



## Understanding Digital Transformation in Management Control Systems: A Review of the Literature

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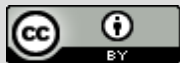
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### ABSTRACT:

The main focus of this review to examine the impact of digital transformation on management control systems. In order to achieve this objective, we conducted a literature search on Web of Science, Scopus and Emerald Insight databases because they are the most comprehensive repositories for obtaining empirical details on information systems, accounting and management. Our search activities were limited to journal articles published from 2015 to 2025 so as to ensure that the current study captures the most recent digital management control developments. The contingent, the socio-technical systems, institutional and the dynamic capabilities theoretical perspectives were further integrated into the analysis so as to enrich our understanding of the interactive connections linking between digital tools with managerial behavior and organizational structures. According to the findings, digitalization affects management control through technological, behavioral and organizational pathways. The current study uncovers that promoting technological efficiency can effectively yield the desired outcome when it does not compromise existing ethical standards. This scholarship uses existing literature to develop novel conceptual ideas that can be contextualized in any organizational regulatory and policy situations. While human oversight is required on an organizational level, policy initiatives are required to complement such efforts so as to address the ethical problems of digitalization.

**Keywords:** Artificial intelligence, Cybersecurity challenges, Data governance, Digital transformation, Ethical accountability, Management control systems, Pathways.



## 1 INTRODUCTION

It is a common norm that digitalization has been increasing on a highly prevalent rate and its features are greatly shaping both individual and organizational activities. With the inception of advanced systems such as Artificial Intelligence (AI) and Enterprise Resource Planning (ERP), one can reckon that managing daily activities is increasingly getting effective and efficient [1,2]. When the subject matter of real time control is incorporated into such developments, management control systems stand as one of the notable areas that has been greatly influenced by digitalization [3,4]. As such, studies reckon that these developments will continue to influence the scale and nature of activities undertaken by organizations [1,2,3,4]. This significantly places a huge demand for academic studies and organizational research to uncover strategies that can be effectively applied to harness the positive benefits of digitalizing operations, especially in managing control systems. Amid such observations, this review seeks to explore these developments by examining how organizations have digitally transformed and this has subsequently affected their control systems.

There has been a substantial growth in the nature and degree of digital tools being developed globally. Thus, as the world continues to adapt to high prevalent digitalization levels, organizations are increasingly integrating such systems into their operations. One notable area that has witnessed such changes is management control systems, which continues to press for better management approach to warrant their effective adoption and ethical use across organizations. Thus, as organizations adapt to more digital systems such as Enterprise Resource Planning (ERP) and Artificial Intelligence (AI)

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being integrated into their operations [1,2], calls can be made for studies to explore the impact of digital transformation on management control systems. Studies assert that these systems often impact the real-time control [3,4].

Within the context of organizational governance, management control systems play an important role of aligning strategic objectives with the organization's resources usage and operational performance [5]. Becker, Mahlendorf and Schäffer outlined that management control systems are traditionally founded on performance measurement and significantly rely on retrospective data [1]. However, digitalization helps companies to integrate automated reporting tools, dashboards and predictive analysis [1,6]. These developments constitute what are known as technological, behavioral and organizational forms of transition as studies consider them as changing how organizations assess their accountability and managerial competences [7,8]. Despite a commendable number of studies having covered digital transformation-related subject matters, this review observes that ideas about how it affects managerial control are still fragmented. Furthermore, studies have shown that research orientations linked to digital transformation are linked to various theories. For example, some studies adopted institutional and socio-technical approaches to studying how digital transformation connects to organizational activities [9,10]. Others only used the contingency theory to examine control adaptation [11]. To further buttress our arguments, we further observed that previous management control systems-related studies are significantly focus on developed economies. Consequently, this neglects other vital contexts such as Small to Medium Enterprise (SMEs) and less developed economies like Kurdistan region of Iraq, where digital adoption is yet to garner traction [4,12]. In light of these research problems, this review's main objective to synthesize existing studies and provide detailed information about how digital transformation influences management control systems. Specifically, this review strivers to answer the following questions:

- 1- How do digital technologies redefine management control systems?
- 2- What gaps exist in the current digital transformation and management control systems literature?
- 3- How can future studies improve existing levels of understanding of the digital transformation and management control systems literature?

