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The effect of digital banking adoption and risk management on bank performance: The intervening role of balanced scorecard

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Abstract

This research examines the effect of digital banking adoption and risk management on bank performance. In addition, this study examines the function of a balanced scorecard in mediating the impact of digital banking adoption and risk management on bank performance. The research was conducted using a survey questionnaire and a hypothetico-deductive approach, placing this in a positivist paradigm. Data were gathered from 200 senior bank managers in 40 banks, comprising 4, 16, and 20 state-owned, regional development, and private-owned banks, respectively. Meanwhile, data analysis and hypothesis testing were performed using the Structural Equation Model – Partial Least Square (SEM-PLS). The results revealed that digital banking adoption, risk management, and balanced scorecards directly and significantly affected bank performance. In addition, digital banking adoption enhanced risk management, and the balanced scorecard mediated the impact of digital banking adoption and risk management on bank performance. The research offers strategic insights for stakeholders such as banks and regulators on the factors influencing their performance in the digital era. Further, the study emphasizes the need for banks to systematically integrate their digital banking adoption and risk management considerations into their strategic planning and performance measurement processes.

Keywords: Balanced scorecard, Bank performance, Digital banking adoption, Risk management.

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1. Introduction

In the ever-evolving financial industry landscape, the advent of digital banking has sparked a revolution in how financial institutions operate and serve their customers [1]. In emerging economies like Indonesia, where technological advancements are reshaping traditional practices, understanding the dynamics between digital banking adoption, risk management, and overall bank performance is paramount [2]. The digital revolution has been reported to drastically transform economic behavior. In this context, jurisdictional limitations are reduced by developing global digital platforms to enhance national economic authority [3]. Digitalization also influences almost all economic attributes, disrupting conservative roles in the monetary sector.

Furthermore, banking trends focus on placing power and information under consumers, offering simple access to budget strategies, credit reporting, savings, and retirement planning, along with other tailor-made features [4]. Mobile banking also grows as customers focus on suitability, providing mobile deposits, funding transfers, bill payments, and account management through a customized smartphone app [5]. Business organizations offering mobile-friendly features are competitive in an overgrowing, crowded financial market [6]. The practical adoption of digital banking decreases operating costs by 20–25%, increasing competitive advantage. Therefore, a necessary approach should be adopted to offer highly satisfying customer service in a competitive market [7]. The potential advantages of digital risk initiatives include efficiency and productivity gains, improved risk effectiveness, and income generation [8]. Greater efficiency and productivity provide better possible cost cuts of 25% or more in the end-to-end credit processes [9]. Risk effectiveness can be improved with superior transparency, management and regulatory reporting, and more accurate model outputs due to better data [6].

On the other hand, risk management in the digital age is becoming more complex as security technology continues to advance. Financial institutions should focus on digital risk assessment and enhance updated risk management practices to ensure customer data privacy, encryption, and appropriate protection [10]. Since governmental bodies and relevant regulators increasingly recognize the risks associated with digital operations, there is a projected increase in regulations and compliance requirements [11]. Therefore, companies are expected to adhere to rising standards for maintaining security. The conventional system for assessing performance has mainly been established based on accounting evaluation rather than operational and non-financial perspectives [12]

Research examining the relationship between digital banking and bank performance has been conducted several times, but the results remain inconclusive. Most studies suggest a positive impact of digital transformation on performance [13]. According to Moffat [14] adopting trends and innovations, such as digital business in the banking sector, has recorded higher performance. Meanwhile, many studies conclude the relatively slow impact of banking digitalization. This is because it takes about five years for companies to feel the changes in bank performance after banking digitalization [15, 16] the analysis revealed that digital banks have an insignificant effect on bank performance. Additionally, the penetration of digital banking technology can lead to issues related to bank efficiency and human resource planning within the banking system [17]. Even in some countries, banking digitalization still encounters difficulties, especially in commercial banks, which still need to develop infrastructure and workflows that lead to online models.

