Journal of Data Analytics and Intelligent Decision-making **Vol. 1 Issue. 4 (2026) 1-31**

Journal of Data Analytics and Intelligent Decision-making

Journal homepage: jdaid.qom.ac.ir

University of Qom

Explaining IT Governance for Implementing Branchless Banking Through Digital Transformation

Vahid Shahabi*[a], Rahim Sarhangi[b], Amir Mehdiabadi[c]

a. Department of Industrial Management, Science and Research branch, Islamic Azad University, Tehran, Iran.
b. Faculty of Governance, University of Tehran, Tehran, Iran.
c. PhD in Industrial Management, Department of Industrial Management, Se.C., Islamic Azad University, Semnan, Iran.

A R T I C L E I N F O

Keywords:
Information Technology Governance (ITG)
Digital Transformation (DT)
Branchless Banking (BB)
Structural Equation Modeling (SEM)
COBIT Framework
Risk Management (RM)
Strategic Planning (SP)
Quality Management (QM)

A B S T R A C T

Purpose: This research addresses the critical gap in Information Technology Governance (ITG) models, specifically tailored for the successful implementation of Branchless Banking (BB). While ITG has been extensively studied, its application within the unique context of BB remains underexplored. This study proposes and validates an operational ITG model designed explicitly for BB implementation.

Design/methodology: Drawing upon a comprehensive literature review and insights from in-depth interviews with information security experts, this study identifies the key effects of ITG implementation on BB success. An operational model is developed and empirically validated using Partial Least Squares Structural Equation Modeling (PLS-SEM).

Findings: The structural modeling results demonstrate that ITG exerts a significantly more favorable and robust effect on BB success when mediated through Digital Transformation (DT). Furthermore, the core ITG framework components, Strategic Planning (SP), Risk Management (RM), and Quality Management (QM), are found to have significant positive influences on the ITG framework itself. Crucially, ITG also exhibits a direct, positive, and significant impact on the successful implementation of BB. These findings underscore the necessity for banks to align their DT strategies with a robust ITG framework to effectively eliminate physical branches and digitize banking processes.

Originality/value: BB represents a transformative digital banking paradigm, digitizing service processes and eliminating the need for

* Corresponding author.
E-mail addresses: vahid.shahabi@srbiau.ac.ir (V. Shahabi), Sarhangi@ut.ac.ir (R. Sarhangi), Amir.mehdiabadi@gmail.com (A. Mehdiabadi)

Received 15 November 2025; Received in revised form 01 January 2026; Accepted 15 January 2026
Available online 25 January 2026
3115-8161

Cite this article: Shahabi, V., Sarhangi, R., Mehdiabadi, A. (2026). Explaining IT Governance for Implementing Branchless Banking Through Digital Transformatio. *Journal of Data Analytics and Intelligent Decision-making*, 1(4), 1-31.
https://doi.org/10.22091/jdaid.2026.14530.1018

the presence of physical branches. A primary challenge in BB delivery is mitigating diverse security risks stemming from malicious activities by hackers and fraudsters aimed at stealing or compromising customer data, thereby exposing banks to substantial operational and reputational risks. This study's originality lies in developing the first dedicated ITG model for BB, incorporating DT as a critical mediator, and integrating QM as a foundational element alongside SP and RM within the COBIT framework.

1. Introduction

Cyber threats, defined as malicious attempts to compromise or destroy data within networks and computer systems, pose a significant risk to the modern banking sector. These threats, originating from various sources, such as compromised websites or systems, primarily aim to obtain sensitive information through online channels (Kumar, 2023). In recent years, digital banking has become increasingly vulnerable to such attacks, exemplified by security breaches where customers of major banks had funds stolen from their accounts during the widespread hacker attacks of 2021 (Kumar, 2023). More recent studies emphasize that the growing adoption of fully digital and branchless banking models has further expanded the attack surface, making cybersecurity governance a critical managerial concern rather than merely a technical issue (Schrofelbauer & Sellinger, 2025). Consequently, the primary goal of cybersecurity in digital banking is to implement protective measures for users' digital assets, such as debit and credit cards, during transactions.

As technology advances and its integration into business processes expands, the need for Information Technology Governance (ITG) has become more critical. ITG plays a vital role in the context of digital and branchless banking (BB), where all operations are conducted remotely (OECD, 2021). It has emerged as a key issue in banking information technology, with bank managers tasked with establishing ITG frameworks to ensure proper investment, optimize value creation, and minimize risks (Aprilinda, 2019). Recent literature highlights that ITG has evolved beyond traditional control mechanisms to encompass risk management, cybersecurity oversight, and regulatory compliance in digitally intensive banking environments (Ahmed & Iqbal, 2025). Given the rapid evolution of information technology, there is a growing need to enhance ITG practices within banks (Henriques et al., 2020).

A central aspect of ITG involves determining the degree to which IT security controls should be centralized or decentralized, requiring organizations to establish and maintain governance procedures to ensure the implementation of security policies and protocols (Fianty & Brian, 2021). This challenge has become more pronounced with the emergence of agile digital platforms, artificial intelligence, and FinTech-based ecosystems, which require adaptive and hybrid governance structures (Pilorget, 2025). Fundamentally, ITG is a subset of corporate governance that focuses on aligning business objectives with IT strategies, a principle widely recognized and implemented by organizations (Debreceny et al., 2013).

The banking industry, facing intensified competition, finds the shift toward new banking methods, such as digital transformation (DT) and branchless banking (BB), an undeniable necessity. Branchless banking represents the digitization of all programs and activities traditionally conducted in physical bank branches (Anisi et al., 2022). Recent studies indicate that BB is not only a technological innovation but also a strategic transformation that requires strong governance mechanisms to manage operational, cybersecurity, and compliance risks (Ali & Khalid, 2025; Nguyen & Phan, 2025). Establishing a foundation for advancing the BB industry requires several measures, with the proper implementation of ITG being among the most fundamental (Ahmadi et al., 2023).

As banking service delivery processes undergo fundamental changes, new models such as BB emerge, necessitating strategies aligned with governance standards like ITG. Given that BB is a strategic business goal, its successful implementation relies on the application of ITG to align business objectives with IT goals (Shahabi et al., 2021). Empirical evidence from recent studies confirms that both traditional and agile ITG mechanisms significantly influence the success of digital transformation initiatives and overall banking performance (khan et al., 2025). The successful execution of BB tasks relies upon the effective application of ITG.

While existing models offer limited guidance, the COBIT framework, with its extensive capabilities compared to other standards, presents a robust methodology for evaluating and measuring IT maturity levels within banks and similar financial institutions (Kurniawansyah et al., 2023). COBIT is a comprehensive framework that helps businesses maximize the value of IT by balancing benefits, optimizing risk levels, and utilizing resources effectively (Kurniawansyah et al., 2023). It aids in establishing clear policies and best practices for IT control, enabling information and related technologies to support business objectives while minimizing operational risks (Fernandes et al., 2020). Recent governance studies reaffirm COBIT's relevance in addressing emerging digital risks, including cybersecurity threats, AI governance, and data protection in digital banking ecosystems (Alnsour et al., 2025).

The transition to digital banking presents a significant challenge for the banking industry. To sustain their operations, banks must implement ITG for digital platforms and construct strong ecosystems capable of evolving and adapting to changes (Khashei et al., 2024). Recent research has highlighted the integration of emerging technologies, such as artificial intelligence, blockchain, and biometrics, into digital banking platforms to enhance customer experience and operational efficiency (Indriasari et al., 2022; Nguyen & Phan, 2025). Moreover, the integrated governance of these technologies has been shown to reduce organizational risk and enhance sustainability and trust in digital financial services (Ali & Khalid, 2025).

The importance of IT governance (ITG) in successful digital transformation and organizational performance has been emphasized, with both traditional and agile/adaptive ITG mechanisms showing a significant effect (Afifah et al., 2022). ITG's function has evolved to include both governing of IT and governing through IT, reflecting a growing connection to corporate governance (Wilkin & Chenhall, 2020). Continuous monitoring and assessment of ITG practices have therefore become essential to cope with rapid technological change, increasing cyber threats, and evolving customer expectations in digital and branchless banking (Hantsch et al., 2025).

Despite the extensive body of research on ITG and digital transformation, the development of a dedicated IT governance model specifically tailored for branchless banking implementation remains limited and underexplored. Accordingly, this study contributes to the literature by proposing and empirically evaluating an ITG-based governance framework for branchless banking using the COBIT framework. The study provides managerial insights for banking executives by identifying key governance mechanisms that enhance cybersecurity readiness, align IT investments with strategic objectives, and support the sustainable implementation of branchless banking models.

1.1 Motivations and Research Gaps

The rapid growth of branchless banking (BB) represents a significant shift within the banking industry, driven primarily by escalating customer demand for faster, more accessible, and cost-effective financial services (Anisi et al., 2022). This transition towards eliminating physical branches is not merely a trend but a strategic imperative for banks seeking to remain competitive and relevant in a digitally-driven marketplace. Recent studies emphasize that BB has evolved into a core digital business model rather than a supplementary service channel, requiring advanced governance and risk management capabilities (Hasan et al., 2025).

However, this transformation concurrently introduces heightened security vulnerabilities, as the rise of sophisticated cyber threats—including hacking and fraud—poses substantial risks to BB operations, potentially compromising sensitive customer data and eroding trust (Alzoubi et al., 2022; Kumar, 2023). Empirical evidence from recent digital banking incidents indicates that governance failures, rather than purely technical weaknesses, are often the root cause of large-scale security breaches in branchless and platform-based banking environments (Ali & Khalid, 2025). Effectively mitigating these risks necessitates robust governance frameworks capable of ensuring data security and operational resilience. Central to navigating this complex landscape is information technology governance (ITG) which plays a pivotal role in ensuring that the broader digital transformation (DT) in banking is executed securely and efficiently (OECD, 2021; Wilkin & Chenhall, 2020). Information technology governance provides the essential structure for aligning IT investments and strategies with the overarching business objectives, thereby enhancing value creation and minimizing risks (Aprilinda, 2019; Debreceny et al., 2013). Recent systematic literature reviews confirm that ITG has become a critical enabler of digital resilience, regulatory compliance, and strategic agility in highly digitized banking ecosystems (Weber et al., 2025).

Despite the recognized importance of ITG and extensive research on its general principles, a critical deficiency persists: the lack of a dedicated, tailored ITG model, specifically designed to address the unique operational, security, and strategic challenges inherent in BB implementation (Henriques et al., 2020).

This gap is particularly pronounced since many banks struggle with the strategic alignment of IT investments, highlighting a clear need for structured governance models that can enhance strategic planning, risk management, and quality assurance within the specific context of digital banking (Arghand et al., 2022). Recent evidence suggests that misalignment between IT governance mechanisms and digital transformation initiatives significantly weakens the performance outcomes of branchless banking models (Afifah & Mulyana, 2025). This study is motivated by these intersecting drivers—the growing significance of BB, the imperative for robust security, the recognized need for effective ITG, and the strategic demand for aligned governance models—and aims to address several critical research gaps that hinder the successful implementation of BB:

1. The Lack of a Specific ITG Model for Branchless Banking: While the existing IT governance literature offers valuable insights, it predominantly focuses on generalized frameworks (e.g., COBIT, ITIL) rather than models explicitly tailored to the distinct ecosystem of BB (Henriques et al., 2020). Recent studies acknowledge that generic ITG frameworks require contextual adaptation to remain effective in fully digital and branchless banking environments (Albderi et al., 2023).
2. This research directly addresses this gap by leveraging the comprehensive COBIT-2019 framework to develop and validate a dedicated ITG model for BB.
3. The Limited Exploration of Digital Transformation's Mediating Role: Although IT governance is widely studied, its intricate interaction with DT as a catalyst for BB success remains underexplored (Afifah et al., 2022). Recent empirical findings highlight DT as a critical transmission mechanism through which ITG influences organizational performance and digital service innovation (Alzoubi et al., 2022).

