



Measuring the Success of Activity-Based Costing within the Enterprise Resource Planning Environment in Greek Companies

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Abstract

Activity-based costing (ABC) is a strategic tool that can enhance all processes and functions of an organization once it is implemented successfully. This study aims to examine ABC implementation success in Greek companies in major sectors of the economy. A web-based questionnaire was conducted between February 2020 and January 2021 to collect data from 102 companies in major sectors of the Greek economy. The success of ABC implementation was assessed across five dimensions: general attitude toward the implementation process, technical and technological characteristics, impact on organizational processes, perceived usefulness in improving job performance, and perceived ease of use. Further, this study compared companies that have fully implemented ABC to those that still practice traditional cost accounting (TCA) by assessing factors that influence ABC success within enterprise resource planning (ERP). Findings from this study show that successful integration of ERP and ABC can minimize operation costs and enhance the competitiveness of the enterprise. In particular, the findings indicate that the degree of ABC within ERP implementation success positively motivates the extent of its use, enhances user performance, increases productivity, and increases user satisfaction with the system. This study contributes to the existing literature since there has been limited research on the measurement of the success of ABC within ERP implementation in Greek companies. It also provides theoretical and practical insights regarding factors that might influence the successful implementation of ABC within ERP that can be applied to other countries. Overall, entities that have implemented ABC have achieved improved outcomes relative to those that still use TCA.

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Activity based costs
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1. Introduction

In today's highly competitive environments, businesses struggle under cost pressure and profit margin squeezes. As a result of intense competition, business entities must effectively manage costs and competitively

price their products and services. Hence, cost management methods and cost measurement are becoming more important aspects of pricing, controlling, and overall decision making.

Several studies have stated that ABC success leads to improved decision making (Anderson & Young, 1999; Byrne, Stower, & Torry, 2009; Innes & Mitchell, 1995; Krumwiede, 1998; Nassar, Morris, Thomas, & Sangster, 2009), satisfaction with the current costing system (McGowan & Klammer, 1997; Swenson, 1996), and perceived financial and non-financial benefits (Hussain & Gunasekaran, 2001; Krumwiede, 1998; McGowan, 1998; Shields, 1995). However, the success of ABC is problematic when it is not clearly defined. Shields (1995) highlighted the difficulty in defining ABC success, as did Anderson and Young (1999), who also acknowledged the difficulty in defining ABC success and stated that “A danger of asking managers to rate ABC implementation success without specifying the definition of success is failure to detect cases in which individuals hold different views on the definition of success but share views on attainment of a particular dimension of success”. Given these issues regarding what constitutes successful ABC implementation, the main objective of this study is to determine the companies that have fully implemented ABC successfully compared with those organizations that still use TCA systems by using the McGowan (1998) and Davis (1989) models in Greece. The second goal of this study is to examine the vital role of information technology (IT) and the diffusion of enterprise resource planning (ERP) systems in motivating the implementation of ABC systems successfully.

This study contributes to the existing literature since there has been limited research regarding ABC implementation success in Greek companies. Further, the results of this research complement the existing literature by linking ABC implementation within the ERP environment and investigating and analyzing specific factors that enhance the ABC system when it is integrated with ERP systems.

This paper is organized as follows: The literature is presented in the second section, the third section is dedicated to the methodology of this research, the fourth section describes the results of the survey, the fifth section discusses the research findings, and the last section presents the conclusions.

2. Literature Review

ABC success refers to the degree to which management uses ABC information for decision making in order to improve financial performance (Foster & Swenson, 1997), the users' attitude towards ABC (Frederick & Supitcha, 2001), the overall use and accuracy of ABC (Anderson & Young, 1999), technical characteristics, perceived usefulness in improving job performance and its impact on organizational processes (McGowan, 1998), its use in decision making, decision actions taken, dollar improvements and manager evaluation (Foster & Swenson, 1997), increase in firm value (Kennedy & Affleck-Graves, 2001), and overall use and accuracy (Anderson & Young, 1999). Thus, companies that have successfully implemented ABC are more likely to have accurate product and service costs, show cost improvement and cost reduction, and provide managers with the right tools for decision making.