Furthermore, some literature has documented the crucial role of risk management practices in the banking industry. Operationally, Enterprise Risk Management (ERM) addresses the inadequacy of applying traditional risk approaches [18]. Several previous studies agree that risk management is the key to improving banking performance [12]. In contrast, it was found that risk management had a negative effect on 285 banks in ASEAN [19, 20] stated that it is not easy for banks to face various risks because the higher the expected performance, the higher the level of risk faced. More specifically, the risk management situation in developing countries is still unstable, with many uncertainties, risks, and challenges that affect their performance.

The inconsistency of the results of the previous study has raised gaps; therefore, further research on the performance of banks in Indonesia is necessary. Based on the research gaps identified above, bank performance should be evaluated using financial, operational, and non-financial indicators [21, 22] examined the correlation between the types of performance measures and the time horizons of business unit managers. In this case, the balanced scorecard (BSC) is proposed as an approach to overcome the limitations of conventional system assessment by complementing the financial evaluation of performance with future drivers of evaluation [23]. According to Kaplan and Norton [24] BSC is widely recognized as a management tool for strategic performance. This tool covers financial, customer, internal business processes, learning, and growth perspectives. BSC encourages managers to concentrate on non-financial perspectives, which influence the organization's long-term effectiveness, rather than solely on the financial perspective [25].Implementing BSC can be a bank strategy that connects all administrative levels to improve employee productivity and introduce service modernization to achieve maximum satisfaction. Furthermore, BSC can help an organization evaluate its business processes by considering financial and non-financial parameters based on its four perspectives. Thus, using financial and non-financial indicators in the BSC approach is of great interest in evaluating bank performance [26].

Moreover, the balanced scorecard is a long-term strategic management tool adopted by the banking sector in Indonesia. The Ministry of Finance has adopted the balanced scorecard since 2011 and continues to refine it, as stated in the Decree of the Minister of Finance number 556/KMK.01/2015. This step was followed by several other ministries and state-owned companies, including those in the banking industry [27]. Thus, to realize a more measurable and directed performance management, implementing a balanced scorecard is required as a prerequisite variable. Based on the above discussions, to address the research gaps highlighted above, therefore, this research examines the effect of digital banking adoption, risk management, and balanced scorecards on bank performance. The intervening role of BSC on the impact of digital banking adoption and risk management is also investigated.

This research focuses on developing countries, especially Indonesia. This research selects Indonesia because the banking sector plays an enormous role in the national economy, including being a main driving force for Indonesia's Gross Domestic Product (GDP), such as consumption, investment, and export-import activities. In addition, the Indonesian context is interesting to study because banks in Indonesia are owned mainly by private and state-run institutions, making it possible to compare the performance of both ownership structures [28].

This study offers several contributions that significantly influence scientific and practical developments, especially in the banking sector. Theoretically, the study provides a comprehensive reference and insight into adopting a balanced scorecard as a prerequisite variable that drives banking performance. The findings also contribute to the recent literature on a developing country, Indonesia, which has a different bank ownership structure. Additionally, this research holds significant potential practical contributions for various stakeholders in the Indonesian banking sector. Firstly, by empirically examining the relationship between digital banking adoption, risk management practices, and bank performance, the study offers valuable insights for banks and financial institutions seeking to optimize their strategies and operations in the digital age. Identifying the balanced scorecard as a mediating variable sheds light on how digital banking initiatives and risk management efforts impact overall bank performance, providing a roadmap for enhancing organizational effectiveness. Moreover, the evidence-based research approach employed in the study ensures the reliability and validity of findings, enabling policymakers, regulators, and industry practitioners to make informed decisions and formulate targeted interventions to support the sustainable growth and development of the banking sector in Indonesia. Overall, the article's findings have the potential to inform strategic decision-making, improve risk management practices, and drive performance enhancement initiatives within Indonesian banks, ultimately contributing to the sector's competitiveness, resilience, and long-term viability in the digital era.