Despite the growing body of literature on digital transformation and management control systems, existing reviews remain largely fragmented, often privileging single theoretical lenses or descriptive synthesis. To address this limitation, the present study advances an integrative conceptual framework that explains how digital transformation reshapes management control systems through three interrelated pathways: technological reconfiguration, behavioral adaptation, and institutional embedding. Rather than proposing a new standalone theory, the framework offers a structured integration of established theoretical perspectives to generate novel conceptual insights. By explicitly linking digital technologies to control design, managerial behavior, and governance structures, the framework clarifies how management control systems evolve under conditions of increasing data intensity and algorithmic decision-making. As part of adding to the existing literature, our study synthesizes existing conceptual and empirical ideas with the aim of improving understanding of possible ways organizations can utilize to enhance efficiency and safeguard the ethical use of digital tools. Firstly, our study uses a mapping technique to ascertain the key technological, behavioral and organizational themes linked to the digital transformation- management control systems debate. Secondly, different the contingent theory, the socio-technical systems theory, institutional theory and the dynamic capabilities theory perspectives were we integrated with the aim of explaining how control systems evolve amid changing digital conditions. Thirdly, the current study for an instrumental foundational role for future studies as it highlights knowledge gaps and proposes directions for future research on digital governance, accountability and performance control in increasingly data-driven business environments.

While prior reviews by Becker et al. [1] and Granlund, and Quattrone [2] have provided foundational insights into the relationship between digitalization and management control, these contributions primarily examine specific mechanisms or theoretical perspectives in isolation. The present review extends this body of work by systematically integrating insights across multiple theoretical traditions and empirical domains. In doing so, it identifies areas of convergence, tension, and omission within the literature, particularly in relation to ethical governance, accountability, and the organizational consequences of algorithmic control. This integrative perspective allows the study to move beyond descriptive synthesis toward a structured conceptual advancement. Following this introduction, the next of the study proceeds to outline the adopted methodological approach and describe the study's search strategy, selection criteria and analytical framework. Section Three presents the thematic synthesis of the reviewed literature with the aim of highlighting how digital transformation influences management control systems through behavioral, technological and organizational dimensions. Section Four proceeds to discuss the findings' theoretical implications, highlighting emerging challenges to digital ethics, accountability and governance. This section also identifies the research gaps and proposes future directions to advance the management control systems and digital transformation scholarship. The practical implications for managers, researchers and policymakers are also provided in this section.