2.1. Measuring ABC Success in the Present Study

This study uses the grounded theory of several prior studies (Anderson & Young, 1999; Foster & Swenson, 1997; Krumwiede, 1998; Shields, 1995) that have been conducted to measure ABC success. Success has been also measured by management evaluation (Shields, 1995), use of, and satisfaction, with ABC (Swenson, 1996), and employee satisfaction (McGowan & Klammer, 1997). Second, this study attempts to measure the success of ABC based on theoretical work developed by McGowan (1998); Davis (1989) and McGowan and Klammer (1997). McGowan (1998) cited that “measures that describe the users' reactions to the innovation, such as attitudes and satisfaction, are appropriate surrogates for assessing the success of an information system”. On the other hand, Davis (1989) applied the theory of reasoned action (TRA) to information technology and developed it into a technology acceptance model, which explains the motivation of users to adopt new technology. The technology acceptance model consists of three components – perceived ease of use, perceived usefulness, and attitude toward its use. Therefore, this approach to successful ABC implementation is divided into five perspectives that contribute to its acceptance: general attitude toward the implementation process, technical and technological characteristics, perceived impact on organizational processes, usefulness in improving job performance, and perceive ease of use.

In the present study, we measure the overall attitude toward the implementation process of the ABC module within the ERP environment. We evaluated differences in technical and technological characteristics between the two costing methods (ABC versus TCA) within the ERP system. The measure of “perceived usefulness” is focused on ABC users' perceptions of its usefulness within the ERP environment concerning their job. The measure of the “impact on organizational processes” explores the impact of ABC within the ERP environment on the quality of decisions, decision making, minimization of the non-value-adding activities, enhancement and simplification of the processes of the costing system, and the overall success of the firm. The measure of the “perceived ease of use” measures ABC users' perceptions of how easy ABC is to use within the ERP environment that contributes to its acceptance.

2.2. Users' Attitude Toward the Implementation Process

Attitude refers to an individual's tendency to respond in a favorable or unfavorable manner to an object or behavior (Ajzen & Fishbein, 1980; Al-Jabri & Rotzocki, 1995; Fagan, Neill, & Wooldridge, 2008). McGowan (1998) stated that attitude is the affective evaluation directed toward an object or event. The theory of reasoned action (TRA) suggests that people form the intention to adopt a technology based on what they believe the consequence of the adoption will be (Ajzen & Fishbein, 1980). Thus, attitude is a central concept in TRA, which suggests that attitude toward a behavior is a key determinant of performing that behavior in the future. TRA maintains that people form their attitudes toward a behavior based on their experience with the behavior or their understanding of the consequences of performing that behavior. From TRA, Davis (1989) developed the technology acceptance model, which attempts to provide reasons why individuals choose to adopt or not to adopt a particular technology when performing a task. Moreover, attitude plays an important role in implementing a new system (McGowan, 1998). In the context of information systems (IS) use, attitude toward their use can be defined as the tendency of users to respond in a favorable or unfavorable manner to an IS application, IS staff member, or a process related to the use of a system or application (Melone, 1995). Numerous studies on information systems utilized attitude as a key determinant of systems' usage (Al-Jabri & Rotzocki, 1995). Evidence shows that if ABC is perceived by users as successful, both the firm's manager (Swenson, 1996) and employees will adopt it. McGowan and Klammer (1997) showed a positive attitude toward the ABC system and claimed that ABC is superior to its predecessor. McGowan (1998) stated that if a firm implements ABC successfully, it will result in a positive attitude toward ABC, users will accept the high technical characteristics of information produced by ABC, it will be useful in improving their job performance, and it will result in improved organizational processes compared with the traditional costing system. However, several researchers revealed that IT determines the success of ABC implementation and is a critical factor for using ABC extensively (Krumwiede, 1998). ABC becomes more beneficial as the cost of data collection and processing is reduced, which requires higher levels of IT (Cooper, 1987) It needs to be supported by a robust IT support team (Weber et al., 2016) as the use of modern IT technology boosts the adoption of ABC into the ERP system and improves its overall success and performance (Ansheng, 2011).

2.3. Technical and Technological Characteristics

Research evidence indicates that traditional costing systems have been criticized for failing to provide accuracy (Argyris & Kaplan, 1994; Billington, 1999; Booth & Giacobbe, 1998), timeliness, reliability (Belardo & Wallace, 1998; Chenhall & Langfield-Smith, 1998), understandability (Booth, 1997), and accessibility (Booth, 1997; Cokins, 1996). However, ABC assigns costs to objects more accurately and reliably (Byrne et al., 2009; Cokins, 2001; McGowan, 1998), providing a better understanding of the activities performed, improving profitability (Innes & Mitchell, 1991) and improving organizational performance (Turney, 1996).