2. Literature Review

2.1. Resource-Based View (RBV) Theory

This research states the Resource-Based View (RBV) theory as the primary theoretical justification. According to the theory, ownership and control of strategic assets play an important role in determining superior profits and establishing a competitive advantage [29]. As Barney [29] RBV argues that an organization's competitive advantage is determined by its essential resources. Core competencies are the drivers of corporate strategy and diversification. The concept of Resource-Based View (RBV) plays a vital role in strategic management Wiratama and Suwandi [30] believe that an organization will achieve sustainable competitive advantage if the organization has values that are valuable and difficult to imitate. In other words, a company's competitive advantage can be achieved if resource management is managed well. Company performance can be seen from how well managers build the organization and handle things that are valuable and difficult to replace. In line with the Resource-Based View (RBV) theory, risk management may be one of the factors that can encourage banking performance to be more efficient and optimal [31].

2.2. Digital Banking Adoption

Influential elements of e-banking service adoption have become the focus of research in the modern world. Most studies have used an extended Technology Acceptance Model (TAM) to examine the factors affecting the adoption of various forms of electronic banking. Therefore, this research applied an extended TAM to the digital banking framework [32, 33] researched the critical antecedents of the intention of Indian customers to adopt mobile banking and recommended a comprehensive framework by extending the conventional TAM. The dimensions of digital banking adoption are (i) perceived usefulness: numerous analyses have also reported a critical correlation between perceived usefulness and mobile banking adoption [34]. (ii) Perceived Ease of Use: TAM, developed by Davis et al. [35], considered perceived ease of use as a factor influencing technology adoption. Several research report that perceived ease of use positively affects the adoption of e-banking channels [32] (iii) security, trust, and privacy**.** Website security, privacy, and reputation directly and significantly affect customer trust and commitment to online transactions in financial service companies [33]. Banks and financial institutions are expected to build confidence and trust in e-banking services for data transfer, privacy, security, reliability, and information quality. (iv) Transaction Cost**:** E-banking transactions are more straightforward and inexpensive than conventional banking. Digital banking is low-cost, and its features are easily accessible without time and place constraints [33] (v) Awareness: Banks should take necessary actions to build customer awareness of e-banking. The most significant setback for marketing digital banking to customers is the need for more awareness of technology development [32]. (vi) Web Features**:** The five officials also allow customers to manage accounts electronically [36]. Adopting electronic banking or financial services extends beyond operational and technical risks. The associated risks must be understood and addressed correctly to enable the financial inclusion industry to capitalize on electronic services.

2.3. Risk Management

Good management of risks is necessary for the opportunities of new technology and business models to be fully realized for providers, partners, customers, and developing economies. Chen et al. [8] argued that one of the hot topics following the financial crisis is risk management in banks. Due to more complex practices and regulations' pressure to improve bank resiliency, risk factors can be categorized into market, credit, [2] liquidity, operational, legal and regulatory, business, strategic, and reputation risk. Enterprise risk management (ERM) exemplifies an essential change in addressing issues. By applying a general approach, ERM recognizes and deals with various risk elements and manages activities across all operating units. ERM comprises eight interrelated components COSO [37] derived from the operation of management, namely: (i) Internal Environment: The internal environment of an institution includes its culture and establishes the basis for the

perception and addressing of risk by the entity's personnel. This includes risk management philosophy, risk appetite, integrity, ethical values, and the operational environment. (ii) Objective Setting: Objectives must be set before management identifies potential occurrences that influence accomplishments. (iii) Event Identification: Internal and external occurrences influencing an organization's objectives and accomplishments must be recognized to distinguish risks from opportunities. (iv) Risk Assessment: Risks are evaluated by considering the probability and impact to determine how these should be addressed. Furthermore, risks are measured on an inherent and residual basis. (v) Risk Response: Management decides on risk responses by evading, accepting, decreasing, sharing, and creating a set of actions with tolerances and appetite. (vi) Control Activities: Guidelines and methods are created and applied to guarantee the effective management of risk responses. (vii) Information and Communication: Related information is recognized, collected, and communicated in a form and timeframe, enabling members to commit to responsibilities. (viii) Monitoring: The entire organization's risk management is supervised, and adjustments are made as necessary.

