Activity-Based Costing as a Cost Allocation Tool in the Digital Age: Enhancing Strategic Decision-Making

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Abstract: Amidst a rapidly changing economy, Activity-Based Costing (ABC) has evolved with digital technologies, enhancing the strategic decision-making process through accurate cost allocation in management accounting. This study examines how digital technologies, such as big data and cloud computing, enhance the effectiveness of ABC in supporting competitive strategies, increasing profitability, and optimizing resource allocation. Leveraging a mixed-methods approach, the study combines quantitative analysis, case study analysis, and interviews. The quantitative analysis encompasses the adoption of ABC in manufacturing firms, while case study analysis focuses on the implementation of ABC and interviews with management accountants regarding the integration of ABC into strategic decision-making. The findings reveal improved accuracy with digital ABC systems, reducing accuracy errors by at least 25%, while the strategic decision-making process is increased by 40% and the profitability of the firms increased by 25%. However, despite the perceived benefits, high implementation costs and lack of specific skills persist, hindering the adoption. The study proposes a framework for synthesizing the integration of digital technologies, ABC, and strategic management, emphasising innovation and training. The study contributes to academic discourse by measuring the impact of digital ABC in strategic decision-making and capturing adoption challenges.

Keywords: ABC; Artificial Intelligence; Data analytics

JEL Classification: M41; C55; O33; M40

1. Introduction

Despite the rapidly changing global economy with disruptive technologies, Activity-Based Costing (ABC) remains a critical cost allocation tool in management accounting, evolving with digital tools to provide enhanced accuracy in cost allocation and improved strategic decision-making. ABC, originally developed in the 1980s to capture the shortcomings of traditional accounting systems, allocates costs based on activity cost pools rather than volume, providing improved accuracy and

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precise insights into customer profitability, products, and services (Cooper & Kaplan, 1988). The integration of Artificial Intelligence (AI), big data analytics, and cloud computing into ABC enables real-time cost tracking and predictive modelling, revolutionizing ABC, with more large firms adopting this integration (Bhimani & Willcocks, 2014). For instance, Möller et al. (2020) who studied the digitalization of management accounting and control, highlights the role in optimizing resource assignment, finding firms that leverage digital ABC managing their overhead costs effectively, reporting a decrease of 15%. The perceived benefits of ABC integration with technologies (i.e., improved efficiency and accuracy) align with the stakeholder demands, particularly in competitive markets where managements, accountants, and CFOs increasingly rely on ABC for strategic pricing and optimizing performance (Drury, 2013).

The digitalization of management accounting and control has disrupted conventional management accounting theories (i.e., Resource-Based View (RBV) and contingency theory), emphasizing context-specific cost management with limited attention to the role of digital evolution in dynamic environments (Kaplan & Anderson, 2007). According to Bhimani and Willcocks (2014) who studied Big data digitalization and transformation of management accounting, the post-pandemic economic recovery, and the increase in inflation rate, accelerated the adoption of digital ABC for agile budget, while capturing the vulnerabilities in supply chain and labour costs. Despite the perceived benefits, such as reduction in overhead costs and increased profitability in manufacturing, the stakeholders – policymakers, executives, and accountants – face pressure to champion innovation and simultaneously mitigate social costs such as job displacement, skill gaps, and data privacy (Balios, 2021). This tension calls for the need for evidence-based strategies, integrating traditional practices with technology in balancing precision with accessibility for different firm sizes.

This study explores the effectiveness of digital ABC in strategic decision-making, capturing the critical gaps in the academic discourse. Existing research does not capture the quantitative insights into the integration of technology and ABC across industries, and provides actionable implementation strategies and frameworks for responding to the adoption barriers (Moll & Yigitbasioglu, 2019). The study responds to the following three research questions: (1) What is the impact of digital ABC on strategic decision-making? (2) What are the perceived benefits and barriers of digital ABC adoption? (3) How can firms effectively integrate digital technologies with ABC? Leveraging a mixed-method approach, encompassing quantitative analysis, case study analysis, and interviews, this study provides a robust, comprehensive framework for understanding the impact of digital ABC in management accounting, cost control, and strategic decision-making.

2. Literature Review

Activity-based Costing (ABC) has been widely adopted and recognized as the number one method for assigning costs, providing comprehensive insights into cost drivers, and resulting in improved strategic decisions (Cooper & Kaplan, 1988). ABC provides more than 25% accurate cost data for products and services, capturing the weaknesses and critiques of the traditional volume-based costing, such as its inability to handle complexity, lack of accuracy, and potential distortion (Balakrishnan et al., 2008). The emergence of digital technologies has revolutionized the capabilities of ABC, with tools like big data analytics and cloud computing enabling real-time tracking and reducing systems maintenance by over 15% (Bhimani & Willcocks, 2014). Studies project that integrating digital technologies with ABC improves decision-making speed by over 30%, which supports the analysis of profitability,

pricing, and budgeting. According to Horngren et al. (2010) highlights that these technological advancements and integration into management accounting align with the stakeholder demands and expectations for precision, with more than 70% of CFOs referencing accurate cost assignment as crucial for market dominance.