Therefore, differences in technical characteristics between the ABC and the TCA systems were assessed to determine whether ABC is superior to TCA. The technical characteristics in this study included accuracy, accessibility, reliability, timeliness, and understandability. For this study, the technological characteristics examined whether subjects' perceptions of their ABC cost management system within the ERP will differ significantly from their perceptions compared to the TCA system in the ERP environment along with seven qualitative characteristics (accessibility, reliability, accuracy, up-to-dateness, timeliness, operability, and performance). According to research evidence (Kim, 2009; Xihui & Zhenwei, 2016), the ABC model is supported and implemented more effectively using ERP technology. Integrating ABC into an ERP system generates several benefits which affect the entire organization (Huijuan, Yuqian, & Guoping, 2011). Byrne et al. (2009) emphasized that improvements in IT (software and hardware) result in less complex and time-consuming implementation of ABC, and the use of modern information technology boosts the adoption of ABC into ERP systems, improving overall success and performance (Ansheng, 2011). Shaw (1998) mentioned that the partnership between ABC and ERP mean that operational managers will have access to ABC data in real time, and ABC within the ERP environment increases the organization's efficiency and improves cost control and decision making (Baxendale & Jama, 2003; Xihui & Zhenwei, 2016). Similarly, Huijuan et al. (2011) suggested that a dedicated ABC module in an existing ERP system may save time and resources. Xinxin and Weiping (2010) indicated that integrated ABC and ERP improves the operability and accuracy of ABC greatly and enhances the competitiveness of enterprises.

2.4. Perceived Usefulness in Improving Users' Job Performance

Davis (1989) defined perceived usefulness as the first factor that refers to the extent to which an individual believes that the use of a particular technology could enhance their job performance. Perceived usefulness refers to whether the system provides accurate, timely, relevant, reliable, and valid information for users or not (Miller, 2007). Therefore, using the system will enhance job performance, productivity, efficiency, and quality of work. Perceived usefulness is regarded as a term for individual impacts, such as improving individual productivity and performance (Rajiv, Jeyaraj, & Chowa, 2006; Seddon, 1997).

Leonard-Barton (1998) emphasized that the acceptance of an innovation by its users in an organization can influence the successful implementation of that innovation. Krumwiede (1998) found that the usefulness of cost information in decision making is significantly associated with extensive use of ABC. McGowan (1998) stated

that if ABC is implemented successfully, individuals may see improvements in the quality of their work, accomplish tasks more quickly, increase job productivity and improve job productivity, resulting in improved organizational processes than the TCA system.

2.5. Impact on Organizational Process

ABC was introduced to address the deficiencies of the TCA system since the TCA system leads to cost distortion (Cooper, 1987; Marx, 2009). It also fails to contribute to decision making and provide accurate costs, and it is unable to modify cost behavior patterns and provide relevant long-term variable costs for strategic decisions. Therefore, one of the most important systems in the field of managerial accounting is the ABC system. ABC emphasizes the continuous improvement of the process (Koehler, Balakrishnan, Lawler, & Shah, 2018), providing more accurate and useful cost information for performance measurement, cost control, and strategic and operational decision making (Bhimani & Pigott, 1992; Innes & Mitchell, 1991; Krumwiede & Roth, 1997). It is also described as a tool that supports managerial movement toward continuous improvement and concentrates on diagnostics and tactical issues (Cokins, 1998; Cooper & Kaplan, 1988). According to Ruan and Zhou (2019), 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 is a revolution in costing systems and can be used as a powerful tool for solving various management problems (Rahnamay, 2009), providing information on value-adding and non-value-adding activities, which managers can use to make the right decisions to achieve their goals.

2.6. Perceived Ease of Use in Contributing to its Acceptance

Perceived ease of use refers to the extent to which users believe that the use of a particular technology or system can manage and manipulate information with limited mental and physical effort (Davis, 1989; Kwasi, 2007; Wang & Strong, 1996). Hence, it shows the degree to which a system is considered easy to understand, learn and use.

There is a significant effect of perceived ease of use on usage intention, either directly or indirectly through its perceived usefulness (Davis, 1989; Jackson, Chow, & Leitch, 1997; Venkatesh & Davis, 2000; Venkatesh & Davis, 2007). Thus, perceived ease of use is hypothesized to be a predictor of perceived usefulness. Furthermore, assuming all things being equal, the easier a technology is to use, the more useful it can be (Wahid, 2007), contributing to its acceptance. Thus, it can be said that perceived ease of use becomes very important for ABC usage in the industry or service sector.

