost management method that is used to manage and reduce costs as well as improving business organizational performance and financial management. Further, ABC is argued to provide more accurate information for products and services. Moreover, ABC enhances cost control and provides managers with relevant and timely information in today's competitive business environment.

Furthermore, this review study emphasizes that ERP can determine the success of ABC implementation, and generate a number of benefits especially, in a situation where the ERP system includes more than just the financial and human resource module. It helps ABC managers make better product costing decisions and it changes the whole structure of the ABC system, having less uncertainty issues. The use of ERP and ABC systems increased the availability of decision-support information for managers and save significant time and resources. Thus, ABC and ERP systems can improve financial and organizational performance for organizations.

Further, this study reviewed the theoretical and empirical literature concerning the use of the ABC method to overcome the deficiencies of TCA systems, recommending the ABC method as a modern management tool. Through this review, we found that ABC has far more advantages over TCA systems, improving profitability, performance and the decision-making process. In contrast, TCA systems failed to provide cost precision for strategic decision-making.

Finally, the study found that integrating ABC within ERP affects the whole organization, enhances all processes and functions of a firm, and maximizes the efficiency of business operations while improving management practices and eliminating non-value-added activities for strategic planning and decision making, improving cost management of organizations.

7. Suggestions for Future Research

Future research may use different methodological approaches, both quantitative and qualitative to further explore this topic. On the one hand, largescale survey questionnaires may allow for large samples of observations in assessing the diffusion stage of ABC within the ERP environment. In this regard, survey questionnaires allow for the measurement of existing levels of ERP knowledge and awareness in ABC costing. On the other hand, qualitative single or multiple case studies may provide in-depth insights into how the ABC accounting system is adapting to the ERP environment and improve management performance.

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