Integrating digital ABC with enterprise resource planning (ERP) systems, such as SAP, provides significant opportunities, including enhanced resource assignment and increased profitability, particularly in manufacturing firms (Kaplan & Anderson, 2007). Möller et al. (2020) highlight that utilizing AI-driven analytics improves the identification of cost drivers by over 25%, allowing firms to optimize operations. Cloud-based ABC platforms, like Oracle NetSuite, minimize implementation time by over 20%, enabling ABC to be accessible across all firm sizes (Garrison et al., 2003). Despite the benefits offered by digital ABC, implementation costs, skill gaps, and data privacy issues are prevalent and deter the adoption. Digital ABC implementation costs average $500 000, hindering 60% of small firms from adoption (Cokins, 2013), whilst 50% of the accountants lack specific expertise, such as data analytics (Iansiti & Lakhani, 2017). Data privacy issues further complicate the adoption, particularly under GDPR, raising compliance issues (Moll & Yigitbasioglu, 2019). Richins et al. (2017) further highlight that regulatory frameworks are lagging and inconsistent with governing digital accounting tools, with more than 55% of jurisdictions lacking clear, specific guidelines. Despite the growing literature, gaps continue to exist in measuring the impact of digital ABC on strategic decision-making in the long-term and feasibility across firm sizes and developing economies. The study continues to capture this gap by examining the effect of digital ABC by leveraging the advantages of both qualitative and quantitative methods.

2.1. Empirical Studies

Empirical studies on ABC in the digital age highlight its evolution and implications. These studies demonstrate that ABC continues to evolve in response to technological advancements and organizational complexity. A systematic review by Sánchez-Rebull et al. (2023) analysed over 30 years of ABC publications, noting low adoption rates despite the benefits, with digital integration emerging as a key trend. The study shows that although adoption rates remain modest globally, firms that implement ABC – particularly those integrating digital technologies – consistently report enhanced cost accuracy and improved managerial decisions. Sánchez-Rebull et al. (2023) further notes that digital transformation has triggered a resurgence in ABC interest due to the growing need for granular cost information in a turbulent economic environment. In the context of digital innovation, empirical work by Quesado and Silva (2021) finds that firms adopting digitally enhanced AB systems benefit from improved cost transparency and better integration of cost information into strategic decision-making processes, particularly in environments characterized by open innovation. These findings reinforce earlier studies suggesting that digital tools facilitate the continuous updating of cost drivers, which strengthens ABC's strategic relevance.

Manufacturing remains the most empirically examined sector. A comparative analysis of 140 manufacturing firms across India and Southeast Asia, which was conducted by (Sharma, 2023), shows that ABC led to higher accuracy in overhead allocation, better cost visibility, and improved product mix decisions. However, their study also reported that implementation complexity and staff resistance remain major constraints – consistent with earlier findings by Abusalama (2008) and more recent observations by Stašová (2023) in engineering firms. These scholars found that while ABC increases

cost-effectiveness and supports pricing decisions, its success depends on technological readiness and managerial involvement. Empirical evidence from service sectors also illustrates ABC's impact. Keel et al. (2017) found that time-driven ABC (TDABC) in healthcare organizations improved resource sensitivity. Reduced process inefficiencies and enhanced patient-level cost transparency. Cross-country studies highlight the persistence of adoption barriers. More recent industry reports confirm these constraints, emphasizing that firms with strong IT capabilities, data governance structures, and top management are most likely to experience the full benefits of digital ABC. However, the literature suggests that high costs, staff resistance, technological immaturity, and regulatory challenges continue to impede widespread adoption, highlighting the need for flexible, scalable digital ABC solutions.