3. Methodology

The sample used in this study consists of companies from all major economy sectors of Greece, including the companies listed on the Stock Exchange of Greece that operate in the Athens region. The information for the sample selection includes financial statements and the number of employees. This information was obtained from the Nationwide Company Database (ICAP), which contains data from the register of legal business entities in the Greek Republic. The companies were included in the sample based on their total assets, their annual turnover, and the total number of employees in the last three years (2016, 2017 & 2018). Specifically, companies were selected if they had total assets of at least 4,000,000 euros, had a minimum net turnover of 8,000,000 euros, and had an average of 50 employees during the period. A total of 220 web-based questionnaires were sent via email, and the addressees were the management from the economic, finance, or control departments. To improve the response rate, email reminders were sent, followed by phone calls. The research was conducted between February 2020 to January 2021. A total of 102 anonymous usable questionnaires were received. However, for this study, we used data from 74 companies², which consisted of eight ABC users and 66 non-ABC users within the ERP environment. Since 28 companies had a standalone cost accounting system, which means that their cost accounting system was not in the ERP environment, they were excluded from the sample. A cover letter was sent to the companies via email stating that the research was being conducted in cooperation with the University of Macedonia and to explain the purpose and the ethical considerations pertaining to this research. The letter also stated that their responses would be treated as confidential according to Law 3627/1956 and Law 22392/1996. It was made clear that all participants will be treated with complete anonymity, no reference will be made to business practices at any point during the study, and all data collected will be used in the context of academic research.

3.1. Statistical Analysis

Descriptive statistics were performed to assess the sample characteristics. Proportions were computed for categorical variables, and the means and standard deviations for continuous variables. The t-test was used to determine any statistically significant differences in the average values of several measures between ABC and non-ABC users. The Statistical Package for the Social Sciences (SPSS) (Bryman & Cramer, 2001) was used to analyze the data.

4. Survey Results and Descriptive Statistics

ABC implementation success was assessed across five dimensions: user attitude toward the implementation process, technical and technological characteristics, perceived usefulness in improving job performance, impact on organizational processes, and perceived ease of use. Furthermore, associations between these five dimensions and acceptance of ABC within ERP were examined.

Sample characteristics of the ERP users by ABC status are shown in Table 1. We found that the majority of the companies were owned by shareholders ($n = 48$; 64.9%) but were not members of the business group ($n = 32$; 43.2%). Collectively, the sample had the least representation as members of the subsidiary ($n = 5$; 6.8%)/multinational ($n = 5$; 6.8%) groups in firm nationality. All of the ABC users were identified as public companies ($n = 8$; 100%). Although non-ABC users mostly identified as being public companies ($n = 65$; 98.5%), they were more likely to be owned by shareholders in comparison to ABC users who were split ($n = 4$; 50%). With regard to firm sector, 50% of the companies that were classified as ABC users belonged in the industrial or food sectors, while a large number of the non-ABC users were classified as trade or industrial companies. Descriptive statistics were also calculated for average assets, turnover, and employees within the last three years. Non-ABC users showed higher means for average assets ($M = 279559011.51$, $SD = 853498032.31$), turnover ($M = 370715068.2323$, $SD = 1163945522.35$), and employees ($M = 286.3990$, $SD = 419.1$) in comparison to ABC users (see Table 1).

Table 1. Sample characteristics of ERP users by ABC and non-ABC users.

