

Effect of Top Management Support on the Adoption of Activity-Based Costing in Malaysia Public University: Moderating Role of Technology

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ABSTRACT

This study examines the relationship between top management support, the adoption of activity-based costing (ABC), and the performance of public universities in Malaysia. The study collected data from senior financial officers of 20 public universities in Malaysia using survey questionnaires and analysed 83 usable responses using partial least square structural equation modelling (PLS-SEM). The results of the study suggest that top management support has a significant positive effect on ABC adoption in public universities in Malaysia. Furthermore, the study found a positive relationship between ABC adoption and the effectiveness and efficiency of public universities, suggesting that ABC adoption can lead to improvements in the performance of public universities in Malaysia. However, the study did not support the moderating effect of technological advancement in strengthening the relationship between ABC adoption and effectiveness and efficiency. Hence, while technology may play a role in ABC adoption and the performance of public universities, it may not necessarily strengthen the relationship between the two. Overall, the findings suggest that ABC adoption can improve public universities' effectiveness and efficiency as part of good governance in managing the education sector.

Keywords: Top management support; ABC adoption; effectiveness and efficiency; technology

INTRODUCTION

Adopting activity-based costing (ABC) in the public sector has gained significant attention and recognition in improving public cost management and decision-making. Public sector organisations, encompassing government agencies, statutory bodies and public universities, recognise the strength of ABC in enhancing resource allocation and financial effectiveness and efficiency. Apart from reforming new public management (NPM) in the public sector, the main reason for adopting ABC is the increasing need for cost optimisation and effective resource utilisation. ABC provides a better understanding of the association between the operational activities and the resources cost structure and subsequently enables organisations to trace and assign costs directly to the products, services, or programs. Managing government-allocated resources is crucial, particularly for public universities (UA), when the trend of a given budget is decreasing while the stakeholders' expectations are rising. Without option, UA must demonstrate their competitive strategy and dynamic capability to face future challenges and be ready to act effectively in line with global higher education developments. UA, funded by the government budget, are held accountable to show good governance by being transparent in managing the public investment effectively and efficiently. Malaysia has three categories of UA, namely research universities, comprehensive universities, and focused Universities (technical, education, management, and defence), focusing on a specific niche. At present, there are 20 UA in Malaysia, comprised of (a) five (5) Research Universities – that focus on research and innovation, (b) four (4) Comprehensive Universities - that offer various taught courses and fields of study, and (c) eleven (11) Focused Universities - focus on specific areas of study. Given UA's consistent budget constraints and rising demand for delivering better education outcome along with industrial impactful research, the adoption of ABC may assist in financial governance as the technique identify cost drivers, directly tracing the actual costs and the undertaken activities and initiatives, enabling managers to make the right decisions about resource allocation, process improvement, and cost control. ABC adoption may assist in fulfilling the stakeholders' demands as the approach can track and trace costs to specific activities, programs, or projects, instilling a better understanding of the costs incurred and the value generated. The techniques undoubtedly enhance university accountability and transparency, as such information is valuable to the stakeholders, such as students, parents, taxpayers, government and industries, in building trust in the UA.

ABC also acts as an indicator for the performance measurement and evaluation in the UA. With the link between resource costs to activities and deliverable outputs, UA assesses their operations' efficiency and effectiveness. The underlying concept of ABC undeniably provides an objective basis for evaluating the cost-effectiveness of programs or services, enabling organisations to identify areas for improvement, prioritise investments, and optimise performance. Despite the benefits of ABC, a successful adoption in UA required consistent organisational support and top management commitment financially and non-financially. ABC's approach, which builds on the principle of direct cost tracing, requires the assistance of sophisticated and expensive technology. The investment in the system and people is enormous and often claimed as challenges, including the complexity of implementing ABC systems with the need for supporting infrastructure, especially

Information Technology (IT) infrastructure. In the technology realm, supporting infrastructure includes data centres, servers, networking equipment, internet connectivity, cloud services, and software applications. These elements are critical for running and maintaining various digital operations. Hence, the top management's support is crucial in successfully adopting ABC within the UA. Top management holds the authority and decision to drive the organisational change. Their commitment and endorsement of ABC send a solid message to the whole organisation on the importance and relevance of ABC as a financial and management tool. Most importantly, it helps gain buy-in from other departments and stakeholders, making implementing ABC across different university departments more accessible. ABC implementation requires time, skilled personnel, training and financial investment. The top management support helps secure the necessary resources and allocates them appropriately to ensure the smooth implementation of ABC.

Given the growing importance of UA financial governance globally, especially in developing countries, a further understanding of the ABC adoption based on the upper-echelon perspective may extend the knowledge regarding NPM practice in the public education sector. Accordingly, this study aims to examine the significance of top management support towards ensuring UA's ABC adoption and subsequently observe the effect on UA performance with the moderating effect of technology. This study contributes to ABC and the public sector research by providing empirical evidence of the effective and efficient performance attributed to strategic cost accounting among higher institutions. The critical role of top management to provide support in the form of leadership, resource allocation, and long-term commitment to the success of ABC adoption is undeniable. Their buy-in facilitates the adoption process through top-down clear communication, which facilitates the ABC project planning, integration of cross-department teams, implementation, and monitoring processes. Apparently, training on the ABC adoption is critical for the UA and other stakeholders to appreciate the strength of the accounting technique in ensuring better financial governance and management accountability. Next, the advancement of technology in enhancing ABC adoption is also observed. Technology enables the efficient collection and analysis of data required for ABC. Organisations may capture detailed information about activities, resources, and cost drivers with digital tools and software. This technology automates data collection, reduces manual errors, and provides real-time insights into cost structures. Advanced analytics capabilities can be leveraged, leading to better and more efficient management of university resources. Finally, the study's results may act as additional inputs for public agencies, particularly UA, in deciding to start on a strategic cost management technique, namely the ABC adoption journey. To the policymakers, the findings highlight the enabler factors that shall support the effort in promoting ABC adoption in UA.