4. This study explicitly integrates DT as a critical mediating variable within the proposed ITG model, investigating how ITG influences BB outcomes through the enabling mechanisms of DT.
5. Underdeveloped and Narrow Risk Management Approaches in BB: Current risk management research in digital banking often exhibits a narrow focus, concentrating predominantly on cybersecurity threats (Sinaga & Suroso, 2023; Warkentin & Johnston, 2016). However, recent research stresses the necessity of holistic risk governance frameworks that simultaneously address cybersecurity, operational, regulatory, and strategic risks in digital and branchless banking models (Arghand et al., 2025).
6. This gap is addressed by adopting a more comprehensive perspective on Risk Management (RM), encompassing not only cybersecurity but also operational, regulatory, and strategic risks inherent in the BB environment.
7. The Scarcity of Empirical Validation in Banking Contexts: A significant portion of prior research on ITG frameworks remains theoretical or conceptual, lacking rigorous empirical testing within real-world banking settings (Ramadhana et al., 2023). Recent literature explicitly calls for context-specific empirical validation of ITG models within regulated industries, such as banking, particularly in emerging economies (Ariyani & Wicaksono, 2025).
8. This study bridges this gap by conducting empirical validation through Structural Equation Modeling (SEM) and insights gathered from expert interviews conducted specifically within the operational context of Resalat Qard-al-Hasana Bank in Iran.
9. The Omission of Quality Management (QM) as a Core Governance Component: Traditional IT governance frameworks tend to prioritize compliance and security, often overlooking the critical role of Quality Management (QM) in ensuring service excellence and customer satisfaction in digital banking (Derakhshan et al., 2022). Recent governance research highlights QM as a strategic governance capability that directly influences customer trust, service reliability, and long-term sustainability in digital financial services (Khashei et al., 2024).
10. This research identifies QM as a frequently missing yet vital component and explicitly integrates it alongside Strategic Planning (SP) and Risk Management (RM) as a fundamental pillar within the proposed ITG model for BB success.

By systematically addressing these interconnected motivations and gaps, this research contributes a novel, empirically grounded ITG model which is specifically designed for branchless banking, offering both theoretical advancement and practical guidance for banking executives seeking to enhance cybersecurity and governance.

2. Theoretical Foundations

2.1 Branchless Banking (BB)

The contemporary banking sector is undergoing a profound transformation, driven by a confluence of forces, including evolving consumer expectations, rapid technological advancements, stringent regulatory requirements, and economic pressures. These dynamics necessitate the fundamental restructuring and modernization of traditional banking architectures (Soltani & Tahmasabi Aghbelaghi, 2020). Within this landscape, branchless banking (BB) has emerged as a pivotal operational paradigm. It leverages digital channels—primarily the internet, mobile phones, and other electronic media—to deliver a comprehensive suite of financial services without reliance on physical branch infrastructure (Wadesango & Magaya, 2020). Banks remain central to national financial systems, facilitating robust payment mechanisms that meet societal needs. The integration of information technology into banking has yielded substantial benefits for both institutions and customers, significantly enhancing operational efficiency and service delivery (Sharma & Dubey, 2022). The adoption of BB models not only improves service accessibility and quality but also serves as a catalyst for fostering enhanced customer loyalty (Marlius, 2022).

The proliferation of portable devices, including mobile phones, smartphones, and tablets, has been instrumental in reshaping the financial services landscape. This widespread device adoption has compelled banks to develop sophisticated mobile banking and dedicated BB applications (Shaikh & Karjaluoto, 2016). Branchless banking is fundamentally characterized by several core attributes: continuous service availability (24/7 access), robust security measures, service personalization, digital user authentication, and the complete digitization of transactions, thereby eliminating the need for physical paperwork (Melnychenko et al., 2020). This shift towards digitization represents a paradigm shift in the industry of financial services, propelled by significant advancements in information technology and the convergence of mobile devices with innovative electronic services, such as crowdfunding platforms and specialized BB solutions (Gasser et al., 2017).

The implications of this digital transformation for the banking industry are multifaceted and far-reaching, impacting key dimensions as outlined by Gasser et al. (2017):

- Bank Customers: Reduced reliance on in-person consultations and a pronounced shift towards electronic service channels.
- Banking Operation Models: A transition towards more decentralized and agile organizational structures.
- Banking Revenue Models: Intensified competition leading to potential erosion of traditional banks' market share.
- Digital Banking Platforms: The emergence of open banking platforms offering innovative services, including branchless banking, social banking, and automated advisory solutions.
- Data-Driven Banking: The strategic utilization of big data analytics to enable customer-centric services and improve operational efficiency.
- Banking Value Chain: The entry of non-banking entities (e.g., FinTechs) into the traditional banking value chain, disrupting established roles.

Digital technologies are the primary enablers of this ongoing Digital Transformation (DT), fundamentally altering the structure and delivery of banking services and products. However, a successful transition from conventional to digital banking models necessitates more than just technological adoption; it demands a strong focus on governance to ensure security, compliance, and strategic alignment (Wewege, 2017).

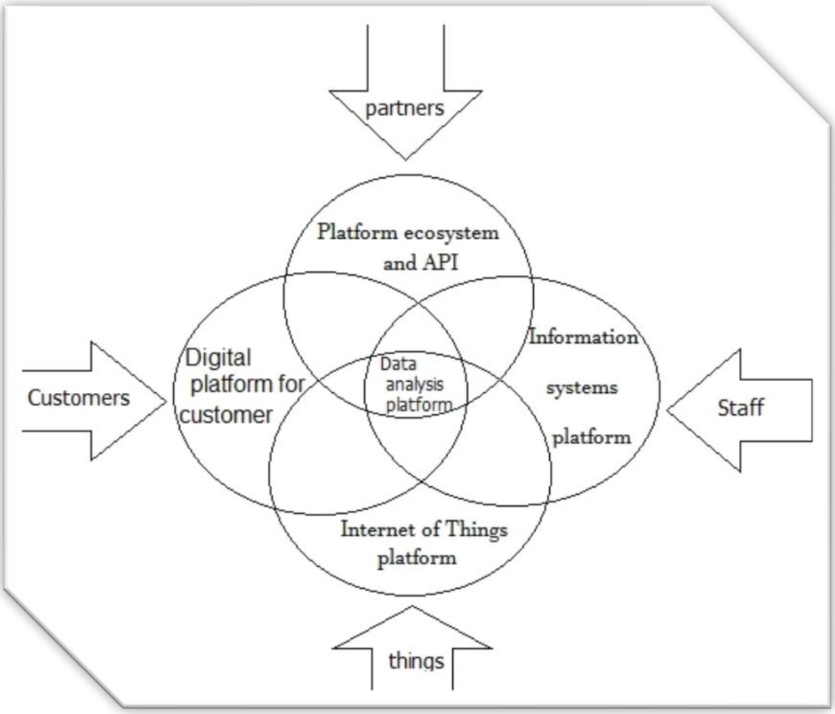

Figure 1

Digital Banking Architecture Framework (Gartner, 2017)

To effectively operationalize this transformation, robust architectural frameworks are essential. Gartner's Digital Banking Architecture Framework (2017), as depicted in Figure 1, provides a foundational blueprint. This model posits that the successful realization of banking digitalization hinges on the development of five core platforms, each adhering to critical design standards:

- Algorithm-Centric Design: Algorithms must form the computational and decision-making core of the platform.
- User-Centric Approach: The platform must be designed to address the diverse needs and experiences of all relevant stakeholder groups (customers, employees, partners).
- Adaptability: The platform's features and underlying algorithms must be capable of dynamically adapting to changing market conditions, regulatory landscapes, and user requirements.
- Scalability: The platform architecture must be inherently expandable, capable of evolving seamlessly in response to technological advancements, market dynamics, and shifts in business strategy.

This framework provides the theoretical underpinning for understanding the structural requirements of modern digital banking ecosystems, including BB, and informs the development of the IT governance model proposed in this research.

2.2 Information Technology Governance (ITG)

In the contemporary business environment, characterized by the pervasive integration of information technology (IT) into core organizational processes and the escalating complexity of managing this integration, the strategic importance of information technology governance

(ITG) has become increasingly pronounced (Borja et al., 2022). As organizations grow more dependent on IT, and investments in this domain continue to rise, ITG has evolved from a supplementary function into a vital determinant of organizational success and sustainability (Arghand et al., 2022). While advancements in IT undeniably enhance competitiveness, improve performance, and increase the effectiveness and efficiency of business operations, the realization of these benefits is contingent upon ITG being strategically aligned with organizational objectives and implemented effectively (Ramadhana et al., 2023). Fundamentally, ITG constitutes a strategic framework through which organizations ensure that their IT investments robustly support and facilitate the achievement of overarching business targets. Given its critical role in aligning IT capabilities with business strategies, ITG has transcended to become a core business imperative. As a structured control mechanism, ITG plays a pivotal role in unlocking the value derived from IT investments. It provides a systematic approach for steering and managing an organization's IT portfolio, ensuring that IT resources are leveraged efficiently to drive measurable business outcomes (Schaefer et al., 2020).

The rapid and relentless evolution of the information technology landscape further accentuates the necessity for robust governance frameworks. Among the most widely recognized and adopted models for ITG is COBIT (Control Objectives for Information and Related Technologies). COBIT functions as a comprehensive framework for ITG, introducing the critical concept of ITG enablers—factors essential for informed decision-making and effective governance processes (Henriques, 2020). Through the systematic implementation of ITG principles, organizations can fortify their leadership structures, optimize organizational designs, and refine operational processes. This ensures that IT initiatives are not only aligned with but also actively support broader enterprise goals. It is crucial to recognize that IT exerts both direct and indirect effects on overall business performance. Furthermore, the adoption of emerging technologies introduces new risks at both strategic and governance levels, necessitating a continuous reevaluation of traditional governance approaches. In the current era of pervasive digitization, organizations must develop new understandings and adopt innovative governance strategies to effectively navigate emerging challenges and capitalize on new opportunities (Levstek et al., 2022).

Conceptually, ITG is a distinct subset of corporate governance, specifically focusing on the role, management, and oversight of information technology within an organization. A growing number of organizations acknowledge this intrinsic link and implement formal ITG frameworks to better align business objectives with IT strategies (Debreceny et al., 2013). The COBIT framework stands out as a preeminent business-oriented framework for both organizational management and ITG, particularly designed to increase the value of enterprise information by structuring governance and management practices according to the latest theories and techniques in the field (Mikalef et al., 2021). A core strength of the COBIT framework lies in its comprehensive coverage of critical governance domains, notably ensuring the organization's effectiveness in Strategic Planning (SP), Risk Management (RM), and Quality Management (QM). These domains are universally recognized as the fundamental pillars of modern business success. Consequently, for the purpose of this research, focusing on the successful implementation of branchless banking (BB), the core indicators selected to measure the effective implementation of the COBIT framework, and by extension ITG, are the variables of strategic planning (SP), risk management (RM), and quality management (QM). These components form the foundational constructs of the proposed governance model.