2.4. Balanced Scorecard

The idea of a balanced scorecard has advanced significantly and has become a holistic system for managing strategies. The main advantage of applying a disciplined framework is providing institutions with a way to link various strategic planning and management components. Therefore, there will be a clear relationship between the projects and the programs, the assessments implemented to track success (KPIs), the organization's aims, and the vision, mission, and strategy [38].

BSC recommends assessing an organization from four perspectives to establish related aims, measures (KPIs), targets, and initiatives. (i) Financial (or stewardship): This includes evaluating an institution's business performance and utilization of financial resources. (ii) Customer/stakeholder: This perspective emphasizes monitoring a bank's performance from the viewpoint of customers or key stakeholders. (iii) Internal process: This involves analyzing an organization's performance in terms of quality and efficiency related to products, services, or other critical business practices. (iv) Organizational capacity (or learning & growth): This perspective evaluates human capital, infrastructure, technology, culture, and other influential capacities to enhance overall performance.

Since the main reason is to increase the organization's performance, BSC must balance financial, operational, and non-financial objectives from all viewpoints. Therefore, the consistency of initiatives with objectives and the development of ownership become vital.

2.5. Conceptual Framework and Hypotheses Development

Based on the explanation, this research analyzes the effect of adopting electronic banking, risk management, and BSC on bank performance. The adoption of BSC mediates the relationship between digital banking and bank performance and the association between risk management and bank performance. Finally, this research examines the moderating effect of different types of banks on the link between risk management and bank performance. The mapping for hypothesis development is presented in Table 1, and Figure 1, the conceptual framework illustrates that various factors influence bank performance, including digital transformation and risk management. The correlation between IT spending and financial performance or market share varies significantly. IT investments seem to (i) increase labor productivity, (ii) reduce payroll expenses, lower operating and administrative costs, (iii) develop new markets, and (iv) generate revenue growth for banks maintaining a high level of IT [39].

Table 1.
Research Mapping for Hypotheses Development.

Relationship	**References**
DBA to ERM	Do et al. [40] and Khanboubi and Boulmakoul [41]
DBA to BSC	Kim and Davidson [39] and Sardjono and Pujadi [42]
DBA to Performance	Borena and Negash [43] and Branco et al. [44] **Contrary:** Khoury and Rolland [45]
Risk to BSC	Cheng et al. [46] and Elkhouly et al. [47]
Risk to Performance	Bianchi and Caperchione [48] and Brownlees et al. [49]
BSC to Performance	Balkovskaya and Filneva [50], Elkhouly et al. [47] and Rasid et al. [51]
BSC Mediates DBA to Performance	Kim and Davidson [39] and Sardjono and Pujadi [42]
BSC Mediates ERM to Performance	El-Dalabeeh [52], Elkhouly et al. [47], and Rasid et al. [51]

Karasneh and Al-Dahir [53] presented the IT-BSC Model in Jordan for assessing and evaluating bank performance. Sardjono and Pujadi [42] evaluated the performance in the Indonesian banking industry using the Managed File Transfer (MFT System). Meanwhile, Álvarez et al. [54] focused on combining BSC, strategy map, and Fuzzy Analytic Hierarchy Process for business sustainability.