This discussion continues with a literature review and subsequently posits the hypothesised relationships. The research methodology is presented next, discussing the sample selection and variable measurement. The third section is on the findings, followed by a discussion and concluding section.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

ABC ADOPTION

ABC is an efficient instrument for monitoring resource-related expenses and activities (Cooper et al. 1992). As a result of implementing ABC, organisations have a deeper comprehension of their operations and the factors that affect their costs. The management can improve their decision-making at both the operational and the strategic levels with the use of this information. ABC considers quality to be a cost, lowering profitability. By analysing cost flow, universities can identify expensive operations. ABC uses surveys and estimates to determine how much it will cost to improve quality. Universities may boost their profitability, market share, customer conformance and contentment, and public relations by determining their improvement margin. ABC evaluates a university's business procedures to determine its competitiveness, including how much inactivity, idle time, and poor service cost. ABC assists management in finding cost-effective solutions to quality challenges (Sorros et al. 2017).

ABC observes the cost allocation functionality (CAF) in terms of the ability of institutes to calculate the costs of specific services and classify data to incorporate it into strategic decision-making. According to Macintosh et al. (1990), allocating costs by categorising them into specific cost centres is possible. They elucidated this concept by illustrating that a packing division cost centre will be responsible for the salary of the packing division manager. However, Shank et al. (1993) claimed that labour cost distribution across cost centres such as stores and maintenance sections is optional. Emerging on the international stage in the late 1980s and beginning in the United States, the ABC adoption of costing has expanded worldwide. Kleinschmidt et al.'s (1991) study revealed that the old costing approach could have been more reasonable in real-world scenarios since it did not effectively execute and distribute costs. The traditional method estimates the cost of fundamental inputs such as labour and materials. These costs are essential, while others fall into the manufacturing overheads category. The ABC adoption of accounting is a better approach when determining cost allocation since it distributes all costs and facilitates accurate analysis (Romney et al. 2012). The ABC adoption has become an essential element of modern accounting (Cooper et al. 1988; Innes et al. 1990; Johnson et al. 1990). It has uncovered the flaws of traditional cost allocation

techniques and enlarged accounting information's role in process optimisation and organisational growth. According to Cooper et al. (1988) and Johnson et al. (1990), cost accounting concepts were formed when production settings and market situations were different from what they are now.

Besides, the cost management capabilities (CMC) embedded in the ABC adoption provide the potential for improving or implementing an improved cost data approach and the difficulties of using a novel approach due to a lack of support from staff. An individual's good or negative thoughts about a specific action describe their cost management capabilities (Ajzen et al. 1975). According to Briciu et al. (2010), implementing the ABC adoption would be effective if management emphasised modifying user attitudes and motivating employees to learn and grow for self-improvement. According to Venkatesh et al. (2012), adopting ABC may be affected by a lack of cooperation inside the organisation. Additionally, the author pointed out that an optimistic user attitude might affect ABC's uptake and proper use. According to Khozein et al. (2011), one of the factors preventing the adoption of ABC in their respective institutions is user dissatisfaction. According to research by Dubihlela et al. (2014) on 149 public sectors in South Africa, user attitude and organisational commitment influenced the adoption of ABC. This study aims to determine if higher education institutions are keen to embrace ABC or face significant barriers. These criteria are chosen because they reflect the current costing methods, facilitate or impede the transfer of information across departments, impose pressure on operations to improve toward competitive advantage, and either improve or degrade organisational cost management capabilities.

Additionally, the ability to control costs (ACC) refers to an institution's ability to inform its employees, comprehend the patterns of change, adopt new ways, and transmit this insight to management. Kulmala et al. (2007) discovered that although public sectors, in general, did not focus on cost management tools, management accounting practises such as the ABC adoption have enabled public sectors to understand better the relationships between activities, operating results, and network cost, thereby increasing cost awareness and prompting the ABC adoption among public sectors. Cagwin et al. (2002) showed that Total Quality Management (TQM) and Just-in-Time (JIT) used in association with ABC led to the effective implementation of ABC in their study on the improvement of financial performance resulting from the adoption of ABC. In addition, James's (2013) research of commercial and merchant banks in Jamaica revealed that the perceived capability of ABC to aid in cost control and savings facilitated the adoption of ABC. ABC is an efficient instrument for monitoring resource-related expenses and activities (Cooper et al. 1992). As a result of implementing ABC, companies have a deeper comprehension of their operations and the factors that affect their costs. The management can improve their decision-making at both the operational and the strategic levels with the use of this information. ABC considers quality to be a cost, lowering profitability. By analysing cost flow, universities can identify expensive operations. ABC uses surveys and estimates to determine how much it will cost to improve quality. Universities may boost their profitability, market share, customer conformance and contentment, and public relations by determining their improvement margin. ABC evaluates a university's business procedures to determine its competitiveness, including how much inactivity, idle time, and poor service cost. ABC assists management in finding cost-effective solutions to quality challenges (Sorros et al. 2017). The ABC (ABC) model integrates resource utilisation monitoring with output pricing. Resources are assigned to activities, while cost objects are attributed to activities. The latter uses cost drivers to associate product prices with inputs (Cohen et al. 2005).

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Besides, the cost management capabilities (CMC) embedded in the ABC adoption provide the potential for improving or implementing an improved cost data approach and the difficulties of using a novel approach due to a lack of support from staff. An individual's good or negative thoughts about a specific action describe their cost management capabilities (Ajzen et al. 1975). According to Briciu et al. (2010), implementing the ABC adoption would be effective if management emphasised modifying user attitudes and motivating employees to learn and grow for self-improvement. According to Venkatesh et al. (2012), adopting ABC may be affected by a lack of cooperation inside the organisation. Additionally, the author pointed out that an optimistic user attitude

might affect ABC's uptake and proper use. According to Khozein et al. (2011), user dissatisfaction is each factor hindering the adoption of ABC in their institutions. According to research by Dubihlela et al. (2014) on 149 public sectors in South Africa, user attitude and organisational commitment influenced the adoption of ABC. This study aims to determine if higher education institutions are keen to embrace ABC or face significant barriers. These criteria are chosen because they reflect the current costing methods, facilitate or impede the transfer of information across departments, impose pressure on operations to improve toward competitive advantage, and either improve or degrade organisational cost management capabilities.