Characteristics	ERP users							P-value
	Entire sample n = 74	ABC users n = 8 (10.8%)	Non-ABC users n = 66 (92.2%)	P-value	Entire sample n = 74	ABC users n = 8 (10.8%)	Non-ABC users n = 66 (92.2%)	
	n (%)	n (%)	n (%)		M (SD)	M (SD)	M (SD)	
Corporate company type				0.892				
Anonymous public company		8 (100)	65 (98.5)					
Anonymous industrial commercial company		0 (0)	1 (1.5)					
Firm sector				0.816				
Industrial	16 (21.6)	2 (25)	14 (21.2)					
Trade	16 (21.6)	1 (12.5)	15 (22.7)					
Construction/materials	7 (9.5)	1 (12.5)	6 (9.1)					
Food service	10 (13.5)	2 (25)	8 (12.1)					
Other	25 (33.8)	2 (25)	23 (34.8)					
Firm ownership (Combined)				0.288				
Not owned by shareholders	26 (35.1)	4 (50)	22 (33.3)					
Owned by shareholders	48 (64.9)	4 (50)	44 (66.7)					
Firm nationality				0.839				
Member of business group	25 (33.8)	3 (37.5)	22 (33.33)					
Member of multinational group	7 (9.5)	1 (12.5)	6 (9.1)					
Member of subsidiary	5 (6.8)	0 (0)	5 (7.6)					
Member of subsidiary of multinational group	5 (6.8)	0 (0)	5 (7.6)					
Not a member of a business group	32 (43.2)	4 (50)	28 (42.4)					
Average assets for the last three years					2654719 13.35 (811805 443.01)	1492533 53.54 (301915 368.99)	2795590 11.51 (8534980 32.31)	0.393
Average turnover for the last three years					3446151 34.4324 (110461 5512.97)	1292906 80.5833 (292020 857.64)	3707150 68.2323 (1163945 522.35)	0.179
Average employees for the last three years					284.1937 (405.82)	266.000 0 (293.4)	286.3990 (419.1)	0.863

The overall attitude toward the implementation of ABC systems within the ERP environment was assessed separately from the other measures of ABC success. The results related to this measure indicate that all of the ABC users expressed a very positive attitude toward ABC implementation.

A reliability analysis using Cronbach's alpha was conducted for the results shown in Table 2 on the perceptions of the test items among ABC users. All reliability scores were deemed acceptable for this study. Perceived usefulness ($\alpha = 0.75$; $n = 8$) was addressed with four items: (1) Using the ABC system within the ERP environment has led to a significant improvement in the quality of the individual respondents' jobs; (2) Using the ABC system within the ERP environment enhances effectiveness on the job; (3) Using the ABC system within the ERP environment enhances performance on the job; and (4) Using the ABC system within the ERP environment enables me to accomplish more work than under the TCA system. The impact on organizational processes ($\alpha = 0.73$; $n = 8$) was measured using six items: (1) Using the ABC system within the ERP environment provides real-time data; (2) Using the ABC system within the ERP environment simplifies the costing processes; (3) Using the ABC system within the ERP environment enhances the costing processes; (4) Using the ABC system within the ERP environment improves the quality of decision making; (5) Using the ABC system within the ERP environment minimizes non-value-adding activities; and (6) Using the ABC system within the ERP environment has a positive impact on interdepartmental relationships. Perceived ease of use contributing to its acceptance ($\alpha = 0.75$; $n = 8$) was measured by three items: (1) Learning to use the ABC module within the ERP environment is easy; (2) It is easy to become skillful at using the ABC module within the ERP environment; and (3) Users' familiarization with the ABC system in the ERP environment is faster. On average, perceived usefulness was higher ($M = 4.44$, $SD = 0.37$) than the other success measures. Impact on organizational processes ($M = 4.23$, $SD = 0.38$) was also important for this sample, followed by perceived ease of use ($M = 4.0$, $SD = 0.31$) (see results in Table 3).

Table 2. Reliability analysis: Measuring ABC success among ABC users within the ERP system.

Perceptions	Items	Cronbach's alpha	Reliability category (≥ 0.7 is acceptable)	Sample size ($n = 8$)
Perceived usefulness	Using the ABC system within the ERP environment has led to a significant improvement in the quality of the individual respondents' jobs. Using the ABC system within the ERP environment enhances effectiveness on the job. Using the ABC system within the ERP environment enhances performance on the job. In general, using the ABC system within the ERP environment enables me to accomplish more work than under the TCA system.	0.75	Acceptable	8
Impact on organizational processes	Integrating ABC within the ERP environment provides real-time data. Integrating ABC within the ERP environment simplifies the costing processes. Integrating ABC within the ERP environment enhances the costing processes. Integrating an ABC system within the ERP environment improves the quality of decision making. Integrating the ABC system within the ERP environment minimizes the non-value-adding activities. Integrating the ABC system within the ERP environment has a positive impact on interdepartmental relationships.	0.73	Acceptable	8
Perceived ease of use	Learning to use the ABC system within the ERP environment is easy. It is easy to become skillful at using the ABC system within the ERP environment. Users' familiarization with the ABC system in the ERP environment is faster.	0.75	Acceptable	8

Table 3. Measurements of ABC success.