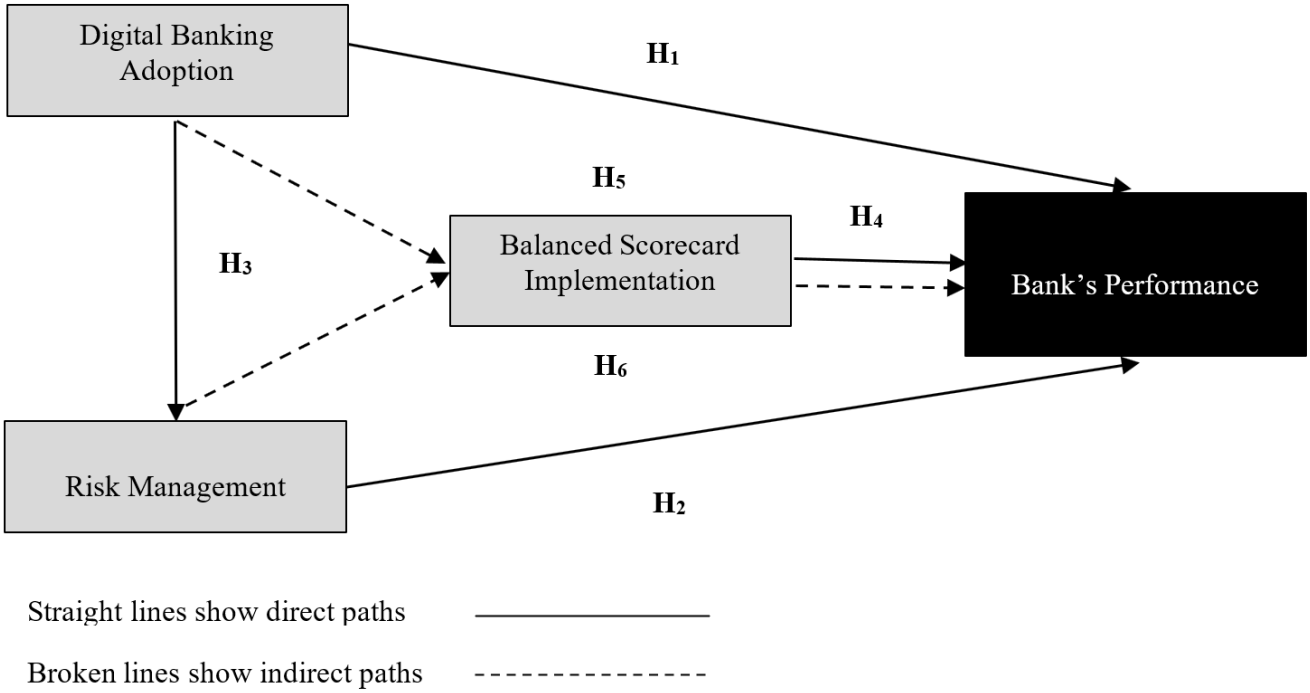

Figure 1.
Conceptual Framework.

Digital banking streamlines various banking processes, such as account management, transactions, and customer service, enhancing operational efficiency. With online and mobile banking platforms, customers can perform transactions and access services remotely, reducing the need for physical branch visits. This operational efficiency translates into bank savings in reduced overhead expenses for maintaining brick-and-mortar branches. Several studies have examined the relationship between IT spending and bank performance [43, 44] positively. According to Khoury and Rolland [45] this research explains the reason for the continuation of heavy investment amid conflicting evidence of positive returns due to the significant increase in I.T. Digital banking offers a multitude of benefits that positively impact bank performance across various dimensions, including operational efficiency, customer reach, experience, data analytics, risk management, and innovation. By embracing digital transformation and leveraging technology effectively, banks can enhance their competitiveness, profitability, and sustainability in the evolving financial landscape.

Hypothesis 1: Digital banking adoption positively impacts bank performance in Indonesia.

Effective risk management practices help banks mitigate credit risks associated with lending activities. Banks can minimize the likelihood of loan defaults and non-performing assets by implementing robust credit assessment processes, including credit scoring models and thorough credit analysis [55]. This leads to a healthier loan portfolio with lower delinquencies and provisioning requirements, ultimately enhancing overall bank performance [56]. The COSO's ERM - Integrating with Strategy and Performance (COSO ERM Framework) defines risk as the likelihood of events occurring that could affect the achievement of strategy and business objectives [37]. Although specific research has explored the effects of ERM and PMS on bank performance, there is a gap in the literature regarding the enhancement of bank performance. The essential points regarding the relationship between ERM and MAS indicate that ERM deployment necessitates the use of advanced MAS data. These variables are essential for decision-making, planning, and controlling a company. This research also emphasizes the importance of ERM in improving non-financial performance. Risk management enhances productivity [57]. Robust risk management practices are pivotal in enhancing bank performance in Indonesia by mitigating credit, market, compliance, and operational risks, ensuring regulatory compliance, preserving stakeholder confidence, and ultimately contributing to financial stability and profitability [58]. By prioritizing risk management and adopting best practices, banks can navigate uncertainties, capitalize on opportunities, and achieve sustainable growth in the dynamic Indonesian banking landscape. This idea aligns with the Resource-Based View (RBV) theory, which posits that the managerial abilities of company managers can create and increase company value [59]. The hypothesis is developed as follows:

Hypothesis 2: Risk management practices positively impact bank performance in Indonesia.