Additionally, the ability to control costs (ACC) refers to an institution's ability to inform its employees, comprehend the patterns of change, adopt new ways, and transmit this insight to management. In response to environmental inputs, our default behaviours and cognitive processes are triggered automatically in various everyday settings. The ability to control cost enables us to modify our thoughts and actions in a variety of ways away from those defaults, allowing us as a species to perform incredible intellectual feats such as planning (Simon et al. 2011), reasoning (Christoff et al. 2001), inhibition (Aron, 2011), and working memory maintenance (Goldman-Rakic, 1987). Nevertheless, what decides when we exercise control, how much we exert it, and its form(s)? In other words, how is the controller itself controlled (Botvinick et al. 2015)? This question is addressed as a reward-based decision-making problem. This method considers cognitive exertion to be defined by the outcome of a choice that weighs the costs and advantages of cognitive control mobilisation at a given time—the elements in favour of control and those that weigh against it. According to research, many internal and external signals act as demand indicators or cues. However, in higher institution education, the necessity to save money may be the driving force behind the adoption of ABC. Kulmala et al. (2007) discovered that although public sectors, in general, did not focus on cost management tools, management accounting practises such as the ABC adoption have enabled public sectors to understand better the relationships between activities, operating results, and network cost, thereby increasing cost awareness and prompting the ABC adoption among public sectors. Cagwin et al. (2002) showed that Total Quality Management (TQM) and Just-in-Time (JIT) used in association with ABC led to the effective implementation of ABC in their study on the improvement of financial performance resulting from the adoption of ABC. In addition, James's (2013) research of commercial and merchant banks in Jamaica revealed that the perceived capability of ABC to aid in cost control and savings facilitated the adoption of ABC.

Evaluation of organisational capabilities (EOC) observes willingness to preserve or gain competitive advantage, which determines the deployment of innovative cost strategies. Organisational capability is "the number of personnel in the company, although the organisation's paid-up capital may also evaluate organisation size" (Nair et al. 2018). Size is a significant element in adopting ABC. Research indicates that organisations with more significant resources and more sophisticated administration systems succeeded more with ABC adoption (Al-Omiri et al. 2007). According to research conducted by Pokorná (2016) on 548 medium and large Czech enterprises, the company size affects the company's financial performance significantly. Elhamma (2012) posited similar arguments as the study of 62 companies in Morocco reported that size influences ABC adoption and effective implementation. The size is often associated with the ability to invest in people through training, having experts in the organisation, and supporting infrastructure, which is pertinent for ABC adoption (Botelho, 2012). These need to be championed by the top management, and therefore, building upon upper-echelon theory, the support from the top management is the driving factor on the UA ABC adoption

TOP MANAGEMENT SUPPORT

Top-management support (TPMS) is essential to drive the organisational change initiatives. They are essential in determining adaptability and system project success. It describes top managers' and executives' endorsement, engagement, and active involvement in guiding and assisting the process when referring to modifying or introducing new processes inside an organisation. As such, it serves as a symbol of the organisation's dedication to new technology and the determination of its upper management to ensure success. TPMS also offers strategic direction and ensures system adaptation efforts align with the broader organisational plan. (Shao, 2019; Yuzliza et al. 2019). The ability of a team manager associated with the top management to provide visionary leadership boosts the strategic consensus and commitment of the team (Abbas, 2020; Ateş et al. 2020). Their support ensures that the adaptation aligns with the organisation's long-term goals, objectives, and vision. Adapting a system requires considerable time, money, and people. TPMS assists in securing the required resources and allocating them efficiently to support the adaptation process (Ateş et al. 2020; Hsu et al. 2019; Kumar et al. 2019), which covers hiring employees, allocating funds for the necessary infrastructure or technologies, and approving the budget. Top management must make numerous crucial decisions daily to ensure their organisation's success. They should seek opportunities to include their teams in the strategic, tactical, and operational decision-making stages. They also must be transparent about big-picture decisions and long-term organisational goals, which is one way to prepare the team for the company's future. The power to make decisions is brought to the process of system adaptation by the support of the top management (Shamim et al. 2019; Shrestha et al. 2019; Yuzliza et al. 2019).

They can make crucial decisions, settle disputes, and lead others along the adaptation path (Alzoubi et al. 2021; Khosravi et al. 2020). Their participation helps to streamline decision-making and accelerate the implementation of critical adjustments. Adapting a system requires making organisational changes, which can be difficult and time-consuming (Fisher et al. 2021; Fountaine et al. 2019). Top management leadership is crucial during transition times because it establishes a sense of urgency, galvanises support, and inspires workers to accept and adapt to new ways of doing things (Graves et al. 2019; Wrede et al. 2020). Their participation assists in overcoming opposition and instilling a culture of adaptation and constant growth.