Characteristics	Mean (SD)
Perceived usefulness	4.44 (0.37)
Impact on organizational processes	4.23 (0.38)
Perceived ease of use	4.00 (0.31)

The average values and associated standard deviations of the sample's technical characteristics are presented in Table 4. The scores for these characteristics range from 1–5 (1 = not at all, 2 = little, 3 = moderate, 4 = very, and 5 = extremely). The results show that, on average, there was a greater emphasis on evaluating the information produced by the cost accounting system with regard to reliability ($M = 3.16$, $SD = 0.88$), followed by accuracy ($M = 3.46$, $SD = 0.86$), timeliness ($M = 3.11$, $SD = 0.80$), and finally accessibility ($M = 3.08$, $SD = 0.79$). Out of the five evaluations, there was less emphasis on evaluating understandability ($M = 3.16$, $SD = 0.72$).

Table 4. Technical characteristics related to cost accounting of companies within ERP.

Technical characteristics	Mean (SD) <i>n</i> = 74
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding accuracy	3.46 (0.86)
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding accessibility	3.08 (0.79)
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding reliability	3.16 (0.88)
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding timeliness	3.11 (0.80)
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding understandability	3.16 (0.72)

Table 5 displays the technical characteristics by ABC status. A t-test was conducted to determine any significant differences in the average number of various technical characteristics between ABC users ($n = 8$) and non-ABC users ($n = 66$) within ERP. Non-ABC users include the entities that used TCA. Findings show that when evaluating the technical characteristics of cost accounting systems, ABC users scored significantly higher ($M = 4.63$, $SD = 0.52$) than the non-users ($M = 3.32$, $SD = 0.79$); $t(73) = -4.56$, $p < 0.000$. A significantly higher average for system accessibility was also found among ABC users ($M = 4.13$, $SD = 0.35$) compared to non-ABC users ($M = 2.95$, $SD = 0.73$); $t(73) = -4.44$, $p < 0.000$. Significant differences between ABC users ($M = 4.13$, $SD = 0.35$) and non-ABC users ($M = 3.05$, $SD = 0.85$) were found with regard to reliability [$t(73) = -3.54$, $p = 0.001$], timeliness [ABC users: ($M = 4.00$, $SD = 0.00$), non-ABC users: ($M = 3.0$, $SD = 0.78$); $t(73) = -10.36$, $p < 0.000$], and understandability [ABC users: ($M = 4.00$, $SD = 0.00$), non-ABC users: ($M = 3.06$, $SD = 0.7$); $t(73) = -10.92$, $p < 0.000$]. In other words, there were significant differences in all characteristics, with ABC users producing higher scores than non-users across all of these characteristics, indicating higher levels of evaluation of the cost accounting system regarding accuracy, accessibility, reliability, timeliness and understandability.

Table 5. Technical characteristics related to the cost accounting of companies within ERP by ABC users and non-ABC users.

Characteristics	ABC users <i>n</i> = 8	non-ABC users <i>n</i> = 66	T-test	P-value
	Mean (SD)	Mean (SD)		
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding accuracy	4.63 (0.52)	3.32 (0.79)	-4.56	< 0.000
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding accessibility	4.13 (.35)	2.95 (0.73)	-4.44	< 0.000
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding reliability	4.13 (0.35)	3.05 (0.85)	-3.54	0.001
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding timeliness	4.0 (0.00)	3.0 (0.78)	-10.36	< 0.000
Evaluation of the technical characteristics of the information produced by the cost accounting system regarding understandability	4.0 (0.00)	3.06 (0.7)	-10.92	< 0.000

Table 6 displays the technological characteristics among ERP users, including both ABC users and non-ABC users. The scale for these characteristics ranges from 1–5 (1 = not at all, 2 = little, 3 = moderate, 4 = very, and 5 = extremely). Integrating the cost accounting module within the ERP system provides better reliability ($M = 2.88, SD = 0.37$) in comparison to timeliness ($M = 2.78, SD = 0.48$) and operability improvement ($M = 2.78, SD = 0.48$), which had the lowest averages. Better accessibility ($M = 2.85, SD = 0.43$), provision of more accurate information ($M = 2.84, SD = 0.44$), improvement in the performance of costing systems ($M = 2.82, SD = 0.45$) and more up-to-date information ($M = 2.79, SD = 0.5$) were all moderately valued on average.

Table 6. Technological characteristics related to cost accounting in companies within the ERP system.