## 2 METHODOLOGY OF THE REVIEW

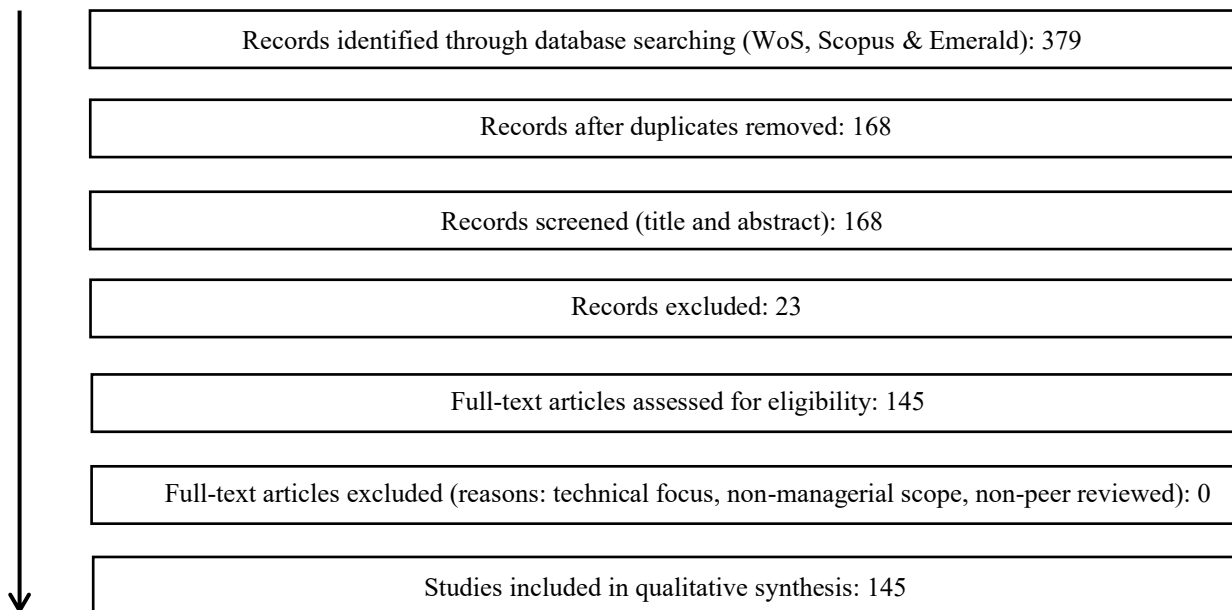
Foremost, we adopted a systematic literature review so as to ensure that this review comprehensively covers all the relevant studies and is transparency and replicability [13,14]. This was accomplished by following four structured stages comprising (1) database search, (2) study selection, (3) data extraction and coding, and (4) thematic synthesis. We then

proceeded to conduct a literature search on Web of Science, Scopus and Emerald Insight databases because they are the most comprehensive repositories for obtaining empirical details on information systems, accounting and management.

The literature search employed a comprehensive Boolean search string combining key terms related to digital transformation and management control systems. Specifically, the following string was applied across all databases: (“digital transformation” OR digitalization OR “Industry 4.0”) AND (“management control systems” OR “management accounting” OR “performance measurement” OR budgeting). Searches were limited to peer-reviewed journal articles published in English between 2015 and 2025. Conference papers, practitioner reports, and studies lacking explicit managerial or control-related implications were excluded to ensure academic rigor and relevance.

Concerning the inclusion and exclusion criteria, we included studies that focused on the role of digital technologies such as blockchain, analytics, AI and ERP in management control as well as management decision-making. This study also included studies that provided empirical or conceptual ideas about control processes, performance management or organizational adaptation. Our study excluded non-academic reports, conference proceedings and articles focusing mainly on technical information systems and lacked details about the related managerial implications.

The study followed the PRISMA 2020 guidelines to enhance transparency and replicability [15]. The review process comprised four stages: identification, screening, eligibility assessment, and final inclusion. The initial database search yielded 379 records, which were reduced to 168 after removing duplicates and clearly irrelevant studies. Figure 1 presents the PRISMA flow diagram detailing the identification, screening, eligibility, and inclusion stages. The diagram visually summarizes the number of records retrieved from databases, the removal of duplicates, the screening of titles and abstracts, the full-text eligibility assessment, and the final inclusion of studies in the review.



**FIGURE 1. PRISMA Flow Diagram of the Study Selection Process.**

Following title and abstract screening, full-text assessment resulted in a final sample of 145 articles that met all inclusion criteria. Table 1 provides a descriptive summary of included studies.

Drawing further, we systematically extracted the required data so as to capture the study objectives, theoretical frameworks, methods and examine digital technologies and the key findings. The mapping technique employed in this review refers to a structured classification process used to organize the literature according to thematic focus, theoretical lens, methodological approach, and technological domain. This approach enables the identification of dominant research streams as well as underexplored areas. By systematically categorizing studies prior to thematic analysis, the mapping process provides a foundation for synthesizing patterns and relationships across the literature. The study then proceeded to perform a thematic analysis to identify dominant patterns across literature [16]. The thematic analysis followed a reflexive approach, involving iterative coding and theme development. Initial codes were generated inductively from recurring concepts in the reviewed studies, such as real-time analytics, behavioral monitoring, and digital governance. These codes were then refined and grouped into higher-order themes using deductive insights drawn from contingency, socio-technical, institutional, and dynamic capabilities theories. This process resulted in four analytically distinct yet interconnected themes. Inductive and deductive coding processes were also applied whereby the initial codes were derived from recurring concepts such as behavioral impacts, analytics and automation.