During the system change process, top management support allows effective stakeholder communication. They communicate, manage expectations, and engage employees, customers, suppliers, and shareholders. Transparent and timely communication builds trust, reduces resistance, and promotes adaptation, ownership, and commitment. Therefore, stakeholder engagement is critical in essential organisational activities such as value creation, strategic planning, and decision-making; innovation; learning and knowledge development; accounting and reporting; corporate social responsibility (CSR); and sustainability (Kujala et al. 2022; Loureiro et al. 2020; Wijethilake et al. 2019). Thus, strategic stakeholder engagement activities require internal support to back them up, especially allowing the involvement of system developers and consultants in the initial stage of designing the system and work processes. TPMS helps identify potential risks and challenges associated with the organisational change and adaptation activities. They guide risk assessment, risk mitigation strategies, and problem-solving. Their involvement ensures that potential obstacles are addressed proactively, minimising disruptions and maximising the chances of successful adaptation (Blagoeva et al. 2020; Netland et al. 2020; Stein et al. 2019). They will ensure that ABC adaptation efforts are monitored and evaluated effectively. They establish performance metrics, review progress, and make adjustments as necessary. Their oversight and involvement in monitoring and evaluation activities help measure the success and impact of the adaptation initiatives (de Sousa Jabbour et al. 2018; van Het Bolscher-Niehuis et al. 2016). ABC adoption thus requires top management assistance to give strategic direction, provide resources, make crucial choices, lead change, effectively communicate, manage risks, and assure successful implementation. The organisation adopts a more flexible mindset through their leadership, creating a conducive environment for successful system adaptation. Hence, the study posits that:

H₁ The top management support is positively related to ABC adoption

EFFECTIVENESS AND EFFICIENCY

Effectiveness is the ability to achieve the intended outcome. At the same time, efficiency is measured by the ability to accomplish or fulfil any task without wasting time, energy, or resources: the value or quality of being effective technology and the capability to produce the intended output, creating uncertainty between the two concepts. Buder et al. (2012) distinguish between quality (i.e. effectiveness) and necessary effort (i.e. efficiency). Zheng et al. (2010) analyse the organisation's effectiveness within strategy and knowledge management, defining organisational effectiveness as the degree to which an organisation successfully achieves its objectives. Frøkjær et al. (2000) highlighted efficiency as the relationship between (a) the completeness and precision with which individuals fulfil specific goals and (b) the resources utilised to accomplish specific objectives (Kucher et al. 2022). Efficiency measurements are frequently (directly and indirectly) connected to time and cost. In economics, efficiency refers to many equilibrium characteristics between supply and demand. It is measured by comparing the value of ends to means. Allocative efficiency (production expresses client desires) and productive efficiency are instances of words (unable to create more of one good without compromising the production of another). Effectiveness and efficiency are evaluation-dependent and subjective. These assessments are based on an individual's knowledge comprehension and interpretation in a specific circumstance (Pask, 1976). When establishing effectiveness and efficiency measurements, a shared knowledge of the context (to which the measurements are relevant) is essential (and the over-arching business context). Current context description research in software engineering gives a valuable checklist of context attributes (product, processes, people, practises and techniques, and organisation and market) (Petersen et al. 2009). Understanding, characterising, and sharing contextual elements (sometimes as part of contractual agreements) is crucial for systematically improving the sub-optimisation level in a business ecosystem.

Effectiveness and efficiency are also strongly tied to governance, which describes how a city or business is managed by its leaders. Understanding governance is equally essential, as evidenced by the references ((Al-Debei et al. 2010; Haaker et al. 2004; Zott et al. 2010). Jansen views measurements and governance as the drivers for a prosperous software ecosystem (Jansen 2014). Zott and Amit suggested that governance is essential to experimentation evaluation (Zott et al. 2010). Page et al. (2016) examined corporate governance with the business model as an increasing necessity to achieve board responsibility by evaluating conformity, performance, and management control systems oversight. They argue that corporate governance and maintaining and creating business models are fundamentally identical (Zott et al. 2010). In this work, the Webster-Merriam definition of governance will be used. The degree to which educational programs, initiatives, and strategies accomplish their

intended results or aims is effectiveness in the education industry or university. It concerns the significance and quality of educational processes and results (Ingvarson et al. 2005). The best use of resources (time, money, and human capital) to achieve educational goals is efficiency in the education sector or university. It prioritises output while limiting resource inputs (Kucharčíková et al. 2015). The following measures can be taken to improve the efficacy and efficiency of the education sector or university: Clear goals and objectives, Data-driven decision-making, Professional development, Technology integration, Streamlined operations, Collaboration and partnerships, Student-centred approach, Resource allocation, and Continuous improvement. Establish quantifiable targets and clearly outline intended results for educational programs and activities (Phillips et al. 2008). Assess student performance, instructional methods, and program efficacy regularly to find opportunities for improvement (Leithwood et al. 1982). Data and evidence should inform decision-making processes, such as finding successful teaching tactics and allocating resources efficiently (Mandinach, 2012). Provide educators with ongoing training and professional development opportunities to help them improve their teaching abilities and keep current on best practices (Collinson et al. 2009). Use technology to simplify administrative operations, improve teaching and learning experiences, and improve communication and cooperation (McKnight et al. 2016). Reduce duplication, remove bottlenecks, and enhance efficiency by optimising administrative procedures and workflows (Tolga Taner et al. 2012). Encourage educators, administrators, and stakeholders to collaborate to exchange best practices, utilise resources, and foster innovation (Murray et al. 2015). Customise educational experiences to match students' requirements, give individualised assistance, and encourage active involvement and participation (Wang et al. 2013). To maximise the use of existing resources, allocate resources wisely based on recognised goals, needs, and evidence-based approaches (Bekemeier et al. 2013). Encourage input, assess progress, and adopt adjustments based on lessons learned and best practices to foster a culture of continuous development (Almuhaideb et al. 2020). Implementing these principles allows educational institutions to aim for effectiveness and efficiency, improving overall educational quality and student results (Cheong Cheng et al. 1997). Accordingly, the following hypothesis is proposed:

H₂ ABC adoption is positively related to the Malaysia UA's effectiveness and efficiency