Characteristics	Mean (SD)
Integrating the cost accounting module within the ERP system provides better accessibility to information	2.85 (0.43)
Integrating the cost accounting module within the ERP system provides more reliable information	2.88 (0.37)
Integrating the cost accounting module within the ERP system provides more accurate information	2.84 (0.44)
Integrating the cost accounting module within the ERP system provides up-to-date information	2.79 (0.5)
Integrating the cost accounting module within the ERP system provides more information in a more timely manner	2.78 (0.48)
Integrating the cost accounting module within the ERP system improves the operability of the costing system	2.78 (0.48)
Integrating the cost accounting module within the ERP system improves the performance of the costing system	2.82 (0.45)

The results in Table 7 are the comparisons of the average values for the technological characteristics between ABC users and non-ABC users. There is a significant difference between the ABC and non-ABC users within ERP in the mean values for accessibility to information [ABC users: ($M = 3.00, SD = 0.00$), non-ABC users: ($M = 2.83, SD = 0.45$); $t(73) = -3.01, p = 0.004$], better reliability [ABC users: ($M = 3.00, SD = 0.00$), non-ABC users: ($M = 2.86, SD = 0.39$); $t(73) = -2.86, p = 0.006$], providing more accurate information [ABC users: ($M = 3.00, SD = 0.00$), non-ABC users: ($M = 2.82, SD = 0.46$); $t(73) = -3.2, p = 0.002$], operability [ABC users: ($M = 3.00, SD = 0.00$), non-ABC users: ($M = 2.76, SD = 0.5$); $t(73) = -3.96, p < 0.000$], and improving the performance of the costing system [ABC users: ($M = 3.00, SD = 0.00$), non-ABC users: ($M = 2.8, SD = 0.47$); $t(73) = -3.4, p = 0.001$]. For all of these characteristics, ABC users scored significantly higher than the non-ABC users, indicating that integrating ABC within the ERP system can provide the ABC module with data contained in the ERP system efficiently and economically. This means that operations managers will have access to ABC data in real-time, greatly improving the operability and accuracy of ABC and enhancing the competitiveness of the enterprise.

There was no significant difference between ABC users and non-ABC users in the average up-to-date information being provided [ABC users: ($M = 2.88, SD = 0.35$), non-ABC users: ($M = 2.77, SD = 0.52$); $t(73) = -0.54, p = 0.591$], or providing information in a more timely manner [ABC users: ($M = 2.88, SD = 0.35$), non-ABC users: ($M = 2.77, SD = 0.49$); $t(73) = -0.57, p = 0.570$].

Table 7. Technological characteristics related to the cost accounting of companies within ERP by ABC and non-ABC users.

Characteristics	ABC users n = 8	Non-ABC users n = 66	T-test	P-value
	Mean (SD)	Mean (SD)		
Integrating the cost accounting module within the ERP system provides better accessibility to the information	3.0 (0.00)	2.83 (0.45)	-3.01	0.004
Integrating the cost accounting module within the ERP system provides more reliable information	3.0 (0.00)	2.86 (0.39)	-2.86	0.006
Integrating the cost accounting module within the ERP system provides more accurate information	3.0 (0.00)	2.82 (0.46)	-3.2	0.002
Integrating the cost accounting module within the ERP system provides up-to-date information	2.88 (0.35)	2.77 (0.52)	-0.54	0.591
Integrating the cost accounting module within the ERP system provides more information in a more timely manner	2.88 (0.35)	2.77 (0.49)	-0.57	0.570
Integrating the cost accounting module within the ERP system improves the operability of the costing system	3.0 (0.00)	2.76 (0.5)	-3.96	< 0.001
Integrating the cost accounting module within the ERP system improves the performance of the costing system	3.0 (0.00)	2.8 (0.47)	-3.4	0.001

5. Discussion

The findings of this study indicate that the degree of success of ABC implementation positively motivates the extent of its use, enhances user performance, increases productivity, and increases user satisfaction with the system. The overall attitude toward the implementation of ABC systems within ERP environments was very positive. Similarly, a study by McGowan and Klammer (1997) showed a positive attitude toward activity-based costing (ABC) and claimed that ABC is superior to traditional cost accounting (TCA).