2.3 The Role of ITG on BB

In the contemporary economic landscape, digitalization has transcended being merely an option to become an imperative for survival and growth. Establishing the essential digital platforms to foster sustainable economic growth and enhance the business environment is fundamental for enabling all economic actors to thrive in the digital age (Khashei et al., 2024). Achieving this necessitates prioritizing the digitization and modernization of the economy across all financial institutions and markets. Given the pivotal role banks play in financing economic activity and developing robust payment systems, it is evident that the realization of a fully functional digital economy is intrinsically contingent upon the establishment of a resilient and sophisticated digital banking infrastructure. This imperative is particularly acute in light of global banking trends and the emergence of innovative business models driven by rapid advancements in information technology (Khashei et al., 2024; Shahabi et al., 2024).

Consequently, digitization has emerged as a non-negotiable strategic priority for the global banking industry. The successful transition to digital banking models, including branchless banking (BB), is fundamentally contingent upon the effective implementation of information technology governance (ITG)**.** Information technology governance provides the essential framework and discipline required to navigate the complex risks and challenges inherent in digital transformation (DT)**,** such as cybersecurity threats, regulatory compliance, operational disruptions, and strategic misalignment (Fianty & Brian, 2023). For ITG initiatives to be effective, IT managers must possess a deep and nuanced understanding of the bank's overarching business strategy. Conversely, the failure to implement robust ITG can lead to the adoption of ineffective, inefficient, or misaligned technologies, ultimately undermining organizational objectives. Therefore, ITG in the banking sector must be specialized, focusing on delivering IT services and solutions meticulously tailored to the unique operational requirements, risk profiles, and the strategic goals of financial institutions.

Recognizing the central role of information technology as a key enabler in achieving an organization's vision, mission, and strategic objectives, this research underscores that the proper implementation of ITG is not merely beneficial but essential for driving the overall success and competitiveness of modern banks (Fianty & Brian, 2023). In practice, effective ITG is operationalized through the active collaboration and commitment of the bank's highest leadership echelons—the Chief Executive Officer (CEO), the Board of Directors, and senior management. This top-down engagement ensures that ITG principles are embedded within the corporate culture and strategic decision-making processes. Crucially, the successful realization of a branchless banking (BB) model is impossible without the foundation of effective ITG. Achieving BB requires establishing a resilient, secure, and scalable IT platform within the bank, coupled with strategic, well-managed, and continuously monitored investments in information technology. Only through this integrated approach, anchored by robust ITG, can banks fully leverage the transformative potential of digital technologies, mitigate inherent risks, and sustain their competitive advantage in an increasingly dynamic and digital-first financial marketplace.

2.4 Background Research

A comprehensive review of extant literature reveals a growing body of research examining the multifaceted relationship between information technology governance (ITG), digital transformation (DT), and the evolving banking landscape. While these studies collectively underscore the strategic importance of ITG, a critical analysis highlights significant gaps that this research aims to address, particularly concerning the development of a dedicated ITG model for branchless banking (BB). The following synthesis organizes key findings thematically:

2.4.1 The Foundational Role of ITG and COBIT Framework

Research consistently positions ITG as a fundamental driver of organizational success. Schaefer et al. (2020) demonstrate that IT has become integral to enhancing organizational success, with outcomes aligning with the objectives of both public and private sector entities to better understand IT's strategic role and governance perspectives. Aprilinda et al. (2019) emphasize that organizational leaders implement ITG to ensure IT investments are directed towards methods that preserve IT advantages, maximize organizational value, and minimize threats. The COBIT framework emerges as a dominant paradigm in this domain. Henriques et al. (2020), utilizing a Delphi algorithm and AI, assert that ITG is vital for aligning IT strategy and infrastructure with business goals, identifying COBIT as the most prominent framework defining seven competency categories. Similarly, Ramadhana et al. (2023), in an empirical study, show that ITG assessment based on COBIT within electronic banking systems boosts bank productivity, with COBIT implementation providing a competitive advantage for e-banking units. Borja et al. (2022), through a survey, reinforce that the extensive use of IT and its increasing governance complexity necessitate heightened attention to ITG issues. Arghand et al. (2022), employing Value Stream Mapping (VSM), further establish that ITG ensures dynamic business-IT alignment in complex environments, particularly as organizational dependence on IT and related investments grow.

2.4.2 Risk Management and Security Imperatives in Digital Banking

A significant stream of research focuses on the critical challenges of risk and security inherent in digital banking. Warkentin and Johnston (2016), in a comparative exploratory study, identify the centralization vs. decentralization of IT security controls as a crucial issue in IT security governance. Sinaga and Suroso (2023), using the Expected Value at Risk (EVAR) method, argue that banks must consider the maximum probable loss from digital financial transactions as a risk management benchmark to ensure adequate reserve funding. Alzoubi et al. (2022), through theoretical analysis, highlight that the primary challenge of digital banking involves diverse security risks stemming from malicious activities targeting customer data, necessitating robust security measures, including verification, authentication, and encryption. Valsamidis et al. (2020), employing cluster analysis and non-parametric tests, note that contemporary demand for banking services is time- and location-dependent, requiring innovation, enhancement, safety, and optimization to meet the expectations of tech-savvy customers. These studies collectively underscore the non-negotiable need for sophisticated risk and security frameworks within any viable ITG model for BB.

2.4.3 Digital Transformation, Innovation, and Performance Impacts

The transformative impact of DT and technological innovation on banking performance and operations forms another critical research theme. Albderi et al. (2023), using regression analysis, posit that DT is simultaneously a trend, a requirement, and the primary pathway to sustainable development for commercial banks, with managers playing a crucial role in this evolution. Warner and Wäger (2019), in a comprehensive review, define DT as a continuous process leveraging new digital technologies, with agility serving as the core mechanism for strategic renewal across business models, processes, and culture. Shahabi et al. (2022), utilizing Factor Analysis (FA), highlight the significant role of emerging technologies (IoT, cloud, big data) in enhancing organizational performance, particularly through the creation of Industry 4.0 cyber-physical systems. Khemiri and Jallouli (2022), in a review, emphasize the potential of new technologies, particularly mobile services, for personalization, identifying technology-based personalization as a key factor in mobile service adoption. Empirical studies consistently link digitalization to performance. Hamdan et al. (2021), using generalized least squares regression, show that increased ATM and internet banking usage directly boosts bank profitability and performance. Aduda and Kingoo (2012), through statistical analysis, establish a strong positive relationship between digital banking and financial institutions' overall performance in the US banking industry. Carbó-Valverde et al. (2020), using questionnaires, find that banks' IT investments increase the likelihood of customers using digital channels over physical branches.

2.4.4 Customer-Centric Perspectives and Operational Shifts

Research also explores the customer experience and operational dimensions of digital banking. Haralayya (2021), in a review, notes that banks develop innovative services to meet growing customer expectations, with digitalization redefining operations, products, and customer interactions, enabling faster, more accurate, and convenient transactions. Marlius (2022), through qualitative analysis, confirms that digital banking improves service quality and fosters customer loyalty. Gangadwala and Goyani (2019), in a review, acknowledge that while cash transactions become harder, online banking supports economic expansion, though digitalization stances vary by country. Veena (2022), using descriptive analysis and questionnaires, identifies a significant digital divide, revealing that elderly customers remain distant from digitalization due to knowledge gaps, lack of awareness, and negative attitudes stemming from misunderstanding. Indriasari et al. (2022) stress the importance of strengthening decision-making processes and their impacts on bank management and policymakers for future digital banking development. Sharma and Dubey (2022), in a synthesis, highlight that bank digitization dramatically increases profitability through cost reduction while simultaneously expanding service offerings. Juiz and Gomez (2021), through experimental and exploratory methods, find that while board and top management involvement in ITG is recognized regarding abilities, duties, and attention, willingness remains comparatively low. Levstek et al. (2022), using experimental and exploratory approaches, advocate for enhancing IT governance to provide leadership, structures, and processes ensuring IT supports and expanding business strategies. Ramadhana et al. (2023), in an analysis, conclude that ITG boosts competitiveness and performance potential, emphasizing that successful ITG requires alignment with organizational goals and effective implementation.

While the literature robustly establishes the strategic importance of ITG, the transformative power of DT, the criticality of risk management, and the customer-centric drivers of digital banking, a conspicuous gap persists**:** the absence of a dedicated, empirically validated ITG model, specifically designed for the unique context of BB implementation. Existing studies provide valuable insights into general ITG principles (e.g., Henriques et al., 2020; Schaefer et al., 2020), DT impacts (e.g., Albderi et al., 2023; Warner & Wäger, 2019), and risk/security challenges (e.g., Alzoubi et al., 2022; Warkentin & Johnston, 2016). However, none integrate these elements into a cohesive, operational framework tailored to the distinct operational realities, heightened security vulnerabilities, and strategic imperatives of BB. Furthermore, the mediating role of DT in the ITG-BB success relationship and the integration of Quality Management (QM) as a core governance pillar alongside Strategic Planning (SP) and Risk Management (RM) within a BB-specific ITG model remain underexplored. This research directly addresses this gap by leveraging the comprehensive COBIT 2019 framework. Through expert interviews, the core ITG dimensions—Strategic Planning (SP), Quality Management (QM), and Risk Management (RM)—were identified as the most critical components that directly influence BB implementation. These dimensions form the foundational constructs of the proposed model, which is empirically validated using structural equation modeling (SEM).

2.5 Theoretical Framework and Hypotheses Development

The theoretical foundation of this research is established through the synthesis of two complementary frameworks: COBIT 2019 for information technology governance (ITG) and the Gartner digital banking architecture framework (2017) for BB implementation. This integration enables the development of a comprehensive model that links governance practices to BB success outcomes, operationalized through clearly defined constructs and hypotheses.

2.5.1 Foundation: COBIT 2019 and Gartner Framework Integration

The selection of COBIT 2019 as the core ITG framework is predicated on its superiority over alternative maturity models. Unlike models offering limited prescriptive guidance, COBIT provides a business-oriented approach specifically designed to evaluate and enhance IT maturity within financial institutions (Derakhshan et al., 2022). COBIT, as a preeminent framework for organizational management and ITG, uniquely structures governance practices to maximize enterprise information value using contemporary theories (Mikalef et al., 2021). Its inherent coverage of three critical governance domains, strategic planning (SP), risk management (RM), and quality management (QM), provides a holistic foundation for governance. These domains, validated through expert interviews as paramount to BB implementation, constitute the core ITG constructs in this research.

Complementing this, the Gartner digital banking architecture framework (2017) operationalizes BB success measurement through four stakeholder-centric platforms:

- Partners: Ecosystem, APIs, and third-party integrations
- Employees: Internal information systems enabling operations
- Customers: Digital service delivery platforms
- Objects: IoT platforms connecting physical/digital assets

The Gartner framework was selected for its industry prominence, structured maturity assessment, and actionable improvement guidance (Taheri & Ziaei, 2021), making it ideal for defining tangible BB outcomes.

2.5.2 Operationalization of ITG Constructs and Their Impact on BB

The core ITG constructs derived from COBIT 2019—SP, RM, and QM—directly influence BB implementation. Their operational definitions and hypothesized relationships are as follows:

Strategic Planning (SP): SP involves formulating digital roadmaps that align IT investments with business objectives. Successful BB implementation depends extensively on SP, as it provides the strategic direction for digital transformation (DT) initiatives (Kitsios et al., 2021). A comprehensive digital roadmap enables new application development, process standardization, and effective monitoring of DT activities (Matović & Milosavljević, 2020).

H1: Strategic Planning (SP) has a significant positive relationship with the successful implementation of Branchless Banking (BB).

Risk Management (RM): RM addresses the operational, strategic, and regulatory risks inherent in digitalization. BB's success is significantly influenced by RM, as digital disruption introduces new vulnerabilities requiring proactive mitigation strategies (Vial, 2021). Effective RM ensures investment security, liquidity preparedness, and organizational stability amid evolving threats (Fitriyanti & Kusumaningdiah, 2023).