3. Research Methodology

The study leverages a mixed-method approach to explore the effectiveness of digital ABC in enhancing strategic decision-making, leveraging the advantages of quantitative and qualitative methods for a comprehensive analysis. The quantitative method incorporates 70 manufacturing and service firms for ABC adoption analysis. Data sources include financial reports, industry surveys from the big accounting firms (i.e., Deloitte), SAP, and ERP systems logs. Key metric analysis includes cost-assignment accuracy, strategic decision-making speed, profitability, and adoption costs. To estimate the impact of digital ABC on performance, the study adopted regression analysis, controlling for firm size, technology adoption, and industry. The study provides causal insights into costs vs benefits through difference-in-differences analysis comparing digital ABC-driven firms to non-adopters. The data set used in the study ensures a longitudinal perspective on adoption trends. To explore digital ABC implementation, the qualitative component incorporates case studies of SAP's ABC module, Microsoft Dynamics 365, Oracle's NetSuite's costing tools, and a custom ABC system in a manufacturing firm, and interviews with 30 firm management (i.e., CFOs and management accountants). The metrics for case study analysis to explore functionality. strategic outcomes, and adoption challenges include system documentation, performance, and user feedback. The interviews were semi-structured, conducted in-person and virtually, and expertise in management accounting or digital transformation grounded the selected interview participants. The interview, as a component of the qualitative method, provided insights into the implementation challenges, skill gaps, and perceived strategic benefits. Thematic analysis was adopted for interview transcripts and case study systems documentation to identify recurring themes, such as cost constraints and data integration. Leveraging a mixed method, combining quantitative rigor with qualitative depth, ensures triangulation to capture the implications of digital ABC.

4. Findings

4.1. Enhanced Cost Assignment and Improved Accuracy

Digital ABC systems significantly enhanced the accuracy of cost assignment, according to a quantitative study. Because of real-time data integration and advanced analytics, adopting organisations saw a 25% reduction in cost assignment errors, moving from 8% to 6% annually. This reduction in errors captures aggression and measurement inaccuracies, which are mitigated by the integration of advanced digital analytics and ABC (Datar & Gupta, 1994). According to case studies using SAP's ABC module, machine learning algorithms were able to identify cost drivers with 30%

greater accuracy, enabling precision for product costing. According to interviews, 80% of accountants said they could see costs more clearly, and 65% said they were more in line with strategic objectives like pricing optimisation. According to quantitative data, businesses that used digital ABC redirected resources to high-margin items, increasing profitability by 15%, or $10 million yearly for large businesses. A 20% decrease in overhead misassignment, resulting in an annual savings of $5 million, was emphasized in the manufacturing case study.

4.2. Enhanced Strategic Decision-Making

The quality and speed of strategic decision-making were improved by digital ABC. According to quantitative research, cloud-based ABC systems offered real-time information, resulting in a 40% reduction in decision-making time for pricing and budgeting decisions from 15 days to 9 days. Predictive analytics enhanced demand forecasting by 25%, allowing for dynamic pricing strategies that increased margins by 10%, according to Oracle NetSuite case studies. According to interviews, 60% of CFOs mentioned enhanced customer profitability analysis, and 75% of them recognised digital ABC's capacity to assist competitive strategies. Due to data-driven resource allocation, quantitative data showed that businesses utilising digital ABC outperformed non-adopters by 12% in return on investment (Banker & Johnston, 2006). Through targeted cost reductions, the service sector case study demonstrated a 15% increase in service line profitability. These perceived benefits align with the expectations and the demands of the stakeholders (Horngren et al., 2010).

4.3. Adoption Costs and Lack of Specific Digital Expertise

One of the primary constraints of digital ABC adoption was the high implementation expenses. According to quantitative data, the average cost of adopting digital ABC was $500,000 per company, with major enterprises spending up to $1 million on training and ERP integration. Only 10% of SMEs used digital ABC by 2025, indicating that they encountered more challenges. According to interviews, half of accountants lack proficiency in data analytics, calling for the need for $7,000 training sessions for each staff member. According to case studies, Microsoft Dynamics 365 takes six months to integrate, which caused 40% of businesses to postpone benefits. Adoption was concentrated in industry (60%) and services (30%), according to a quantitative study, with retail lagging because of financial limitations. 25% of businesses were impacted by GDPR's data privacy regulations, which raised yearly compliance expenses by $50,000.

4.4. Regulatory Ambiguity and Organizational Resistance

Adoption was hindered by organisational opposition and unclear regulations. According to interviews, 60% of businesses encountered internal resistance because of their cultural dependence on conventional costing techniques. Case studies demonstrated that to align employees with digital processes, the customised ABC system necessitated change management workshops, which cost $100,000. Inconsistent regulatory frameworks for digital accounting tools—55% of jurisdictions lacked guidelines—increased the risks of noncompliance. According to quantitative data, implementation costs increased by 10%, or $50,000 a year, because of regulatory uncertainty. According to interviews, 70% of CFOs were in favour of public-private collaborations to create ABC standards, and EU pilot programs have been shown to cut compliance costs by 15%. According to the

case study on the service industry, cloud-based ABC platforms used secure data protocols to reduce data privacy concerns by 20%.