**Table 1. Descriptive summary of included studies.**

Category	Classification	Number of Studies	Percentage (%)
<b>Publication Period</b>	2015–2017	28	19.3
	2018–2020	47	32.4
	2021–2023	51	35.2
	2024–2025	19	13.1
<b>Research Method</b>	Qualitative (case studies, interviews, ethnography)	62	42.8
	Quantitative (survey, archival, econometric)	41	28.3
	Mixed methods	17	11.7
<b>Geographical Context</b>	Conceptual / theoretical	25	17.2
	Europe	58	40.0
	North America	29	20.0
	Asia (excluding Middle East)	34	23.4
	Middle East & North Africa	12	8.3
<b>Organizational Focus</b>	Cross-national / global	12	8.3
	Large enterprises	79	54.5
	SMEs	32	22.1
	Public sector / hybrid organizations	21	14.5
<b>Key Digital Technologies Examined</b>	Mixed or unspecified	13	9.0
	ERP systems	46	31.7
	Big data analytics / dashboards	51	35.2
	Artificial intelligence / algorithms	29	20.0
	Blockchain / cybersecurity systems	19	13.1
<b>Core Control Variables Studied</b>	Performance measurement & KPIs	61	42.1
	Budgeting and planning	38	26.2
	Accountability and governance	33	22.8
	Behavioral control & decision-making	49	33.8
<b>Theoretical Lens Applied</b>	Contingency theory	44	30.3
	Socio-technical systems theory	31	21.4
	Institutional theory	27	18.6
	Dynamic capabilities theory	22	15.2
	Other / atheoretical	21	14.5

*Note:* Several studies address multiple geographical contexts, digital technologies, control variables, or theoretical perspectives. Accordingly, categories beyond publication period and research method are not mutually exclusive, and column totals may exceed the overall sample size of 145 studies.

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The contingency theory, socio-technical systems theory and institutional theory were used to guide higher level theme development. During the final review, we categorized the findings into four key thematic domains namely; (1) technological integration, (2) changes in performance management and budgeting, (3) behavioral and organizational impacts and (4) cybersecurity, ethics and resistance to change challenges. As a result, the adopted structural approach offers a solid understanding of how digital transformation shapes management control systems and also sheds light into possible ways that can be used to support conceptual interpretations and future studies.

### 3 THEORETICAL REVIEW

Rather than treating the selected theories as parallel explanatory tools, this study integrates them into a coherent conceptual logic. Contingency theory explains how management control systems adapt to contextual complexity introduced by digital technologies. Socio-technical systems theory accounts for the interaction between technological infrastructures and organizational actors. Institutional theory elucidates the legitimacy pressures shaping digital control adoption, while dynamic capabilities theory captures organizations’ ability to sense, seize, and reconfigure control mechanisms over time. Together, these perspectives provide a multi-dimensional explanation of digital transformation in management control systems. There are numerous theoretical views applicable to studying how technological tools

and systems affect human behavior and organizational activities. Concerning the interactive connection linking digital transformation and management control systems, our study selected four theoretical frameworks comprising the dynamic capabilities, institutional, socio-technical and contingent theories, which are dominantly exploited in academic research.

Starting with the contingent theory, Otley opines that the design and use of management control systems is influenced by a myriad of factors ranging from technological, environmental, strategic and organizational factors [17]. According to Becker Mahlendorf and Schäffer, digitalization increases data availability, reduces information asymmetry and promotes the development of feedback cycles [1]. Other related studies also contend that using advanced digital tools like ERP platforms and data control systems causes organizations to adopt adaptive systems that are highly predictable compared to traditional tools that use rigid rule-based systems [8,12]. These views are further broadened by the integration of the socio-technical systems theory. According to Scapens and Jazayeri [9] and Teittinen et al. [10], the socio-technical systems theory postulates that there is an existing interactive connection that links technological infrastructure with an organization's social practices. As a result, this theory considers digital tools and systems as crucial for automating control systems, reconfiguring work practices and decision-making [9,10]. Following these notions, we can thus establish that ERP systems, AI-driven data analytics and digital dashboards socio-technical systems theory tend to influence accountability structures, communication patterns and managerial roles.