Regarding perceived usefulness in improving job performance, the impact on organizational processes and the perceived ease of use contributing to ABC acceptance, all reliability scores were deemed acceptable for this study. On average, perceived usefulness achieved higher scores ($M = 4.44$, $SD = 0.37$) than the other factors. The objective of perceived usefulness was to examine the extent to which the individual respondents believe that using the ABC system would enhance the effectiveness of their job performance and enable them to accomplish more work than under a TCA system. The impact of ABC on organizational processes ($M = 4.23$, $SD = 0.38$) was also important for this sample. The objective of this measure was to assess the impact on organizational processes as an effective function of ABC to minimize non-value-adding activities, enhance and simplify the costing processes, and improve decision making. The objective of measuring the perceived ease of use ($M = 4.0$, $SD = 0.31$) was to investigate the extent to which an individual believes that the use of a particular technology influences its acceptance. According to Krumwiede (1998), the usefulness of cost information in decision making is significantly associated with extensive use of ABC. Similarly, perceived ease of use was found to influence the behavior of users, either directly or indirectly, by the use of the system (Davis, 1989). McGowan (1998) stated that if ABC is implemented successfully, individuals may perceive improvements in the quality of their work, accomplish tasks more quickly, increase job productivity, and see improved organizational processes that are better than the TCA system. ABC emphasizes the continuous improvement of processes (Koehler et al., 2018), providing more accurate and useful cost information for performance measurement, cost control, and strategic decision making (Bhimani & Pigott, 1992; Innes & Mitchell, 1991; Krumwiede & Roth, 1997).

The assessment of the technical characteristics allowed us to examine the extent to which the individual respondents believe that using the ABC system versus the TCA system was more accurate, accessible, reliable, timely, and understandable. The results highlighted that there was a significant difference between ABC versus non-ABC users within ERP. Hence, there were significant differences in all characteristics, with ABC users showing higher scores than non-ABC users across all of these characteristics, indicating higher levels of satisfaction with the ABC system regarding accuracy, accessibility, reliability, timeliness and understandability.

Research evidence indicates that ABC compared to TCA increases the accessibility of the information produced by the system (Booth, 1997; Cokins, 1996). ABC provides better reliability and timeliness (Belardo & Wallace, 1998; Chenhall & Langfield-Smith, 1998), enhances understandability (Booth, 1997) and accessibility (Booth, 1997; Cokins, 1996), improves profitability (Innes & Mitchell, 1991), increases organizational performance (Turney, 1996), and improves accuracy (Byrne et al., 2009; Cokins, 2001; McGowan, 1998).

Finally, assessing the technological characteristics allowed us to determine whether the subjects' perceptions of their ABC cost management system differ from those who use the TCA system within the ERP environment. This was assessed using seven qualitative characteristics: accessibility, reliability, accuracy, up-to-dateness, timeliness, operability, and performance. The results showed a significant difference between the ABC and non-ABC users within ERP. Most of the seven specific qualitative characteristics, except up-to-date and timely information, were significantly higher in ABC users than non-ABC users. This indicates higher levels of satisfaction with the cost accounting system regarding accessibility, reliability, accuracy, operability, and performance among ABC users.

Xinxin and Weiping (2010) indicated that integrated ABC and ERP gives full play to the advantages of both, reverses the cost information distortion situation, and provides strong technical support for the implementation of ABC, greatly improving its operability and accuracy and enhancing the competitiveness of the enterprise. ERP and ABC systems will improve the organization's cost information while preserving the quality of the services in a timely and effective way (Kitsantas, Vazakidis, & Stefanou, 2020).

6. Conclusions

This study reviewed the theoretical and empirical literature and examined the use of the activity-based costing (ABC) method versus traditional cost accounting (TCA) within the enterprise resource planning (ERP) environment. The ABC method is recommended as a modern management tool. In this study, it was found that ABC has far more advantages over TCA systems, improving profitability, performance, and decision making processes, and it enhances and simplifies the costing process. The technical characteristics of information produced by the ABC versus the TCA system (non-ABC users) are significant determinants of success, increasing the accessibility to information, providing better reliability of information and timeliness and enhancing understandability of the information produced by the cost accounting system.

Furthermore, this study emphasizes that ERP systems can determine the success of ABC implementation and generate several benefits, which may affect the entire organization. For example, it can assist ABC

managers in making better product costing decisions, and it can change the entire structure of the ABC system to reduce uncertainty issues. The findings also indicate that the use of ERP and ABC systems increased the availability of decision support information for managers and saved significant time and resources. Further, the findings show that successful integration of ERP and ABC can minimize operating costs and enhance the competitiveness of the enterprise. Integrating ABC within ERP can affect the organization in a positive way as it enhances the costing process and functions of a firm while maximizing its performance. It also improves management practices and eliminates non-value-added activities for strategic planning and decision making, improving the cost management of companies.

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