Digital banking adoption promotes automation and digitization of risk management processes, streamlining operations and improving efficiency. Automated risk assessment tools enable banks to standardize risk evaluation criteria and conduct assessments consistently across different business units and customer segments [60]. Banks can free up resources and focus on strategic risk management initiatives by automating routine tasks, such as compliance monitoring and regulatory reporting. Lifen et al. [61] argued that many empirical analyses on the adoption of services (IBS) have focused on perceived risk or trust. However, some studies have integrated these ideas and used empirical evidence to examine the relationship. The findings show that trust and perceived risk have a considerable relationship and are essential for understanding Internet banking usage intentions. Zabala and Ślusarczyk [62] have researched threats to diversification management, operational risks associated with financial services, and the resultant impact on clients and banks. The results show the importance of

judiciously selecting a risk management model for banks, recognizing its role in ensuring the long-term development of competitiveness and facilitating the transformation of banking activities. Digital banking adoption revolutionizes risk management practices within banks by empowering them with advanced analytics, automation capabilities, and collaborative tools, ultimately strengthening their ability to identify, assess, and mitigate risks in today's dynamic financial landscape.
Hypothesis 3: Digital banking adoption has a positive impact on the risk management practices of banks.

The use of BSC in banking performance measurements provides a variety of viewpoints [63] offered a theoretical framework for applying BSC in the banking industry and showing the practices in the literature. Ibrahim and Murtala [64] evaluated the utility as a method for evaluating the performance of the Nigerian banking sector. Despite the critique, Tsai et al. [23] discovered that BSC addresses risk management challenges, resulting in enhanced internal business processes due to the capacity to eliminate or reduce risk exposures. Therefore, BSC adoption has a favorable and considerable impact on bank performance [65]. Implementing the Balanced Scorecard positively affects bank performance in Indonesia by providing a structured framework for strategic management, performance measurement, learning, and alignment. By adopting the BSC methodology, banks can enhance their ability to translate strategic vision into actionable initiatives, monitor progress toward goals, foster a culture of continuous improvement, and drive organizational performance in Indonesia's dynamic and competitive banking landscape.
Hypothesis 4: BSC implementation positively impacts bank performance in Indonesia.

Kim and Davidson [39] used the BSC methodology to evaluate the business performance of information technology expenses in the Korean banking industry. This evidence suggests two critical practical consequences. First, banks using IT strategy to gain a competitive advantage are more likely to cut personnel costs, gain market share, and maximize profits. Second, according to the report, bank executives should consider using the BSC technique to assess IT and management strategy performance. Therefore, these findings provide a competitive advantage for the banking industry. Sardjono and Pujadi [42] evaluated the performance of IT-BSC using the Managed File Transfer (MFT System). A mediating influence of BSC implementation was stated on the connection between digital banking uptake and bank performance. Balanced Scorecard implementation mediates the relationship between digital banking adoption and bank performance by providing a structured framework for setting strategic objectives, tracking performance, and aligning efforts across the organization [28]. By integrating digital banking initiatives within the BSC framework, banks can effectively measure the impact of digital transformation on key performance indicators and drive continuous improvement in performance outcomes. Thus, the BSC serves as a critical mediator in translating digital banking adoption into tangible business results and enhancing overall bank performance in the evolving landscape of the banking industry.

Hypothesis 5: BSC implementation mediates the relationship between digital banking adoption and bank performance in Indonesia.