Another theoretical view that adds to the digital transformation and management control systems discourse can be provided by incorporating the institutional theory, which explains how adopting digital control systems can be impacted by legitimacy pressure [6,7]. Building on ideas provided by Arnaboldi et al. [6] and Busco et al. [7], one can attest those efforts to digitalize reporting and control processes and are as a result of the need to ensure that the organization's operations meet the desired stakeholders' demands. These theoretical details tend to direct attention to digital transformation as an instrumental organizational change and technological upgrade process.

Lastly, we further augmented our theoretical perspectives by integrating the dynamic capabilities theory so as to provide a future-orientated platform for analyzing how digital tools enables real time sensing as well as reconfigure organizational resources [1,18]. In addition to enhancing agility, this demonstrates the noteworthy connections between digital transformation and management control systems. In light of these four theoretical perspectives, we can therefore argue that digital transformation is an essential component that enables businesses to intentionally and consistently renew their operations. Furthermore, through technological, organizational and behavioral pathways, we can demonstrate the multifaceted impact of digital transformation on control systems. This enhances our fundamental comprehension of the digital mechanisms that can be employed to propel and encourage change through contemporary management control systems. The selection of contingency, socio-technical, institutional, and dynamic capabilities theories is based on their complementary explanatory strengths. Alternative perspectives such as the resource-based view and actor-network theory was considered but deemed less suitable for the study's objectives. The resource-based view emphasizes static asset advantages, while actor-network theory prioritizes micro-level relational dynamics that are less conducive to synthesizing organizational control mechanisms across studies. The chosen theories collectively capture structural fit, human-technology interaction, legitimacy dynamics, and adaptive capacity.

## 4 THEMATIC SYNTHESSES OF LITERATURE

The four themes identified in this review emerged through an iterative coding process and were selected based on their analytical salience and theoretical relevance. Each theme captures a distinct dimension of how digital transformation influences management control systems, while collectively providing a holistic understanding of the phenomenon. The themes were validated through repeated comparison across studies and theoretical perspectives.

### 4.1 TECHNOLOGICAL INTEGRATION AND CONTROL ARCHITECTURE

This section commences by describing how an organization's control architecture becomes affected by technology integration. This is predicated on the idea that, once automation processes, artificial intelligence, and real-time data are incorporated into important management control processes, digitalization transforms the design of management control systems [1,4,8]. This is consistent with the ideas of Becker, Mahlendorf and Schäffer [1], who emphasize that employing sophisticated digital technologies, such as cloud computing and data visualization tools, helps to reduce errors. Appelbaum et al. [4] further elaborated on this, arguing that ERP and other cutting-edge digital tools contribute to more transparency. Recent studies highlight that AI-driven control systems introduce new risks related to algorithmic bias, opacity, and data governance failures. These issues challenge traditional accountability structures by obscuring decision rationales and diffusing responsibility. The review emphasizes the importance of hybrid control models that combine algorithmic efficiency with human judgment to mitigate these risks and uphold ethical standards.

According to Quattrone's [8] research, digitalisation enhances data integration. Digital technologies help organizations perform predictive analysis, according to a different study by Hyvönen et al. [12]. As a result, they are better able to foresee changes and protect the company from unfavourable circumstances. The growing trend of using dynamic forecasting capabilities is a noteworthy illustration of these opportunities [2]. Granlund also mentioned the advantages of decentralised decision-making and information sharing [2]. This review emphasises that digital integration helps

businesses increase coordination by contrasting these insights with concepts found in comparable studies like Scapens and Jazayeri [9]. To prevent its detrimental impacts, organizations must be extremely cautious while digitizing their control operations. This supports the conclusions of a study by Scapens and Jazayeri [9], which showed that data governance and cybersecurity issues are brought on by digitalization. Therefore, Moll and Yigitbasioglu [19] argue that businesses must make sure that the technology aspects of digital transformation comply with the necessary ethical data use and digital literacy requirements in order for organizations to solve these difficulties.