H2: Risk Management (RM) has a significant positive relationship with the successful implementation of Branchless Banking (BB).

Quality Management (QM): QM ensures service excellence through standardized processes and continuous improvement. In competitive banking environments, QM is crucial for meeting customer expectations and sustaining loyalty (Albderi et al., 2023). Strategic investments in ICT and cybersecurity enable banks to adapt QM practices to unforeseen challenges, enhancing service quality (Derakhshan et al., 2022).

H3: Quality Management (QM) has a significant positive relationship with the successful implementation of Branchless Banking (BB).

2.5.3 ITG Implementation and the Mediating Role of Digital Transformation

The holistic implementation of ITG, encompassing SP, RM, and QM, directly enables BB success by establishing governance structures that align IT with business objectives. Effective ITG provides a systematic approach to risk mitigation, policy enforcement, and stakeholder trust-building (Al-Gasaymeh et al., 2023; Edrin & Wang, 2023).

H4: The implementation of ITG has a significant positive relationship with the successful implementation of Branchless Banking (BB).

Digital Transformation (DT) acts as a critical mediator in the ITG-BB relationship. DT encompasses changes in business models, processes, and organizational structures driven by digital technologies (Porfírio et al., 2024). Its success requires skilled leadership leveraging technology for innovation (Nadkarni & Prügl, 2021), resulting in new service development and business model reconfiguration (de Miguel et al., 2022; Ogunrinde, 2022).

H5: The implementation of ITG has a significant positive relationship with the successful implementation of BB, mediated through Digital Transformation (DT).

2.5.4 Conceptual Model and Research Hypotheses Summary

The integration of these constructs forms the research's conceptual model (Figure 2), illustrating the hypothesized relationships between SP, RM, QM, ITG implementation, DT (mediator), and BB success. This model addresses two central research questions:

1. How does effective ITG implementation influence BB success in Iran's banking sector?
2. What constitutes an optimal IT governance pattern for BB?

The formal hypotheses (H1–H5), summarized in Table 1, are empirically testable propositions derived from COBIT 2019 and Gartner frameworks. Their validation through structural equation modeling (SEM) constitutes the core analytical approach of this study.

Table 1

Research Hypotheses Summary

Hypothesis	Relationship	Direction
H1	SP → BB Success	Positive (+)
H2	RM → BB Success	Positive (+)
H3	QM → BB Success	Positive (+)
H4	ITG Implementation → BB Success	Positive (+)
H5	ITG Implementation → BB Success (Mediated by DT)	Positive (+)

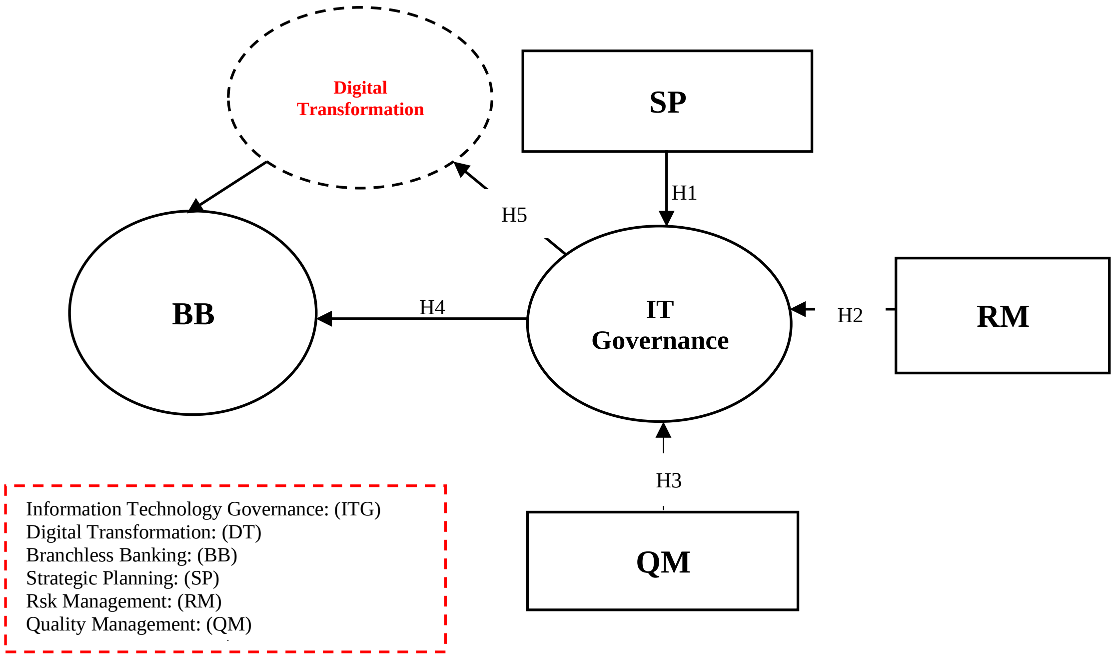

Figure 2

The Conceptual Model of Research

The subsequent section details the methodology employed to empirically test this theoretical framework.

3. Methodology

This study employs a quantitative, applied research approach utilizing a descriptive survey design to develop and validate an information technology governance (ITG) model for the successful implementation of branchless banking (BB), with digital transformation (DT) serving as a mediating variable. The methodology encompasses population definition, sampling strategy, instrument development and validation, data collection procedures, and data analysis techniques.

3.1 Research Design and Population

The research adopts a cross-sectional survey design to collect quantitative data at a single point in time. The target population consists of managers, deputy managers, and subject-matter experts employed at Resalat Qard-al-Hasana Bank in Iran. This population was selected due to the bank's active engagement in digital transformation initiatives and its relevance as a case study for BB implementation in the Iranian banking sector. The accessible population comprised 85 individuals holding the aforementioned positions within the bank.

3.2 Sampling Procedure and Sample Characteristics

A stratified random sampling technique was employed to ensure proportional representation of key demographic and professional groups within the accessible population. The strata were defined based on roles (manager, deputy Manager, expert), as this factor was deemed most relevant to understanding ITG perspectives. From each stratum, participants were selected randomly using a computer-generated random number sequence. The final sample size was determined to be 55 respondents, achieving a response rate of 64.7% and providing adequate statistical power for the planned partial least squares structural equation modeling (PLS-SEM) analysis, which is suitable for sample sizes between 30 to 100 (Hair et al., 2011). The demographic and professional characteristics of the sample are summarized in Table 2. The sample predominantly consists of male participants (91%), reflecting the gender distribution within the bank's managerial and expert roles. A significant proportion holds a Master's degree (45%), and the majority possess 1-10 years of work experience (41%). Experts constitute the largest job category (63%), ensuring the inclusion of individuals with hands-on knowledge of IT systems and banking operations.

Table 2

The Demographic and Professional Profile of Sample (N=55)

Category	Sub-category	Frequency	Percentage
Gender	Male	50	91%
	Female	5	9%
Education	Bachelor's Degree	17	31%
	Master's Degree	25	45%
	Doctoral Degree	3	5%
	No Response	10	18%
Experience	< 10 years	23	42%
	11-20 years	27	49%
	> 20 years	5	9%
Job Role	Expert	35	64%
	Deputy Manager	10	18%
	Manager	15	27%

3.3 Instrument Development and Validation

Data were collected using a structured, researcher-developed questionnaire designed to measure the core constructs derived from the theoretical framework: Strategic Planning (SP), Risk Management (RM), Quality Management (QM), ITG Implementation, Digital Transformation (DT), and BB success. The instrument development followed these rigorous psychometric procedures:

3.3.1 Item Generation and Purification

Initial item generation was based on an extensive review of literature related to ITG (COBIT 2019), digital banking (Gartner framework), and BB implementation. A pool of 25 items was initially created, covering all six constructs. These items underwent content validation by a panel of five domain experts (three senior IT managers and two banking professors with expertise in digital transformation). Experts evaluated each item for relevance, clarity, and representativeness using a 4-point Likert scale (1=Not Relevant, 4=Highly Relevant). Items with a Content Validity Ratio (CVR) ≥ 0.99 (critical value for 5 experts [Lawshe, 1975]) were retained. This process resulted in the final questionnaire comprising 20 items distributed across the constructs.

3.3.2 Questionnaire Structure and Scaling

The final questionnaire is organized into five sections, each corresponding to a primary construct:

1. Strategic Planning (SP): 4 items (e.g., "Impact of ITG committee at board level on partner platforms")
2. Risk Management (RM): 4 items (e.g., "Impact of IT risk assessment process on partner platforms")
3. Quality Management (QM): 4 items (e.g., "Impact of QM requirements on partner platforms")
4. ITG Implementation: 4 items (e.g., "Impact of ITG on partner platforms")
5. Digital Transformation (DT): 4 items (e.g., "Impact of ITG through DT on partner platforms")

All items were measured using a 5-point Likert scale ranging from: 1 = Very Low (VL) to 5 = Very High (VH). This scale provides a balanced range for assessing the perceptions of respondents.

3.3.3 Validity and Reliability Assessment

As detailed in Section 3.3.1, content validity was established through expert review using CVR, ensuring that the instrument adequately represents the constructs of interest.

Construct Validity: Assessed using Confirmatory Factor Analysis (CFA) within the PLS-SEM framework (detailed in Section 4.1). Key indicators include:

- **Convergent Validity:** Measured by Average Variance Extracted (AVE) > 0.50 and Composite Reliability (CR) > 0.70.
- **Discriminant Validity:** Assessed using the Fornell-Larcker criterion (square root of AVE > inter-construct correlations).

Reliability: Assessed using:

- **Internal Consistency Reliability:** Measured by Cronbach's Alpha and Composite Reliability (CR), with thresholds > 0.70 considered acceptable (Nunnally, 1978). Values for all constructs exceeded 0.70 (see Table 4, Section 4.1).
- **Indicator Reliability:** Measured by outer loadings > 0.70 (Hulland, 1999).
- **Suitability for Factor Analysis:** Confirmed using Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (> 0.60) and Bartlett's Test of Sphericity ($p < 0.05$). Results for each construct met these criteria (KMO values ranged from 0.73 to 0.88; Bartlett's test p = 0.000 for all constructs), as detailed in Table 3.

Table 3

The Psychometric Properties of Measurement Scales

Construct	No. of Items	KMO	Bartlett's Test (p-value)	Cronbach's Alpha	Composite Reliability (CR)	AVE
SP	4	0.78	0.000	0.916	0.937	0.670
RM	4	0.88	0.000	0.954	0.960	0.785
QM	4	0.73	0.000	0.893	0.962	0.667
ITG	4	0.79	0.000	0.892	0.930	0.764
DT	4	0.85	0.000	0.900	0.903	0.591

3.4 Data Collection Procedure

Data collection was conducted over a six-week period. Prior to distribution, the study received approval from the organization. Participants were contacted via official bank email. The questionnaire was administered using Google Forms, accompanied by a cover letter explaining the research purpose, ensuring confidentiality, and emphasizing voluntary participation. Two follow-up reminders were sent at one-week intervals to non-respondents to maximize the response rate. All responses were anonymized and stored securely on a password-protected server.

3.5 Data Analysis Technique

The collected data were analyzed using PLS-SEM with SmartPLS 3.0 software (Ringle et al., 2015). PLS-SEM was chosen over covariance-based SEM (CB-SEM) for several reasons:

1. Suitability for Complex Models: PLS-SEM is well-suited for analyzing complex models with multiple constructs and indicators, particularly in early-stage theory development (Hair et al., 2019).
2. Sample Size Efficiency: PLS-SEM is robust for smaller sample sizes (N < 100), aligning with the current study (N=55) (Hair et al., 2011).
3. Non-Normal Data: PLS-SEM does not assume multivariate normality, making it appropriate for survey data that may deviate from normality.