TECHNOLOGY

Technology is the extent of digitalisation and automation of organisational operations and storage of business information. Technology is vital to operational operations as it enables the presentation of precise and accurate information, thus facilitating employee decision-making and management. Technology is useful and applicable for accounting and non-accounting related task activities in service organisations (Al-Nuaimi et al. 2017; Al Daoud et al. 2014; Basardien et al. 2016; Venkatesh et al. 2012). In accounting specifically, the technology assists the accounting process by allowing the digitalising of accounting processes, starting from data entry in the general ledger, accounts receivable, accounts payable, financial control, asset management, funds flow, cost centres, profit centres, profitability analysis, order and project accounting, up until product cost accounting, and performance analysis. The technology has enabled data sharing and integration within the organisation, and the practical evidence has been widely known, such as in the use of technology in the financial services and banking sector (Sadagopan 2003). In service organisations, particularly, technology also plays a crucial role in communications networks, protecting information and data, and assisting employees with various inputs to guide decisions and actions in ensuring effectiveness and efficiency (Al-Nuaimi et al. 2017). It is important to note that technology has entered and positively impacted organisations because it enables the development of strategies to create competitive advantages and innovate in a world that is constantly changing, taking into account the processes, structure, policy, and organisational culture that are executed following decision making. as well as explain complex concerns and develop novel goods. Information systems gather testimonies from many organisations, individuals, and locations. They have activities such as input, process, and output that require feedback, which is crucial because it facilitates strategic decision-making, problem resolution, and the development of innovative products (Dagiliene et al. 2019). Organisations may efficiently share timely and precise information by incorporating technology into operational processes, leading to enhanced decision-making for managers and employees. In short, technology is no longer an option to opt out of, especially in today's data-driven and dynamic organisational management control settings (Hunton 2002).

According to Maelah et al. (2006) and Abduldayan et al. (2019), technology plays a vital role in designing ABC systems and significantly impacts ABC adoption. The complexity and detailed information required in the ABC system demands a higher level of technology. Tracing costs and their cost drivers to the cost objects is crucial to determining the accuracy of cost figures. Abduldayan et al. (2019) emphasised that technological advancement may significantly affect ABC adoption. Jusoh and Miryazdi (2015) added that technology moderates the extent of ABC diffusion in organisations. The technology may support streamlining the data collection process, reduce complexity, facilitate data integration, and enhance accuracy, which is the strength of practising ABC in an organisation. Considering that ABC is a sophisticated cost management system, researchers (e.g.

Cagwin et al. 2002; Fei & Isa. 2010 Aljabr 2020; Al-Nuaimi et al. 2020) indeed agreed that technology does facilitate the success of ABC adoption, and therefore, it is hypothesised that:

H₃ Technology moderates the relationship between ABC adoption and Malaysia UA's effectiveness and efficiency.

THEORY OF UPPER ECHELON

The upper echelon theory (Hambrick & Mason 1984) proposes that top management support strongly determines an organisation's strategic decisions and behaviour. The "upper echelon" refers to the senior executives, such as the CEO, COO, CFO, and other leaders, who play a vital role in shaping the company's direction. This theory suggests that these top managers' personalities, backgrounds, experiences, cognitive biases, and values significantly impact the organisation's strategic decisions. Accordingly, the theory evolves into how an organisation's top leadership shapes the strategic direction and overall organisational behaviour. Building upon the underlying premise, researchers and practitioners may understand better how leadership impacts organisational outcomes and adapts management practices by recognising the influence of top management characteristics (Abatecola and Cristofaro, 2020). Therefore, the theory used in this study is the upper echelon perspective, observing the extent of top management's traits and decision-making processes significantly influencing ABC adoption in Malaysia UA. Understanding the perspectives, preferences, and experiences of the UA's top management is crucial for successfully implementing UA's strategic cost management system. Subsequently, the support and commitment may eventually lead to UA's better performance. Focusing on the experience of Malaysia UA, the research framework is shown in Figure 1.

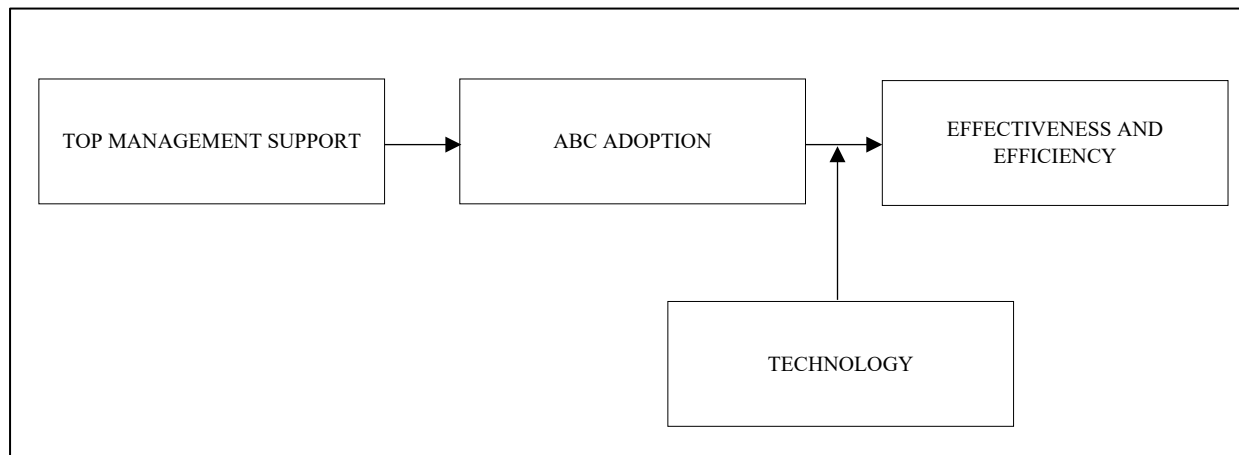


FIGURE 1. Research framework

RESEARCH METHOD

The quantitative method is used in this study to gather the primary data. The population for this study is managers/senior officers from UA's bursary departments and their Strategic Business Units (SBUs). These senior officers are in charge of the accounting and costing departments at their public universities. They were preferred because they may decide whether or not to implement ABC and base their decisions on ABC-related information. Accountants are responsible for designing and implementing ABC in the organisation. One hundred eighty directors, managers, and accountants were identified from the Bursar Department and SBUs. Thus, based on Krejcie et al. (1970), 120 questionnaires were distributed between November 2022 and January 2023, with 83 providing complete responses, giving a response rate of 69.2%.