#### **4.2 DATA-DRIVEN PERFORMANCE MEASUREMENT**

Drawing attention to the second theme, we noted numerous studies directing attention to the increased prevalence of data-driven performance measurement systems as a form of digital transformation. Within the domain of management control systems, digital tools such as data-driven dashboards were noted to have changed organizations' financial indicators from being static to dynamic indicators. In addition, Arnaboldi et al. [6] and Bui and de Villiers [20] noted that their integration has been broadening to encompass numerous organizational activities such as balanced scorecards. These benefits are best achieved in organizations that have achieved higher customer engagement, innovation and sustainability levels [6,20]. Therefore, measuring and sustaining organizational performance requires organizations to adopt modern capabilities such as real-time analytics. Apart from improving the organization's responsiveness and ability to monitor organizational activities, this is also significantly important for aligning organizational goals. Hence, the need to place calls on organizations to leverage on digital tools and systems. Nonetheless, it is still essential to recognise that technology systems have negative consequences for organisations, and this research highlights these disadvantages in relation to management control systems. Becker Mahlendorf and Schäffer's [1] and Quattrone's [8] remarks that digital technologies often compromise management control lend credence to this. In most cases, this can result in a situation called 'control myopia', which occurs when there is overemphasis on quantifiable indicators which undermine the organization's strategic thinking and judgement. Therefore, organizations must ensure that their attempts to digitalize their management processes and systems are established on a platform that promotes an increased use of managerial intuition and algorithmic efficiency to warrant ethical responsibility.

#### **4.3 BEHAVIORAL AND ORGANIZATIONAL IMPACTS**

Building from the data-driven performance measurement theme, we further proceed to highlight the behavioral and organizational impacts of digital transformation on management control systems. This is because transforming the organization's digital systems affects the way it uses its control tools. In addition, this can also impact its managers' behavior and culture. Comparisons made by Busco et al. [7] and Hyvönen et al. [12] revealed that the transformation of organizational activities, systems and processes has resulted in changes in management accountants' roles from being scorekeepers to strategic business partners. These benefits were further postulated as enabling accountants to interpret complex data and make rational decisions. Furthermore, this also mirrors academic views shared by Granlund [2], which showed that organizational roles are bound to change as new forms of technology continuously demand companies to adopt new communication systems and data analytics tools, and exercise ethical judgement. In addition, Arnaboldi et al. [6] and Scapens and Jazayeri [9] highlighted that digital transformation's effects are mainly observable through changes in the companies' power dynamics. Though other benefits such as improving accountability are cited in academic studies by Arnaboldi et al. [6] and Scapens and Jazayeri [9], the same studies also raised concerns about induced stress, resistance and employee surveillance. Hence, we build on Tessier and Otley's [21] ideas and contend that digital transformation initiatives are effective when implemented on a platform of good organizational culture. Having established these behavioral and organizational impact ideas, our study argues that a good organizational culture that values trust, learning and responsible data use must be used to support the adoption of digital systems to warrant an effective control of organizational activities.

#### **4.4 CHALLENGES, RISKS AND FUTURE DIRECTIONS**

Though the benefits of digitally transforming organizational systems and processes are commendable, our review cites the prevalence of challenges, which it uses to suggest future directions for other studies. In as much as benefits such as new generated ideas and improved efficiency are appreciated, digitalizing operations poses system integration, cybersecurity and ethical governance challenges and risks. For instance, Appelbaum et al. [4] as well as Moll and Yigitbasioglu [19] opine that digital control environments are prominently affected by privacy violation, algorithmic bias and data breaches problems. Quattrone [8] mentioned that complex digital ecosystems tend to negatively affect the lines of accountability, making it difficult for companies to determine how the decisions were made. As a result, ideas provided by Becker Mahlendorf and Schäffer [1] highlight the importance of adopting hybrid control models in addressing such issues. Teittinen et al. [10] supported the importance of combining algorithmic intelligence with human oversight to reduce such challenges. Using these discussed themes, we, therefore, recommend organizations to reinforce these measures with robust digital governance and ethical auditing frameworks so as to further boost organizational effectiveness.