The analysis followed a two-stage approach:

Stage 1: Measurement Model Assessment

- Evaluated indicator reliability (outer loadings > 0.70).
- Assessed internal consistency reliability (Cronbach's Alpha, CR > 0.70).
- Examined convergent validity (AVE > 0.50).
- Tested discriminant validity using Fornell-Larcker criterion and Heterotrait-Monotrait (HTMT) ratio.

Stage 2: Structural Model Assessment

- Assessed collinearity among predictor constructs using Variance Inflation Factor (VIF < 5).
- Evaluated the significance of path coefficients using bootstrapping with 5,000 subsamples to generate t-statistics and p-values.
- Calculated coefficients of determination (R^2) for endogenous latent variables to assess model explanatory power.
- Examined predictive relevance (Q^2) using Stone-Geisser's Q^2 statistic ($Q^2 > 0$ indicates predictive relevance).
- Analyzed the mediating effect of DT using the approach proposed by Preacher and Hayes (2008) through bootstrapping.

This rigorous analytical procedure ensures that the robust testing of the hypothesized relationships exists in the theoretical framework.

4. Analysis and Results

This section presents the results of the data analysis conducted using PLS-SEM to test the proposed theoretical framework and research hypotheses. The analysis was performed in two distinct stages: (1) Assessment of the Measurement Model to evaluate the reliability and validity of the constructs, and (2) Assessment of the Structural Model to test the hypothesized relationships between constructs. All analyses were conducted using SmartPLS 3.0 software (Ringle et al., 2015).

4.1 Assessment of the Measurement Model

The measurement model assessment evaluates the psychometric properties of the constructs, including indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. This step is crucial to ensure that the measurement instruments accurately represent the underlying theoretical constructs before testing the structural relationships.

4.1.1 Indicator Reliability and Internal Consistency

Indicator reliability was assessed by examining the outer loadings of each measurement item on its corresponding latent construct. As recommended by Hulland (1999), loadings should exceed 0.70 to indicate adequate indicator reliability. The results, summarized in Table 4, demonstrate that all outer loadings range from 0.643 to 0.909, with the majority exceeding the 0.70 threshold. Only two items (RM2: 0.643; RM3: 0.697) fell slightly below 0.70, but were retained as they approached the threshold and contributed to the construct's content validity (Hair et al., 2019). Internal consistency reliability was evaluated using Cronbach's Alpha (α) and Composite Reliability (CR). Both metrics should exceed 0.70 to demonstrate acceptable internal consistency (Nunnally, 1978). As presented in Table 4, all constructs exhibit Cronbach's Alpha values ranging from 0.892 to 0.954, and Composite Reliability values ranging from 0.903 to 0.962, all well above the recommended threshold. These results confirm excellent internal consistency reliability for all measurement scales.

4.1.2 Convergent Validity

Convergent validity assesses the extent to which a construct converges with its indicators. It was evaluated using the Average Variance Extracted (AVE). According to Fornell and Larcker (1981), an AVE value of 0.50 or higher indicates acceptable convergent validity, meaning that the construct explains at least 50% of the variance in its indicators. As shown in Table 4, the AVE values for all constructs range from 0.591 to 0.785, all exceeding the 0.50 threshold. Additionally, the condition CR > AVE is satisfied for all constructs, further supporting convergent validity (Fornell & Larcker, 1981). The Kaiser-Meyer-Olkin (KMO) values (ranging from 0.73 to 0.88) and significant Bartlett's Tests of Sphericity (all p = 0.000) confirm the suitability of the data for factor analysis.

Table 4

Measurement Model Assessment: Reliability and Validity

Construct	Items	Outer Loading	Cronbach's Alpha	CR	AVE	KMO	Bartlett's Test (p)
SP	SP1	0.812	0.916	0.937	0.670	0.78	0.000
	SP2	0.901					
	SP3	0.800					
	SP4	0.764					
RM	RM1	0.719	0.954	0.960	0.785	0.88	0.000
	RM2	0.643					
	RM3	0.697					
	RM4	0.708					
QM	QM1	0.808	0.893	0.962	0.667	0.73	0.000
	QM2	0.846					

	QM3	0.876					
	QM4	0.789					
ITG	ITG1	0.743	0.892	0.930	0.764	0.79	0.000
	ITG2	0.839					
	ITG3	0.881					
	ITG4	0.759					
DT	DT1	0.776	0.900	0.903	0.591	0.85	0.000
	DT2	0.881					
	DT3	0.909					
	DT4	0.832					

Note: All Cronbach's Alpha, CR, and AVE values meet or exceed recommended thresholds ($\alpha > 0.70$, CR > 0.70, AVE > 0.50).

4.1.3 Discriminant Validity

Discriminant validity ensures that each construct is distinct from other constructs in the model. It was assessed using two complementary approaches:

1. Fornell-Larcker Criterion: The square root of the AVE for each construct must be greater than its highest correlation with any other construct (Fornell & Larcker, 1981). Table 5 displays the inter-construct correlations, with the square roots of the AVE values presented on the diagonal in bold. The results confirm that for every construct, the square root of its AVE (diagonal) is greater than its correlations with all other constructs (off-diagonal elements), establishing discriminant validity.
2. Heterotrait-Monotrait Ratio (HTMT): The HTMT values should be below 0.90 (or conservatively 0.85) to indicate discriminant validity (Henseler et al., 2015). All HTMT values in this study ranged from 0.411 to 0.782, well below the 0.85 threshold, further confirming that all constructs are empirically distinct.

Table 5

Fornell-Larcker Criterion for Discriminant Validity

Construct	SP	RM	QM	ITG	DT
SP	**0.819**				
RM	0.451	**0.886**			
QM	0.364	0.490	**0.817**		
ITG	0.563	0.508	0.466	**0.874**	
DT	0.796	0.884	0.608	0.538	**0.768**

Note: Square roots of AVE are shown on the diagonal (bold). Off-diagonal elements are inter-construct correlations.

4.2 Assessment of the Structural Model

With the measurement model validated, the structural model was assessed to test the hypothesized relationships (H1–H5). Prior to hypothesis testing, collinearity diagnostics were performed using the Variance Inflation Factor (VIF). All VIF values were well below the threshold of 5.0 (ranging from 1.21 to 2.87), indicating no significant multicollinearity issues among predictor constructs (Hair et al., 2019). The structural model's explanatory power was evaluated using the coefficient of determination (R^2) for endogenous latent variables. As shown in Figure 3, the R^2 values for ITG (0.412), DT (0.632), and BB success (0.578) indicate that the model explains 41.2%, 63.2%, and 57.8% of the variance in these constructs, respectively. These values demonstrate substantial explanatory power, particularly for DT and BB success. Predictive relevance was assessed using Stone-Geisser's Q^2 statistic. A Q^2 value greater than 0 indicates predictive relevance (Geisser, 1974; Stone, 1974). The Q^2 values for ITG (0.287), DT (0.412), and BB success (0.361) were all positive, confirming the model's predictive accuracy.

4.3 Hypothesis Testing

The hypotheses were tested by analyzing the path coefficients (β) and their statistical significance using the bootstrapping procedure with 5,000 subsamples (Hair et al., 2019). Path coefficients were considered statistically significant if their p-values were below 0.05. The results of the hypothesis testing are summarized in Table 6 and visually represented in Figure 3.

Table 6

Hypothesis Testing Results

Hypothesis	Path Relationship	Path Coefficient (β)	Standard Error	t-value	p-value	Decision	Supported
H1	SP → ITG	0.259	0.042	6.167	0.000	Significant	Yes
H2	RM → ITG	0.247	0.038	6.500	0.000	Significant	Yes
H3	QM → ITG	0.268	0.041	6.537	0.000	Significant	Yes
H4	ITG → BB Success	0.213	0.039	5.462	0.000	Significant	Yes
H5	ITG → BB Success (Mediated by DT)	0.272*	0.045	6.044	0.000	Significant	Yes

Note: The indirect effect for H5 (ITG → DT → BB Success) was calculated as β_ITG→DT * β_DT→BB Success = 0.547 * 0.499 = 0.272. Total effect of ITG on BB Success = Direct Effect (0.213) + Indirect Effect (0.272) = 0.485.

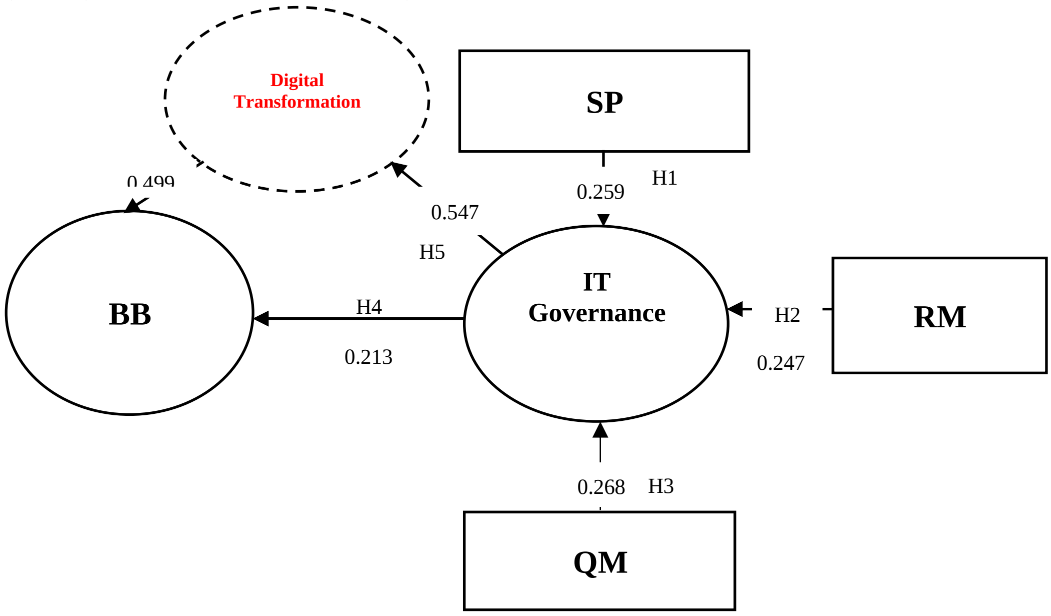

Figure 3

Structural Model with Path Coefficients

The analysis revealed the following key findings:

1. Strategic Planning (SP) has a significant positive effect on ITG implementation ($\beta = 0.259$, $p < 0.001$), supporting H1.
2. Risk Management (RM) has a significant positive effect on ITG implementation ($\beta = 0.247$, $p < 0.001$), supporting H2.
3. Quality Management (QM) has a significant positive effect on ITG implementation ($\beta = 0.268$, $p < 0.001$), supporting H3.
4. ITG implementation has a significant positive direct effect on BB success ($\beta = 0.213$, $p < 0.001$), supporting H4.
5. The indirect effect of ITG implementation on BB Success mediated by Digital Transformation (DT) is significant ($\beta = 0.272$, $p < 0.001$), supporting H5. The total effect of ITG on BB success is substantial ($\beta = 0.485$).

4.4 Mediation Analysis

To further elucidate the mediating role of DT (H5), a formal mediation analysis was conducted using the bootstrapping approach with 5,000 subsamples (Preacher & Hayes, 2008). The results indicate:

- **Direct Effect (Path c'):** ITG → BB Success = 0.213 ($p < 0.001$)
- **Indirect Effect (Path a*b):** ITG → DT → BB Success = 0.272 ($p < 0.001$)
- **Total Effect (Path c):** ITG → BB Success = 0.485 ($p < 0.001$)

Since the direct effect remains significant while the indirect effect is also significant, DT acts as a complementary (partial) mediator in the relationship between ITG implementation and BB success (Zhao et al., 2010). This confirms that while ITG has a direct impact on BB success, a significant portion of its influence is channeled through enabling digital transformation capabilities.