TABLE 1. Respondents' profile

Details	Category	Frequency N=83	Per cent (%)
Gender	Male	46	55.4
	Female	37	44.6
Position	Bursar	3	3.6
	Accountant	19	22.9
	Director	5	6.0
	Senior Director	3	3.6
	Senior Deputy Bursar	1	1.2
	Senior Assistant Bursar	26	31.3

	Deputy Bursar	6	7.2
	Deputy Director	13	15.7
	Other	7	8.4
Grade	JUSA	1	1.2
	54	4	4.8
	52 / 48	22	26.5
	44 / 41	56	67.5
Education Level	Philosophy Doctor	6	7.2
	Master Degree	17	20.5
	Bachelor Degree	60	72.3
Years in organisation	≤10 years	27	32.5
	> 10 years	56	67.5
Years of ABC experience	≤ 3 years	14	16.9
	> 3 years	69	83.1
University	Research University	26	31.3
	Comprehensive University	26	31.3
	Focused University	31	37.3

Table 1 provides the respondent profile for the study. In the demographic data, there is no significant difference in the number of male and female respondents to the survey. Mostly, the respondents were in grades 41/44 with the position of officers. The demographic profile on the education level is consistent with the respondent position as 72.3% of respondents have a bachelor's degree, 20.5% have a master's degree, and 7.2% have a doctorate. Obviously, these officers are using the system and assessing the usefulness and effectiveness of ABC in managing the UA's management decisions. Considering that 67.5% of respondents had been with the organisation for more than ten years, they have experience and good knowledge of the financial and cost management techniques practised in their respective institutions. Additionally, most of them have been involved in ABC for over three years of experience, with only 16.9% having less than three years of experience. The demographic profile, thus, clarifies that the provided information for this study has been gathered from the most appropriate respondents directly involving the US's cost management system. The distribution of usable respondents with a higher percentage of usable responses is from focused universities, while feedback from research universities and comprehensive universities is equal and consistent with the percentage represented by each UA category.

MEASUREMENT OF VARIABLES

The assessment of adopting ABC (ABC) involves various factors from different studies. Sorros et al. (2017) provide a set of items that pertain to the functionality of cost accounting, comprising eight items. Additionally, it considers the ability to control costs, encompassing four items. Cost management capabilities involve three items, and evaluating organisational capabilities consists of 4 items. The influence of technology as a moderating factor is evaluated based on Al-Nuaimi et al. (2017), which includes four items. The factors related to top management support are derived from Krumwiede (1998), comprising three items. Finally, effectiveness and efficiency (ENE) are measured using an adapted version of the 16-item instrument used by Aziz et al. (2019) that was initially developed by Pulido-Fernández and Pulido-Fernández (2017). All measurements are based on a 5-point Likert Scale, ranging from 1 (totally disagree) to 5 (totally agree).

PLS was used to analyse the data because it is the method of choice when (a) the goal is to explain and predict target constructs and detect significant driving constructs, (b) the structural model comprises formatively measured constructs, (c) the model is complicated (with numerous constructs and indicators), and (d) the researcher is dealing with a with small sample size and data that are possibly non-normal (Hair et al. 2017; Hair et al. 2012; Rigdon, 2016). Consequently, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) must be used to examine the constructs' reliability (Hair et al. 2017) before the measurement model's quality can be evaluated. The section that follows presents the factor loadings and Cronbach Alpha in detail.

RESULTS

The descriptive statistics for the variables in this study are presented in Table 2. The statistics show that all variables have a mean greater than 4.0, indicating that scores are skewed towards the agreement. The scales signify the likeliness of the presence of the TPMS, ABC, TECH and ENE, along with the knowledge-sharing effort among the public universities.

TABLE 2. Descriptive statistics

	Items	Theoretical range	Mean	Standard Deviation
ABC	19	1-5	4.1129	0.6698
ENE	16	1-5	4.1521	0.5286
IT	5	1-5	4.0217	0.6800
TPMS	3	1-5	4.0281	0.6811

Note(s) : TPMS = Top Management Support; ABC = ABC adoption; ENE = Effectiveness and efficiency; IT = Tec

Reliability is the extent to which consistent results provide measurement stability over time. The research instrument is reliable if the results can be reproduced under a similar methodology. Traditionally, Cronbach's Alpha is the primary reliability analysis used to measure the internal consistency of each item in the construction component. Cronbach's Alpha works on the assumption that all items are equally reliable (Hair et al. 2013). This measure is sensitive to the number of items in the scale and underestimates the internal consistency reliability. Both Cronbach Alphas were used as the lower bound of the internal consistency reliability, and composite reliability was used as the upper bound for true reliability (Hair, 2010). Table 3 shows the construct reliability in this study. Hair et al. (2017) suggested that loading values equal to or greater than 0.708 will be retained. A latent variable could explain at least 50% of the indicator's variance. As depicted in Table 3, the composite reliability for all indicators is more than 0.700. Composite Reliability (CR), ranging from 0.883 to 0.980, indicate adequate convergence or internal consistency. The Cronbach Alpha values of all constructs ranged from 0.846 to 0.979, with convergent validity above 0.700.

The amount to which an indicator correlates favourably with other validity indicators. Only a reflective item-construct relationship can measure convergent validity. Hair (2010) assesses convergent validity using the Average Variance Extracted (AVE) and factor loadings. Hair et al. (2017) said that an AVE of 0.5 or greater suggests that a construct explains half or more of the variance of its indicators. All constructs with AVEs over 0.5, proving their validity, are shown in Table 5. Table 3 shows that all items have factor loadings over 0.708. Therefore, it is revealed that all measurement model constructs satisfy the convergent validity criterion. As per the content validity, all items in this study represent different meanings supporting the theory applied. Table 3 contains the items belonging to the four factors, their loadings and the associated factor analysis statistics. Most indicate good indicator reliability except for five ENE dropped items. These items focus on the characteristics of the factors that influenced ABC adoption and impacted the effectiveness and efficiency of public universities.