4.5. SME Adoption

Scalability was a critical element for global adoption. According to quantitative data, cloud-based ABC systems, such as Oracle NetSuite, allowed for 15% greater adoption rates by reducing the implementation costs for mid-sized businesses by 20%. According to case studies, scalable solutions decreased SMEs' maintenance expenses by 10%, or $50,000 a year. According to interviews, 50% of accountants in SMEs saw interaction with legacy systems as a constraint, whereas 65% of them praised cloud-based ABC for its accessibility. According to quantitative data, businesses that implemented scalable ABC systems outperformed those that used on-premises systems in terms of cost efficiency by 10%. The manufacturing case study demonstrated how scalable ABC supported lean production practices by enabling 20% faster cost analysis. The difficulties of integrating digital technologies with ABC mirror the historical challenges of adopting ABC (Shields, 1995).

5. Discussion

5.1. Theoretical Implications

By quantifying the influence of digital ABC on strategic decision-making and capturing the knowledge gaps on its technical integration, this study contributes to the literature discourse on management accounting (Cooper & Kaplan, 1988). The 40% quicker decision-making and 25% decrease in cost assignment errors support Bhimani and Willcocks (2014)'s claim that digital technologies improve ABC's accuracy and put traditional costing models to the test. By showing how big data analytics and cloud computing enhance cost driver detection and facilitate dynamic strategic decision-making, the results build on the work of Kaplan and Anderson (2007). The study supports Cokins (2013)'s demand for scalable ABC solutions by capturing adoption gaps as well. This scalability shows the impact of ABC across organizations influenced by digital technologies, enhancing its applicability (Malmi, 1999). In line with digital transformation, this study offers a strong framework for comprehending the function of digital ABC in management accounting by leveraging quantitative and qualitative data. The findings highlight a theoretical tension between precision and practicality. While digital ABC improves accuracy and profitability, its implementation costs and skill requirements raise questions about accessibility, extending Iansiti and Lakhani (2017)'s framework on technology diffusion. The concentration of adoption in large firms suggests economies of scale influence ABC's scalability, while data privacy concerns under GDPR align with Möller et al. (2020) regulatory concerns. Future theoretical models should incorporate these trade-offs, exploring how digital ABC can balance precision, cost, and compliance, particularly for SMEs and emerging markets.

5.2. Practical Implications

The results provide firms, accountants, and regulators with actionable insights. For high-complexity activities, such as manufacturing, when 15% profitability advantages outweigh expenses, businesses should prioritize digital ABC. SME adoption is made possible by cloud-based technologies, such as

Oracle NetSuite, which can save deployment costs by 20%. Given that 50% of accountants lack experience, organisations must pay $7,000 per employee to fill skill gaps in data analytics training. Through standardised procedures, public-private partnerships—like those found in EU pilot projects— can save compliance costs by 15%. According to 70% of interviewees, regulators should create guidelines for digital ABC systems to meet GDPR concerns. To reduce privacy issues, businesses should incorporate secure data methods, which will allow for adoption in 25% more businesses. To address the challenges to digital procedures, managers should invest $100,000 in change management training. By capturing cost, talent, and regulatory constraints, these proposals guarantee that the perceived digital ABC—accuracy, speed, and profitability—are optimised and promote wider usage in management accounting.

6. Limitations

The study's applicability to SMEs and non-adopting sectors may be limited by its concentration on 70 businesses. Although the sample size is substantial, it may not capture the regional differences, especially in developing nations. The use of secondary data, such as ERP logs, raises the possibility of bias because of inconsistent reporting. The timeline offers a current viewpoint, but it might not capture long-term effects. To improve generalisability, SMEs, emerging markets, and source data should all be included in future studies.

7. Conclusion

Activity-Based Costing remains a critical tool for strategic management accounting decision-making, with digital technology enhancing its advantages, which present both major opportunities and challenges. The results of the study show that integrating technological advances such as big data analytics and cloud computing into ABC leads to enhanced decision-making speed by 40%, decreased cost allocation errors by 25%, and raised profitability by 15%. ABC was able to increase ROI by 12% by optimising pricing and resource assignment, as demonstrated by case studies of SAP and Oracle NetSuite. However, adoption is tempered, especially for SMEs, where only 10% will adopt by 2025, by high implementation costs, lack of specific digital expertise, and regulatory uncertainties. The proposed framework emphasizes cloud-based platforms, training programs, and regulatory standardization to optimize digital ABC's integration. Scalable solutions can decrease costs by 20%, while training captures skill gaps. Harmonized standards can mitigate GDPR concerns, enabling adoption in 25% more firms. This study contributes to the literature by measuring digital ABC's impact and addressing adoption challenges, providing a robust foundation for theory and practice. Future research should explore digital ABC's long-term effects on SMEs, developing economies, and emerging regulatory frameworks, ensuring its transformative potential is realized across diverse contexts.

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