4.5 Model Fit Indices

While PLS-SEM primarily focuses on prediction, several approximate fit indices were calculated to assess the overall model fit, as shown in Table 7. The results indicate that the model demonstrates acceptable fit across multiple indices:

Table 7

Model Fit Indices

Fit Index Type	Index	Value	Recommended Value	Assessment
Absolute	χ^2/df	1.56	≤ 3.00	Good
	GFI	0.84	≥ 0.80	Acceptable
	RMSEA	0.056	≤ 0.08	Good
Incremental	CFI	0.91	≥ 0.90	Good
	TLI (NNFI)	0.90	≥ 0.90	Good
Parsimony	NFI	0.87	≥ 0.90	Acceptable

Note: χ^2/df = Chi-square/degrees of freedom; GFI = Goodness-of-Fit Index; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; NFI = Normed Fit Index.

The χ^2/df ratio (1.56), RMSEA (0.056), CFI (0.91), and TLI (0.90) all meet or exceed recommended thresholds for good model fit (Bentler, 1990; Hu & Bentler, 1999). The GFI (0.84) and NFI (0.87) are within acceptable ranges. Collectively, these indices provide evidence supporting the overall validity and robustness of the proposed structural model.

5. Conclusion and Discussion

This study set out to design and validate a dedicated information technology governance (ITG) model for the successful implementation of branchless banking (BB), explicitly recognizing digital transformation (DT) as a critical mediating variable. Drawing upon the robust theoretical foundations of COBIT 2019 and the Gartner digital banking architecture framework, and employing a rigorous mixed-method approach encompassing literature review, expert interviews, and quantitative survey analysis, this research successfully developed and empirically tested an operational ITG model tailored to the unique challenges and opportunities of BB. The findings provide compelling evidence that effective ITG, when strategically channeled through DT, exerts a significantly stronger influence on BB success than ITG alone. This section synthesizes the key findings, discusses their theoretical and practical implications, acknowledges limitations, and proposes avenues for future research.

5.1 Summary of Key Findings

The empirical validation of the proposed model yielded several critical insights:

1. The Mediating Power of Digital Transformation (DT): The most significant finding is the confirmation of H5, establishing DT as a powerful complementary mediator in the relationship between ITG and BB success. While ITG has a direct positive effect on BB implementation ($\beta = 0.213$, $p < 0.001$, supporting H4), its indirect effect mediated by DT is substantially stronger ($\beta = 0.272$, $p < 0.001$). This underscores that ITG's primary value in enabling BB lies not just in establishing governance structures, but in catalyzing and sustaining a holistic digital transformation that permeates the organization's strategy, operations, and customer engagement. The total effect of ITG on BB success is substantial ($\beta = 0.485$), highlighting DT's indispensable role as the engine through which governance principles translate into tangible BB outcomes.
2. Foundational Role of Core ITG Components: The study robustly confirmed that the three core dimensions of ITG—Strategic Planning (SP) ($\beta = 0.259$, $p < 0.001$, H1**),** Risk Management (RM) ($\beta = 0.247$, $p < 0.001$, H2), and Quality Management (QM) ($\beta = 0.268$, $p < 0.001$, H3)—are significant positive predictors of effective ITG implementation. Among these, SP emerged as the most influential driver, emphasizing that successful BB implementation is fundamentally anchored in strategic alignment between IT investments, governance frameworks, and the bank's overarching business objectives in the digital era. RM and QM are equally critical, providing the necessary risk mitigation and service quality foundations upon which sustainable BB models are built.
3. Synergistic Impact on BB Success: The model demonstrates strong explanatory power, accounting for 41.2% of the variance in ITG implementation, 63.2% in DT, and 57.8% in BB success. This indicates that the integrated framework, combining COBIT-based governance dimensions with Gartner's architectural indicators, effectively captures the key drivers of BB implementation in the studied context. The significant positive path from ITG to BB success, amplified by DT, validates the core proposition that robust ITG is not merely beneficial but essential for

navigating the complexities of BB and achieving sustainable competitive advantage**.**

5.2 Theoretical Contributions

This research makes several distinct contributions to the academic literature on ITG, DT, and digital banking:

This study addresses a critical gap identified in Section 1.2 by proposing and validating the first dedicated ITG model, specifically tailored for branchless banking. While prior research has examined ITG in banking (e.g., Henriques et al., 2020; Ramadhana et al., 2023) and DT enablers (e.g., Afifah et al., 2022), recent literature reviews confirm that existing governance frameworks remain largely generic and insufficiently adapted to fully digital and branchless banking ecosystems (Kurniawansyah et al., 2025).

None of these studies provide a holistic, empirically validated governance framework focused exclusively on the unique operational, security, and strategic imperatives of BB. By contextualizing the COBIT-2019 framework for BB and validating it empirically, this study fills a clearly identified gap in recent ITG research (Ramadhana et al., 2025).

The study provides robust empirical evidence for the mediating role of DT in the ITG–BB success relationship, a relationship theoretically suggested but rarely tested rigorously in prior literature (e.g., Warner & Wäger, 2019). Recent empirical studies emphasize the importance of examining DT not merely as an outcome but as an enabling mechanism through which governance capabilities translate into digital performance (Afifah & Mulyana, 2025). By demonstrating that DT acts as a complementary partial mediator, this research offers a more nuanced understanding of how ITG influences BB outcomes; that is, by enabling broader digital capabilities, organizational agility, and transformational change beyond compliance-oriented governance mechanisms.

Unlike traditional ITG frameworks that often prioritize compliance and risk (Fianty & Brian, 2021; Warkentin & Johnston, 2016), this study explicitly integrates Quality Management (QM) as a foundational pillar alongside Strategic Planning (SP) and Risk Management (RM) within the COBIT framework for BB. Recent governance and digital banking studies increasingly recognize QM as a strategic governance capability that enhances service reliability, customer trust, and long-term sustainability in digital financial services (Ahmed & Iqbal, 2025). This inclusion directly responds to the gap identified in Section 1.2 and reflects the inherently customer-centric nature of BB, where service quality, user experience, and continuous improvement are critical determinants of adoption, satisfaction, and customer loyalty (Marlius, 2022). By grounding the model development and empirical testing within the Iranian banking sector, particularly Resalat Qard-al-Hasana Bank, this research provides valuable insights into the applicability, constraints, and governance challenges associated with implementing advanced ITG and BB models in an emerging economy context. Recent studies highlight the importance of context-sensitive validation of ITG frameworks, particularly in regulated financial sectors within developing and emerging economies (Ali & Khalid, 2025). This contribution complements prior research predominantly focused on developed markets (e.g., Indriasari et al., 2022; Khashei et al., 2024) and extends the external validity of ITG and digital banking scholarship.

5.3 Practical Implications for Bank Management and Policymakers

The findings offer actionable insights for bank executives, IT managers, and policymakers:

1. Strategic Alignment of DT with ITG: Bank leadership must recognize that DT strategies cannot be developed in isolation from ITG frameworks. The significant

mediating role of DT necessitates that investments in digital technologies (AI, blockchain, cloud, IoT) and process redesign are explicitly guided and governed by the principles of SP, RM, and QM embedded within the ITG structure. This ensures that DT initiatives directly support strategic objectives and mitigate risks.

2. Elevating Strategic Planning (SP) as the Cornerstone: The prominence of SP in driving ITG effectiveness underscores the need for active board-level engagement in digital strategy formulation. Boards and executive management must champion the development of a clear, comprehensive digital roadmap aligned with the bank's macro-strategies, ensuring IT investments are directed towards enabling BB and other digital innovations (da Silva et al., 2019). This requires continuous assessment, strategic orientation, and reliable monitoring mechanisms.
3. Adopting a Holistic Risk Management (RM) Approach: BB's inherent vulnerabilities (cybersecurity, regulatory compliance, operational disruptions) demand a holistic RM approach that extends beyond traditional IT security. Banks must integrate operational, strategic, and regulatory risk perspectives into their ITG frameworks for BB, implementing robust risk assessment methodologies and acceptance level monitoring processes (Fitriyanti & Kusumaningdiah, 2023; Sinaga & Suroso, 2023).
4. Embedding Quality Management (QM) for Competitive Advantage: In the competitive digital banking landscape, QM must be elevated to a core governance priority. Banks should invest strategically in ICT and cybersecurity capabilities to enable continuous improvement of digital service quality, personalization, and user experience. Establishing QM processes aligned with organizational needs and stakeholder expectations is crucial for fostering customer loyalty and differentiating BB services (Derakhshan et al., 2022).
5. Building Robust and Adaptive Governance Ecosystems: The successful implementation of BB requires more than technology; it necessitates the establishment of resilient IT platforms and adaptive governance ecosystems (Khashei et al., 2024). This involves cross-functional collaboration, continuous monitoring of ITG practices, and a culture that embraces change and innovation, ensuring the bank can evolve with the rapidly changing technological landscape and customer demands (Indriasari et al., 2022; Wilkin & Chenhall, 2020).

5.4 Limitations and Future Research Directions

While this study provides valuable insights, several limitations must be acknowledged, offering avenues for future research:

Contextual Specificity: The model was developed and validated within a single bank (Resalat Qard-al-Hasana Bank) in Iran. While this provides depth, it may limit the generalizability of findings to other banks in Iran, different emerging economies, or developed markets. Future research should test the model's applicability across diverse institutional and national contexts. **Cross-Sectional Design:** The study employed a cross-sectional survey design, capturing data at a single point in time. This limits the ability to establish definitive causality or observe the dynamic evolution of the ITG-DT-BB relationship over time. Longitudinal studies are needed to track how these relationships mature and adapt as digital transformation progresses. **Reliance on Perceptual Data:** Data were collected primarily through self-reported perceptual measures from managers and experts. While validated instruments were used, perceptual data may be subject to common method bias and may not fully capture objective performance metrics. Future research could incorporate objective data (e.g., actual BB adoption rates, transaction volumes, security incident statistics, cost savings) alongside perceptual measures. **Scope of the Model:** While the model integrates key constructs (SP, RM, QM, ITG, DT, BB), other potentially relevant factors (e.g., organizational culture, regulatory environment intensity, customer readiness, technology infrastructure maturity) were not explicitly included. Future research could extend the model by incorporating these contextual and organizational factors to provide a more comprehensive understanding of BB success drivers. **Focus on COBIT and Gartner:** The model is grounded in COBIT 2019 and the Gartner framework. While these are leading standards, future research could explore the applicability and effectiveness of alternative or complementary frameworks (e.g., ITIL, ISO/IEC 38500) in the context of BB governance.

5.5 Conclusion

In an era where digitalization is no longer optional but imperative for banking survival and growth (Oyarhossein et al., 2022), and where fully digital and branchless banking models are increasingly viewed as strategic necessities rather than technological experiments (Nguyen & Phan, 2025), this research provides a timely and significant contribution by developing and validating a dedicated ITG model for branchless banking. The findings unequivocally demonstrate that effective ITG is the cornerstone of successful BB implementation. Consistent with recent empirical evidence, the results confirm that governance mechanisms play a decisive role in mitigating digital risks and enhancing organizational resilience in technology-intensive banking environments (Sinaga et al., 2025). However, its impact is maximized not in isolation, but through its powerful synergy with digital transformation.

Strategic planning, risk management, and quality management emerge as the critical triad underpinning effective ITG, with strategic planning holding particular significance in aligning governance with strategic objectives. This finding aligns with recent ITG research, highlighting strategic alignment as the primary driver of value creation and performance in digital financial institutions (Wilkin et al., 2025).