TABLE 3. Summary of estimation measurement model parameters

Constructs	Factor Loadings	'Cronbach's Alpha	CR	AVE
TPMS1	0.845	0.8222	0.846	0.7333
TPMS2	0.880			
TPMS3	0.842			
ABC1	0.751	0.977	0.979	0.711
ABC2	0.730			
ABC3	0.819			
ABC4	0.873			
ABC5	0.829			
ABC6	0.865			
ABC7	0.869			
ABC8	0.906			
ABC9	0.772			
ABC10	0.886			
ABC11	0.915			
ABC12	0.843			
ABC13	0.761			
ABC14	0.798			
ABC15	0.908			
ABC16	0.895			
ABC17	0.884			
ABC18	0.815			
ABC19	0.870			
ENE4	0.767	0.943	0.946	0.638
ENE5	0.873			
ENE6	0.835			
ENE7	0.778			
ENE8	0.777			
ENE9	0.790			
ENE11	0.807			
ENE13	0.782			
ENE14	0.878			
ENE15	0.745			
ENE16	0.740			

Constructs	Factor Loadings	'Cronbach's Alpha	CR	AVE
IT1	0.880	0.901	0.909	0.717
IT2	0.836			
IT3	0.758			
IT4	0.886			
IT5	0.866			

According to Hair et al. (2017), the degree to which the measures of different constructs differ is called the "Discriminant validity" when using the Fornell-Larcker condition. Fornell et al. (1981) require that a latent variable have more variance with its assigned indicators than any other to be assessed for discriminant validity using PLS-SEM. They also propose assessing discriminant validity by comparing the square root of two components' AVE values to their correlation estimate (r), as shown in Table 7. To prove discriminant validity, the square root of the AVE must exceed the correlation estimations of the two components ($\sqrt{AVE} > r$). Table 4 shows that the model's constructs have substantial discriminant validity, meaning they differ considerably. All measurement model constructs meet discriminant validity criteria. Discriminant validity determines the study's constructs' distinctiveness. It reveals that research constructs are distinct and not heavily connected. Based on Henseler et al. (2015), distinct path model constructs should meet the criteria of 0.85 as the threshold for HTMT.

TABLE 4. Discriminant Validity - Heterotrait-Monotrait Ratio (HTMT) - Matrix

	ABC	ENE	IT	TPMS
ABC Adoption				
Effectiveness and efficiency	0.757**			
Technology	0.863**	0.868**		
Top Management Support	0.813**	0.859**	0.829**	
Technology x ABC Adoption	0.258	0.165	0.204	0.125