Although the reviewed studies are not empirically situated in the Kurdistan Region of Iraq, this context is introduced as an analytically relevant setting for future research. The dominance of studies conducted in developed economies limits

the generalizability of existing findings to emerging regions and SME-dominated environments. Accordingly, references to Kurdistan and SMEs are framed as theoretical extensions rather than empirical claims, highlighting the need for context-sensitive investigation.

While much of the literature emphasizes the benefits of digital transformation, this review identifies several limitations. Many studies rely on cross-sectional designs, single-case analyses, or small samples, which restrict causal inference. Furthermore, conflicting findings emerge regarding accountability, autonomy, and control intensity, suggesting unresolved tensions within digital control environments. These inconsistencies underscore the need for more rigorous and longitudinal research designs.

The reviewed studies exhibit substantial heterogeneity in terms of organizational context, industry focus, methodological approach, and theoretical orientation. Rather than treating this diversity as a limitation, the review explicitly accounts for these differences by comparing findings across contexts and analytical frameworks. This approach reveals that digital transformation does not produce uniform control outcomes but interacts with organizational and institutional conditions. Table 2 consolidates the key findings across the four identified themes, illustrating how digital technologies reshape management control systems through technological, behavioral, and governance-related mechanisms.

**Table 2. Consolidates the key findings across the four identified themes.**

Theme	Digital Technologies Examined	Key Effects on Management Control Systems	Theoretical Lenses Informing Findings	Key Implications
<b>Technological Integration and Control Architecture</b>	ERP systems, AI-based analytics, cloud platforms, digital dashboards	Digital technologies reconfigure control architectures from static, retrospective systems to real-time, predictive, and interactive controls. Automation improves transparency and coordination but increases system complexity and data dependency.	Contingency theory; Socio-technical systems theory	Control effectiveness depends on contextual fit and alignment between technological capabilities and organizational structures. Over-automation without governance increases control fragility.
<b>Data-Driven Performance Measurement and Budgeting</b>	Big data analytics, performance dashboards, balanced scorecards, forecasting tools	Performance measurement shifts toward dynamic indicators and continuous monitoring. Budgeting becomes more flexible but risks short-termism and control myopia due to excessive quantification.	Contingency theory; Dynamic capabilities theory	Digital performance systems enhance responsiveness and strategic alignment when combined with managerial judgment and interpretive control.
<b>Behavioral and Organizational Impacts</b>	Decision-support systems, AI-assisted reporting, digital communication platforms	Digital transformation alters managerial roles, redistributes power, and intensifies monitoring. Accountants shift from scorekeeping to strategic interpretation, while employees may experience surveillance pressure and resistance.	Socio-technical systems theory; Institutional theory	Successful digital control requires supportive organizational culture, trust, learning orientation, and ethical data use to mitigate resistance and stress.
<b>Challenges, Risks, and Governance Issues</b>	AI algorithms, cybersecurity systems, data governance frameworks	Algorithmic opacity, bias, cybersecurity threats, and unclear accountability challenge traditional control logics. Digital control environments blur responsibility and complicate auditability.	Institutional theory; Dynamic capabilities theory	Hybrid control models combining algorithmic intelligence with human oversight are essential to ensure accountability, ethical compliance, and stakeholder trust.

**CONCLUSION**

This study set out to systematically examine how digital transformation reshapes management control systems by synthesizing peer-reviewed literature published between 2015 and 2025. By adhering to PRISMA 2020 guidelines and applying a structured thematic synthesis to a final sample of 145 studies, the review moves beyond descriptive aggregation and provides an analytically grounded understanding of the mechanisms through which digital technologies influence control design, use, and outcomes. The conclusions drawn are therefore directly anchored in the systematic review process and the thematic patterns identified across the literature.