By integrating these elements within a robust framework validated in an emerging economy context, this study offers both theoretical advancement and practical guidance for banks navigating the complex journey towards a branchless future.

The proposed model provides a roadmap for bank executives and policymakers to harness the power of ITG and DT, not just to eliminate physical branches but to build more resilient, efficient, customer-centric, and ultimately more successful financial institutions in the digital age. Recent studies emphasize that governance-driven digital transformation enables banks to move beyond cost reduction toward sustainable innovation, trust enhancement, and long-term competitiveness (Sinaga & Suroso, 2025).

As the digital ecosystem in banking continues its exponential growth and evolution (Ariyani & Wicaksono, 2024), and as emerging technologies such as AI-driven decision systems and platform-based financial services further reshape banking operations, continuous refinement and adaptation of such governance models will remain essential for sustainable success in both developed and emerging market contexts (Ahmed & Iqbal, 2025).

Reference

Adrian, F. X., & Wang, G. (2023). Measure the level capability it governance in effectiveness internal control for cybersecurity using the COBIT 2019 in organization: Banking company. *Journal of Theoretical and Applied Information Technology, 101*(5), https://www.jatit.org/volumes/Vol101No5/9Vol101No5.pdf

Aduda, J., & Kingoo, N. (2012). The relationship between electronic banking and financial performance among commercial banks in Kenya. *Journal of Finance and Investment Analysis, 1*(3), 99-118. https://www.scienpress.com/Upload/JFIA/Vol%201_3_6.pdf

Afifah, N., Mulyana, R., & Abdurrahman, L. (2022). Survey of IT governance influence on digital transformation and bank organization performance. *Sistemasi: Jurnal Sistem Informasi*, *11*(3), 749-760. https://doi.org/10.32520/stmsi. v11i3.2179

Ahmadi, R., Sahraei S., Saheb, T. (2023). Ranking the effective dimensions of knowledge management on the acceptance of digital banking in the banking industry (Case study: Parsian Bank). 12(4), 11-27. https://doi.org/20.1001.1.22286977.1401.12.4.2.8

Ahmed, F., & Iqbal, A. (2025). The role of artificial intelligence in enhancing credit risk management: A systematic literature review of international banking systems. *Pakistan Journal of Humanities and Social Sciences, 13*(1), 478-492. https://doi.org/10.52131/pjhss.2025.v13i1.2727

Albderi, A. J. T., Hasan, M. F., & Flayyih, H. H. (2023). Measuring the level of banking performance according to the requirements of comprehensive quality management: An application study. *Ishtar Journal of Economics and Business Studies, 4*(1), 1-18. https://doi.org/10.55270/ijebs.v4i1.15

Ali, N. M. S., & Khalid, N. A. (2025). Fiscal sustainability of the palestinian local government units (lgus): challenges and opportunities. *Lex Localis, 23*(S4), 2605-2634. https://doi.org/10.52152/nn00bh97

Alnsour, I. R., Al-Nsour, I., Malkawi, E. M., & Allahham, M. I. (2025). The role of internet of things in fintech adoption within banking sector: the moderating role of digital transformation capability. *Lex Localis- Journal of Local Self-Government, 23,* 2486-2510. https://www.researchgate.net/profile/Iyad-Al-Nsour/publication/395413685_THE_ROLE_OF_INTERNET_OF_THINGS_IN_FINTECH_ADOPTION_WITHIN_BANKING_SECTORTHE_MODERATING_ROLE_OF_DIGITAL_TRANSFORMATION_CAPABILITY/links/68c30cf57e1397188302e76e/THE-ROLE-OF-INTERNET-OF-THINGS-IN-FINTECH-ADOPTION-WITHIN-BANKING-SECTORTHE-MODERATING-ROLE-OF-DIGITAL-TRANSFORMATION-CAPABILITY.pdf

Al-Gasaymeh, A., Qasaimeh, G. M., Alrawashdeh, N., Alsmadi, A. A., & Alzoubi, H. M. (2023). The impact of cobit 5 on the effectiveness of applying governance tools in jordanian commercial banks. *Calitatea, 24*(194), 377-384. https://doi.org/10.47750/QAS/24.194.42

Alzoubi, H. M., Ghazal, T. M., Hasan, M. K., Alketbi, A., Kamran, R., Al-Dmour, N. A., & Islam, S. (2022, May). Cyber security threats on digital banking. In *2022 1st International Conference on AI in Cybersecurity (ICAIC)* (pp. 1-4). https://doi.org/10.1109/ICAIC53980.2022.9896966

Anisi, F., & Chavoshi, S. K. (2022). Strategic control model for implementing digital banking in Iranian banking system. *Journal of Strategic Management Studies, 13*(50), 1-19. https://doi.org/10.22034/smsj.2022.133676

Aprilinda, Y., Puspa, A. K., & Affandy, F. N. (2019, November). The use of ISO and COBIT for IT governance audit. *Journal of Physics: Conference Series, 1381*(1), 012028. IOP Publishing. https://doi.org/10.1088/1742-6596/1381/1/012028

Arghand, A. A., Alborzi, M., & Ghatari, A. R. (2022). A methodology for IT governance by viable system modeling (VSM): An action research in designing a data center. *Systemic Practice and Action Research, 35*(2), 131-152. https://doi.org/10.1007/s11213-021-09559-8

Ariyani, L., & Wicaksono, A. (2024). The dynamics of economy in the regional msmes' digital ecosystem. In *the digitalization of indonesian small and medium enterprises: human capital, inclusivity and platform capitalism* (pp. 91-116). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-97-0029-5_6

Borja, S., Moon, Y., Yoon, H., & Hwang, J. (2022, August). IT governance mechanisms, it governance domains, and their influence on it governance effectiveness: Empirical analysis in Colombia. In *2022 Portland International Conference on Management of Engineering and Technology (PICMET)* (pp. 1-10). IEEE . https://doi.org/10.23919/PICMET53225.2022.9882803

Carbó-Valverde, S., Cuadros-Solas, P. J., Rodríguez-Fernández, F., & EY. (2020). The effect of banks' IT investments on the digitalization of their customers. *Global Policy, 11*, 9-17 https://doi.org/10.1111/1758-5899.12749

de Miguel, P. M., Martínez, A. G., & Montes-Botella, J. L. (2022). Review of the measurement of dynamic capabilities: A proposal of indicators for the automotive industry. *ESIC Market*, *53*(1), e283-e283. https://doi.org/https://doi.org/10.7200/esicm.53.283

Debreceny, R. S. (2013). Research on IT governance, risk, and value: Challenges and opportunities. *Journal of Information Systems, 27*(1), 129-135. https://doi.org/10.2308/isys-10339

Derakhshan, S., Nabiollahi, A., Khani, N., & Khayami, S. R. (2022). Presenting a capability planning model based on Cobit organizational architecture management process (Case study: Fava management of Isfahan University of Medical Sciences). *Health Information Management, 19*(2), 60-70. https://doi.org/10.48305/him.2022.39198.1026

Fernandes, A. J., Hartono, H., & Aziza, C. (2020). Assessment IT governance of human resources information system using COBIT 5. *International Journal of Open Information Technologies, 8*(4), 59-63. https://cyberleninka.ru/article/n/assessment-it-governance-of-human-resources-information-system-using-cobit-5

Fianty, M. I., & Brian, M. (2023). Leveraging COBIT 2019 framework to implement it governance in business process outsourcing company. *Journal of Information Systems and Informatics, 5*(2), 568-579. DOI:10.51519/journalisi.v5i2.492

Fitriyanti, F., M. I., & Kusumaningdiah R. S. (2023). Detection implementation of risk management for commercial digital banking. *Migration, 20*(S11), 727-734. https://doi.org/10.59670/ml.v20iS11.5760

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50. https://journals.sagepub.com/doi/abs/10.1177/002224378101800104

Gangadwala, D. R., & Goyani, M. R. (2019). A study of issue of e-banking from the customers perception. Emerging Trends in Global Management and Information Technology, 73. https://books.google.com/books?hl=en&lr=&id=Uao5EAAAQBAJ&oi=fnd&pg=PA73&dq=Gangadwala,+D.+R.,+%26+Goyani,+M.+R.+(2019).+A+study+of+issue+of+e-banking+from+the+customers+perception.+Emerging+Trends+in+Global+Management+and+Information+Technology,+73.&ots=7mdb_D3qSY&sig=xf11Q6056_KEJIWkiW6-nmN5MFY#v=onepage&q&f=false

Gartner Inc. (2017). Hype cycle for emerging technologies 2017. https://www.gartner.com/document/3768572?ref=ddrec (visited on 11/25/2017).

Gasser, U., Gassmann, O., Hens, T., Leifer, L., Puschmann, T., & Zhao, L. (2017). Digital banking 2025. *Research platform Alexandria*. https://www.alexandria.unisg.ch/entities/publication/184e0b83-78cf-4338-8567-f4bcf441b139

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-152. https://doi.org/10.2753/MTP1069-6679190202

Hantsch, C., Westner, M., & Matschi, M. (2025). IT/OT-Konvergenz: status-quo und umsetzungsempfehlungen. *HMD Praxis der Wirtschaftsinformatik, 62*(2), 402-418. https://doi.org/10.1365/s40702-024-01111-1

Hamdan, M., Gharaibeh, O., Al-Quran, A., & Nusairat, N. (2021). The impact of information technology investment on the financial performance of the banks. *Acad Strateg Manag J, 20*(6), 1-12. https://www.researchgate.net/profile/Omar-Gharaibeh-3/publication/360756941_THE_IMPACT_OF_INFORMATION_TECHNOLOGY_INVESTMENT_ON_THE_FINANCIAL_PERFORMANCE_OF_THE_BANKS/links/628897426e41e5002d36c77c/THE-IMPACT-OF-INFORMATION-TECHNOLOGY-INVESTMENT-ON-THE-FINANCIAL-PERFORMANCE-OF-THE-BANKS.pdf

Haralayya, B. (2021). How Digital Banking has brought innovative products and services to India. *Journal of Advanced Research in Quality Control and Management, 6*(1), 16-18. https://www.researchgate.net/profile/Dr-Haralayya/publication/352681606_HOW_DIGITAL_BANKING_HAS_BROUGHT_INNOVATIVE_PRODUCTS_AND_SERVICES_TO_INDIA/links/60d31e92a6fdcce58bab3f24/HOW-DIGITAL-BANKING-HAS-BROUGHT-INNOVATIVE-PRODUCTS-AND-SERVICES-TO-INDIA.pdf

Henriques, D., Pereira, R., Almeida, R., & Da Silva, M. M. (2020). IT governance enablers. *Форсайт, 14*(1(eng)), 48-59. https://cyberleninka.ru/article/n/it-governance-enablers

Hassan, S. W. U., Kiran, S., Gul, S., Khatatbeh, I. N., & Zainab, B. (2025). The perception of accountants/auditors on the role of corporate governance and information technology in fraud detection and prevention. *Journal of Financial Reporting and Accounting, 23*(1), 5-29. https://doi.org/10.1108/JFRA-05-2023-0235

Indriasari, E., Prabowo, H., Gaol, F. L., & Purwandari, B. (2022). Intelligent digital banking technology and architecture: A systematic literature review. *International Journal of Interactive Mobile Technologies, 16*(19). https://doi.org/10.3991/IJIM.V16I19.30993

Juiz, C., & Gomez, B. (2021). Delving into the IT governance-management communication Interface: A scoping review. *International Journal of Digital Strategy, Governance, and Business Transformation (IJDSGBT), 11*(1), 1-37. https://doi.org/10.4018/IJDSGBT.291542