** Correlation is significant at the 0.01 level (2-tailed)

HYPOTHESES TESTING

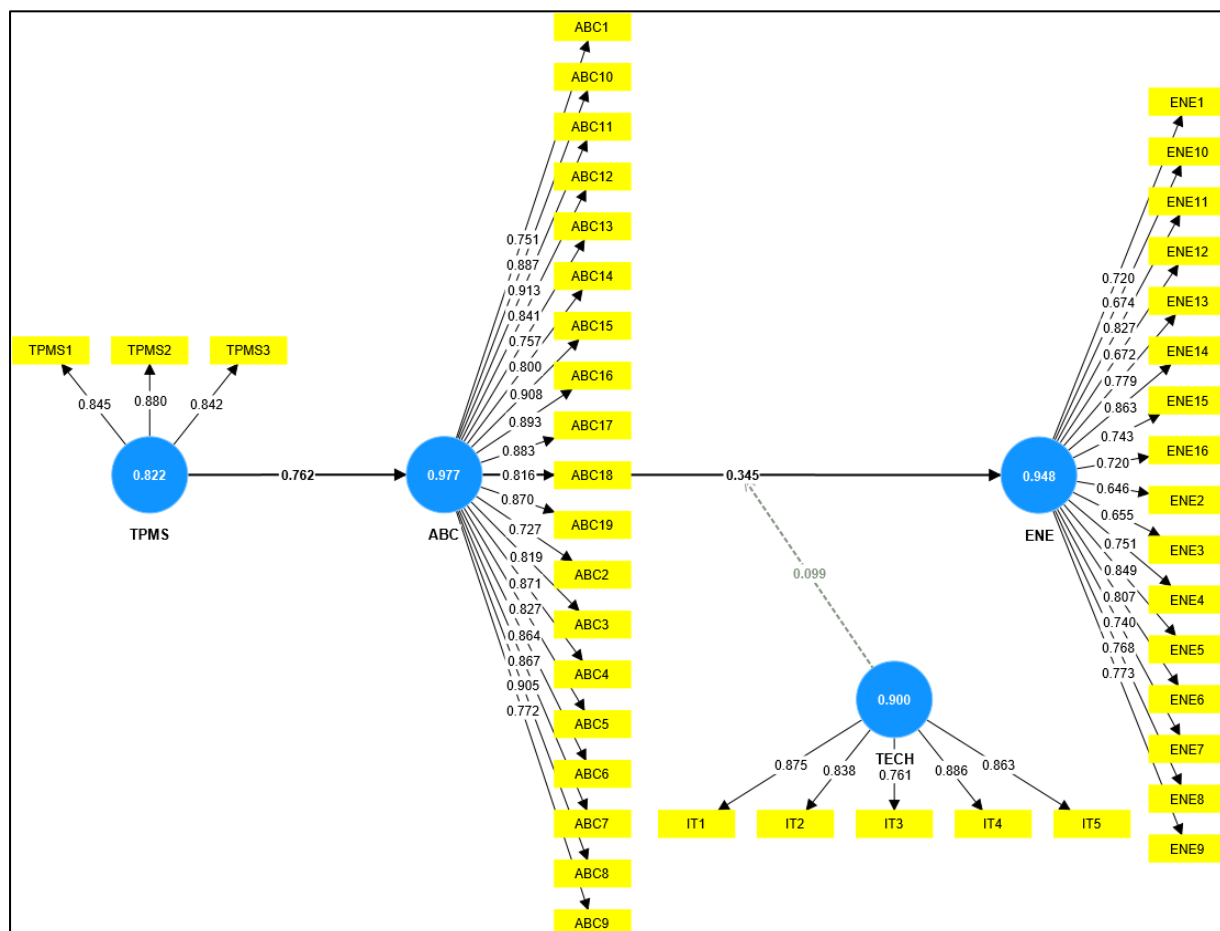


FIGURE 2. Path Coefficient Model

The path coefficients evaluate the significance of the posited hypotheses. Based on the model, there were two direct relationship results. T-statistic for all paths was generated using Smart PLS bootstrapping to test the significance level. Running t-statistic on the sample size of 83 respondents and the direct hypotheses should result in ≥ 1.96 and indicate a significant p-value of < 0.05 . The results of the analysis are shown in Table 5. The analysis has shown that all three effects, $\beta = 0.762$, $\beta = 0.263$, and $\beta = 0.099$, are significant at $p \leq 0.01$ level.

TABLE 5. Summary hypotheses testing results

		Coefficient	t-value	p-value	Result	f ²
H ₁	TPMS -> ABC	0.762	20.280	0.000	Significant	0.149
H ₂	ABC -> ENE	0.263	2.704	0.007	Significant	1.386
H ₃	TECH*ABC -> ENE	0.099	1.092	0.275	Not Significant	0.036

Hypothesis 1 predicted that the top management support may directly affect the ABC adoption (refer to Figure 2 and Table 5). The evidence was consistent with past studies (Alzoubi et al. 2021; Fisher et al. 2021). For that reason, H1 is supported.

Hypothesis 2 observed the direct relationships between ABC adoption and effectiveness and efficiency, whereas hypothesis 3 examined technology moderating effect on ABC and effectiveness and efficiency relationship (refer to Figure 2 and Table 5). For the second hypothesis, ABC reported significant positive relationships with effectiveness and efficiency, consistent with past studies (McKnight et al. 2016; Almuhaideb et al. 2020) that adopting a strategic cost management system improves organisational financial governance. However, the posited technology moderating effect is insignificant. Therefore, H2 was supported, while H3 was not supported.

Meanwhile, the magnitude of the effect size was also measured using Cohen's guideline (1992), where 0.02, 0.15, and 0.35 represent small, medium, and significant effects. Table 5 reports that only H₂ has significant effects, $f^2 = 1.386$, whereas H₁ and H₃ have small effects.

DISCUSSION AND CONCLUSION

The emphasis on ABC adoption without realised has been embedded in the Malaysian government's Public Sector Transformation Policy. The Outcome-Based-Budgeting implemented at the ministry is based on activity-based costing and activity-based budgeting principles. The ability to be transparent in allocating and tracing the use of resources by each cost object is the strength of ABC. Besides that, ABC cost information integrates all activities incurred financially and non-financially, providing accurate cost figures. Furthermore, tracing such costing knowledge is essential in managing tactical operation matters and crucial in making strategic decisions. In public sector governance, ABC is a sound financial management technique that may improve the federal and state government's governance in delivering promises to the people. The ABC system may provide high-quality cost information in this new Malaysian public sector accountability and governance landscape. Therefore, this study aims to observe the role of the public servant top management in driving the success of ABC adoption.

Focusing on UA, which is responsible for building the nation's present and future knowledge, accountability and being effective and efficient in using the government budget to deliver the impact outcome is essential. Hence, ABC has been adopted to facilitate the universities' efforts in fulfilling their roles. The top management's support is crucial as it sets the organisation's tone and provides the resources and leadership required to complete the transformation. In alignment with the upper-echelon theory, ABC implementation requires senior management assistance in some aspects: (1) leadership and direction: senior management sets the organisation's tone and priorities and leads the ABC adoption process; (2) funding and resources: top management invests in technology, training, and employees to implement ABC; (3) communication and engagement: top management explains the benefits of ABC and involves stakeholders, including faculty, administrators, and support personnel, to achieve successful implementation; (4) long-term commitment: ABC adoption is a long-term process that involves continual investment, support, and improvement; therefore, top management commits to sustaining ABC and improving the system over time; (5) decisions and accountability: top management makes ABC adoption decisions and ensures responsibility and performance monitoring. The findings are consistent with past studies (Aziz et al. 2019; Cagwin et al. 2005; Dwivedi et al. 2016; Elahi 2009; Vetchagool et al. 2020), signifying the positive effect of strategic management accounting technique adoption on organisation better performance. Evidently, ABC does improve UA's effectiveness and efficiency. Pursuing effectiveness and efficiency is important for UA to avoid suboptimal outcomes, nonvalue-added activities and inefficiency. The strive enables UA to maximise their stakeholders' value and promote good governance.

The ABC has evolved significantly with the advancement of technology. The data integration from various sources and tracking of resources and cost objects using different cost drivers are possible with the presence of technology. Hence, the technology may strengthen ABC adoption's effect on UA's performance. The research finding, however, does not support the premise. Given the budget constraint, UA has limited capability to invest and keep pace with technological advancement. Only a few UA have the financial ability to leverage the potential

benefits of technology. Hence, it may be a possible explanation for the insignificant moderating role as opposed to the past findings (Aljabr 2020; Al-Nuaimi et al. 2020). The results justify the need for the governing bodies to understand the benefits and challenges of adopting ABC among the UA, which requires financial and nonfinancial commitments. However, the results should be interpreted in light of several limitations. The first limitation is that the questions are based on perceptions. Thus, the responses may represent what the respondent considers to be the facts rather than the facts. Second, the concentration on UA limits the ability to generalise the results of studies to the public sector. The small number of samples causes a low response rate that cannot be avoided, potentially limiting the statistical power of the results and the application of more advanced statistical techniques. Future research can be carried out involving government entities to prove the validity of the results received for the ABC adoption and good governance in public sector agencies. Despite the limitations, the results provide practical input on the relevance of NPM in the Malaysian public sector environment.

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