The thematic synthesis demonstrates that digital transformation affects management control systems through four interrelated domains: technological integration, data-driven performance measurement, behavioral and organizational change, and governance-related risks. Across these domains, the literature consistently shows a shift away from static, retrospective control models toward real-time, predictive, and interactive systems enabled by ERP platforms, analytics, and artificial intelligence. While these technologies enhance visibility, coordination, and responsiveness, their effects are contingent on organizational context, managerial interpretation, and institutional constraints. Digital control systems do not uniformly strengthen control; rather, they reconfigure it in ways that may simultaneously improve efficiency and introduce new vulnerabilities.

From a theoretical standpoint, the study contributes by integrating contingency theory, socio-technical systems theory, institutional theory, and dynamic capabilities theory into a single explanatory framework. This integration clarifies that digital transformation should not be understood as a purely technological intervention. Instead, it represents a dynamic process in which control systems evolve through the interaction of technological capabilities, human agency, legitimacy pressures, and organizational learning. The review extends prior work by showing how these theories operate in combination rather than isolation, thereby offering a more robust explanation of why similar digital tools generate different control outcomes across organizational settings.

The synthesis further reveals persistent tensions within digital control environments. While data-driven performance measurement enhances strategic alignment and monitoring capacity, excessive reliance on quantifiable indicators risks narrowing managerial judgment and encouraging short-termism. Similarly, automation and algorithmic decision support can strengthen accountability structures, yet algorithmic opacity and cybersecurity risks may blur responsibility and weaken auditability. These findings underscore the importance of hybrid control models in which algorithmic intelligence is complemented by human oversight, ethical governance mechanisms, and interpretive control practices.

The conclusions also highlight clear gaps in the existing literature that are methodologically grounded in the review findings. Much of the empirical evidence relies on cross-sectional designs and single-context case studies, limiting causal inference and contextual generalization. Moreover, research remains heavily concentrated in developed economies and large organizations, with comparatively limited attention to SMEs and emerging regions. Future studies should therefore adopt longitudinal and mixed-method designs to capture the dynamic evolution of digital control systems over time, and should explicitly examine how institutional environments shape control outcomes in underexplored contexts. Particular attention is warranted for issues of algorithmic accountability, ethical auditing, and the governance of AI-enabled control systems. In conclusion, this systematic review demonstrates that digital transformation fundamentally reshapes management control systems through intertwined technological, behavioral, and institutional processes rather than linear technological substitution. By linking its conclusions directly to a transparent SLR methodology and a rigorous thematic synthesis, the study provides a defensible and cumulative foundation for advancing both theory and empirical inquiry in digital management control research.

Though this manuscript provides a comprehensive review of digitalization's impact on management control systems, there are limitations that are worthy addressing. Foremost, given that a literature search was conducted on Web of Science, Scopus and Emerald Insight databases and limited to journal articles published from 2015 to 2025, essential details available might be left out. Secondly, there are no qualitative and quantitative methods that were used to validate the established ideas. Most importantly, there is no specific empirical evidence that was used to validate the findings. In light of these establishments, it is crucial for future studies to apply longitudinal and mixed methods in examining similar issues. Additionally, academics can carry out cross-national studies in Kurdistan's Dohuk, Sulaimaniyah, and Erbil that span a larger time period and environment. Other important themes that surfaced throughout the study, such as algorithmic control and performance evaluation, were also mentioned in the review. Future studies can be conducted to explore their moderating effects on the digital transformation and management control relationship. Building on the integrated framework, this study demonstrates that digital transformation fundamentally reshapes management control systems through intertwined technological, behavioral, and institutional processes. Future research should adopt longitudinal and mixed-method designs, examine SME contexts in emerging economies, and explore the governance implications of algorithmic control. Such approaches are essential for advancing both theoretical understanding and practical relevance.

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## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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