Khan, I., Amin, M. Y., & Akbar, S. (2025). Fintech adoption and sustainable performance in banking institutions: the role of digital transformation. *Journal of Media Horizons, 6*(1), 11-20. https://www.researchgate.net/profile/Imran-Khan288/publication/387792861_Fintech_Adoption_and_Sustainable_Performance_in_Banking_Institutions_The_Role_of_Digital_Transformation/links/677d6e987934b95644a7da00/Fintech-Adoption-and-Sustainable-Performance-in-Banking-Institutions-The-Role-of-Digital-Transformation.pdf

Khemiri, M., & Jallouli, R. (2022). Technology-enabled personalization for mobile banking services: Literature review and theoretical framework. *Journal of Telecommunications and the Digital Economy, 10*(2), 173-194. https://search.informit.org/doi/abs/10.3316/informit.587268320552265

Khashei Varnamkhasti, V., Ebrahimi, M., Khalil Nezhad, S., & Motahari Nejad, F. (2024). Generative mechanisms of digital banking ecosystem evolution. *Business Intelligence Management Studies, 12*(48), https://doi.org/10.22054/ims.2024.76327.2394

Kitsios, F., Giatsidis, I., & Kamariotou, M. (2021). Digital transformation and strategy in the banking sector: Evaluating the acceptance rate of e-services. *Journal of Open Innovation: Technology, Market, and Complexity, 7*(3), 204. https://doi.org/10.3390/joitmc7030204 kumar, M. (2023). An overview of cyber security in digital banking Sector. *East Asian Journal of Multidisciplinary Research, 2*(1), 43-52. https://doi.org/https://doi.org/10.55927/eajmr.v2i1.1671

Kurniawansyah, K., Marthiawati, N., & Rohayani, H. (2023). Analisis kinerja tata kelola teknologi informasi pada bank menggunakan framework Cobit 2019. *Bulletin of Computer Science Research, 4*(1), 112-120. https://doi.org/https://doi.org/10.47065/bulletincsr.v4i1.320

Levstek, A., Pucihar, A., & Hovelja, T. (2022). Towards an adaptive strategic IT governance model for SMEs. *Journal of Theoretical and Applied Electronic Commerce Research, 17*(1), 230-252. https://doi.org/10.3390/jtaer17010012

Marlius, D. (2022). Use of digital banking in improving services at banks. *Jurnal Keuangan Dan Perbankan (KEBAN), 1*(2), 59-65. http://download.garuda.kemdikbud.go.id/article.php?article=2811275&val=25022&title=Use%20of%20Digital%20Banking%20in%20Improving%20Services%20at%20Banks

Matović, I. M., & Milosavljević, P. (2020). Digital transformation of serbian banking sector: Case study of bank's strategic planning for a creation of digital roadmap. *ICAICTSEE–2020, 224*. https://ibn.idsi.md/sites/default/files/imag_file/ICAICTSEE-2020.pdf#page=224

Melnychenko, S., Volosovych, S., & Baraniuk, Y. (2020). Dominant ideas of financial technologies in digital banking. *Baltic Journal of Economic Studies, 6*(1), 92-99. https://doi.org/10.30525/2256-0742/2020-6-1-92-99

Mikalef, P., Pateli, A., & van de Wetering, R. (2021). IT architecture flexibility and IT governance decentralisation as drivers of IT-enabled dynamic capabilities and competitive performance: The moderating effect of the external environment. *European Journal of Information Systems, 30*(5), 512-40. https://doi.org/10.1080/0960085X.2020.1808541

Nadkarni, S., & Prügl, R. (2021). Digital transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly, 71*, 233-341. https://doi.org/10.1007/s11301-020-00185-7

Nguyen, T. T. H., & Phan, H. D. (2025). The role of governance and digital transformation in enhancing operational sustainability of non-banking financial institutions. *Pakistan Journal of Life & Social Sciences, 23*(1). https://doi.org/10.57239/PJLSS-2025-23.1.0087

OECD. (2021). *ICT investment (indicator)*. https://doi.org/10.1787/b23ec1da-en Gartner Inc. (2017a). Hype Cycle for Emerging Technologies 2017. https://www.gartner.com/document/3768572?ref=ddrec

Ogunrinde, A. (2022). The effectiveness of soft skills in generating dynamic capabilities in ICT companies. *ESIC Market, 53*(3), e286-e286. https://doi.org/10.7200/esicm.53.286

Oyarhossein, S., Toloie Eshlaghy, A., Radfar, R., & Pour Ebrahimi, A. (2022). Digital transformation in corporate banking: Theoretical approach and behavioral analysis. *Journal of Investment Knowledge, 11*(44), 603-630. http://www.jik-ifea.ir/article_20674.html?lang=en

Pilorget, L. (2025). IT-Governance. In *Managing IT in einer digitalen Welt: Zusammenhänge der IT verstehen und die Kriterien für eine erfolgreiche Transformation beherrschen* (pp. 289-313). Wiesbaden: Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-46012-9_9

Porfírio, J. A., Felício, J. A., & Carrilho, T. (2024). Factors affecting digital transformation in banking. *Journal of Business Research, 171*, 114393. https://doi.org/10.1016/j.jbusres.2023.114393

Ramadhana, R., Izaac, B. V., Tangka, G. W., & Mambu, J. Y. (2023). Information technology governance analysis using the COBIT 2019 framework at PT. *Daya Adicipta Wisesa. Jurnal Informasi dan Teknologi*, 141-146. https://doi.org/10.60083/jidt.v5i3.414

Schaefer, J., Baierle, I., Nara, E., Benitez, G., & Haetinger, C. (2020). Corporate governance and information technology: A hybrid vision based on COBIT and ITIL for small companies. *Proceedings of the XL Encontro Nacional de Engenharia de Producao, Foz do Iguaçu* (pp. 20-23). Brazil. https://www.researchgate.net/profile/GuilhermeBenitez/publication/344885938_Corporate_Governance_and_Information_Technology_A_Hybrid_Vision_Based_on_COBIT_and_ITIL_for_Small_Companies/links/5f96bea6458515b7cf9f0194/Corporate-Governance-and-Information-Technology-A-Hybrid-Vision-Based-on-COBIT-and-ITIL-for-Small-Companies.pdf

Schrofelbauer, M., & Sellinger, M. (2025). Automatisierung in der IT-Governance. In *Insurance & Innovation 2025* (pp. 5-13). VVW, Karlsruhe. https://doi.org/10.33283/978-3-86298-893-8_2

Shahabi, V., Azar, A., Faezy Razi, F., & Fallah Shams, M. (2021). Modeling the impact of the industry 4.0 on the banking supply chain using fuzzy dimatel technique. *Journal of International Business Administration, 4(*1*),* 67-89. https://doi.org/10.22034/jiba.2021.43213.1589

Shahabi, V., Azar, A., Faezy Razi, F., & Fallah Shams, M. F. (2022). Analysis of factors affecting the development of the banking service supply chain in the Industry 4.0. *Management Research in Iran, 26*(2), 95-114. https://doi.org/20.1001.1.2322200.1401.26.2.5.4

Shahabi, V., Radfar, R., Wanke, P., Shahabi, A., & Tan, Y. (2024). Agent-based modeling of banking service supply chain in Industry 4.0: A case study of Resalat Qard al Hasana Bank. *International Journal of Innovation in Management, Economics and Social Sciences, 4*(1), 64-85. https://doi.org/https://doi.org/10.59615/ijimes.4.1.64

Shaikh, A. A., & Karjaluoto, H. (2016, January). Mobile banking services continuous usage--case study of Finland. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 1497-1506). IEEE. https://doi.org/10.1109/HICSS.2016.189

Sharma, B., & Dubey, A. (2022). Digital banking: A need of time. *International Journal of Advance and Applied Research (IJAAR), 9*(3), 504-513. https://www.researchgate.net/publication/360809100_DIGITAL_BANKING_A_NEED_OF_TIME

Silva, H. C. C. D., Silveira, D. S. D., Dornelas, J. S., & Ferreira, H. S. (2019). Information technology governance in small and medium enterprises-a systematic mapping. *JISTEM-Journal of Information Systems and Technology Management, 17,* e202017001. https://doi.org/10.4301/S1807-1775202017001

Sinaga, P., & Suroso, J. (2023). The influence of electronic service quality on digital bank application. *Journal of Theoretical and Applied Information Technology, 31*(10). https://www.semanticscholar.org/paper/THE-INFLUENCE-OF-ELECTRONIC-SERVICE-QUALITY-ON-BANK-Sinaga-Suroso/5306332418049a85fca1ad457cedbfa99ff8b25f

Soltani, M., & Tahmasebi Aghbelaghi, D. (2020). Explaining the role of tejarat bank's strategic alliance with fintechs in efficiency mediated by technological developments and digital banking. *Journal of Business Management, 12*(3), 800-832. https://doi.org/10.22059/jibm.2020.296288.3753

Taheri, M., & Ziaei, S. (2021). Providing a model to motivate information technology maturity in information science and knowledge in Gartner style in organizations and libraries (Case study: Documentation Organization). *Digital and Smart Libraries Researches, 8*(30), 79-92. https://doi.org/10.30473/mrs.2022.62680.1500

Valsamidis, S., Tsourgiannis, L., Pappas, D., & Mosxou, E. (2020). Digital banking in the new era: Exploring customers' attitudes. *Business Performance and Financial Institutions in Europe: Business Models and Value Creation Across European Industries*, 91-104. https://doi.org/10.1007/978-3-030-57517-5_6Top of Form

Veena, V. B. (2022). Effect of digital banking acceptance on digital banking usage. *Webology*, *19*(1), 1344-1357. https://doi.org/10.14704/WEB/V19I1/WEB19090

Vial, G. (2021). Understanding digital transformation: A review and a research agenda. *Managing Digital Transformation*, 13-66. https://doi.org/10.1016/j.jsis.2019.01.003

Warner, K. S., & Wäger, M. (2019). Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long Range Planning, 52*(3), 326-349. https://doi.org/10.1016/j.lrp.2018.12.001

Warkentin, M., & Johnston, A. C. (2016). IT governance and organizational design for security management. In *Information security* (pp. 46-68). Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315288697-5/governance-organizational-design-security-management-merrill-warkentin-allen-johnston

Wadesango, N., & Magaya, B. (2020). The impact of digital banking services on performance of commercial banks. *Journal of Management Information and Decision Sciences*, *23*, 343-353. https://www.abacademies.org/articles/THE-IMPACT-OF-DIGITAL-BANKING-SERVICES-ON-PERFORMANCE-OF-COMMERCIAL-BANKS-1532-5806-23-S1-204.pdf

Weber, K., Otto, B., & Lis, D. (2025). Data governance. In *Daten-und Informationsqualität: Die Grundlage der Digitalisierung* (pp. 271-292). Wiesbaden: Springer Fachmedien Wiesbaden. https://link.springer.com/chapter/10.1007/978-3-658-47317-4_16

Wewege, L. (2017). The digital banking revolution. *Lulu*. https://books.google.com/books?hl=en&lr=&id=rXcnDwAAQBAJ&oi=fnd&pg=PA4&dq=Wewege,+L.+(2017).+The+digital+banking+revolution.+Lulu.+com.&ots=AKNynHOxRm&sig=bKMX8dDKYqAGie0u2JMEtyExtpA#v=onepage&q=Wewege%2C%20L.%20(2017).%20The%20digital%20banking%20revolution.%20Lulu.%20com.&f=false

Wilkin, C. L., & Chenhall, R. H. (2020). Information technology governance: Reflections on the past and future directions. *Journal of Information Systems, 34*(2), 257–292. https://doi.org/10.2308/isys-52632