According to Cheng et al. [46], BSC has no visible qualities implemented in a formal process that integrates risk management within a larger strategy framework. Elkhouly et al. [47] developed a Banking Risk Balanced Scorecard (BRBS) in response to BSC criticism. A conceptual framework was created to evaluate the effectiveness of BRBS beyond Basel standards, as well as its critical role in enhancing stakeholder competitiveness. Rasid et al. [51] responded to rising expectations for creating a new paradigm known as ERM as an internal control system. Organizations have used PMS as a critical management control system for company performance. Considering the relevance of the two control systems, the potential of implementing an ERM in existing PMS should be investigated. Risk management is supposed to enhance a PMS by detecting and minimizing risks in pursuing strategic goals. El-Dalabeeh [52] examined the relationship between balanced scorecards, ERM, and organizational performance. According to the literature, ERM is a mediating variable between BSC and organizational performance. However, research on the impact of ERM on the relationship between BSC and organizational performance is in its early stages. This research proposes a mediating influence of balanced scorecard implementation on the link between risk management and organizational performance. The Balanced Scorecard implementation is a critical mediator in the relationship between risk management and bank performance by providing a structured framework for aligning strategic objectives, measuring performance, fostering accountability, and promoting continuous improvement [56]. By integrating risk management within the BSC framework, banks can enhance their ability to mitigate risks, optimize performance outcomes, and achieve sustainable growth and value creation in today's dynamic and competitive banking environment [66].

Hypothesis 6: BSC implementation mediates the relationship between risk management and bank performance in Indonesia.

The impact of bank ownership type (state-owned and private banks) on performance is also discussed to increase statistical power. The ownership structure of banks is essential to study in depth because it affects the capital adequacy ratio and risk-taking character of banks. This is in line with the fact that government-run banks such as SOEs tend to be privileged because most of their funding sources are supported by the government. Furthermore, each bank has different organizational objectives, regulatory environments, governance structures, and decision-making dynamics. Hence, performance differences between public and private firms should be examined. Specifically, this study examines the effect of bank type in moderating the relationship between risk management practices and performance. Recognizing these moderating factors is critical to understanding how risk management strategies translate into performance outcomes across different types of banks and tailoring risk management approaches to each institution's specific characteristics and constraints [67].

3. Methodology

This research follows a positivist research paradigm. The methodological approach is categorized as top-down, starting with a theory. Given the availability of previous literature, a hypothetico-deductive strategy was more appropriate to answer

the research questions. The relationship among constructs was confirmed using reflective measurement and the path between the dependent and independent constructs.

Digital banking refers to the application of technology in bank frameworks and services. The measurement of digital banking variables in this study relies on twenty-four indicators adopted from Ananda et al. [32]. Then, risk management refers to the general approach to mitigating various risks. Specifically, the risk management variable is measured in reference to Mbama et al. [36]. In addition, the Balanced Scorecard leads to strategic planning within the framework of an organization. While bank performance refers to the effectiveness of managerial actions measured from the perspectives of finance, customers, processes, learning, and growth. In line with this, the instrument from Al-Alawi [68] was adopted to measure balance scorecard items and banking performance. The adoption was carried out because the context of the research was carried out in the same scope.

Stratified sampling assessed 4, 16, and 20 SOE, Regional Development, and Private Banks. A total of 200 senior bankers from 40 banks with minimum manager/senior manager levels were randomly given a set of questionnaires to observe the dimensions of developing online banking, risk management, applying balanced scorecards, and the performance of banks. The indicators of digital banking adoption, risk management, BSC implementation, and bank performance as perceived by management are assessed using a 5-point Likert scale, ranging from "1- strongly disagree" to "5- strongly agree". The study collected primary data from research participants, who participated voluntarily and expressed their consent by signing a written consent form provided by the researchers.

To ensure the survey was accurate and reliable, the study's questions and measurements were checked by experts and tested before being used [69]. To ensure the accuracy of the content, we incorporated data from different studies in various scenarios. These items were later examined and evaluated by a group of experts. The expert panels are divided into two groups: academicians and practitioners. After selecting a group of experts, they were sent an email asking for their opinions on the relevance, representativeness, clarity, and thoroughness of the items. This was done to ensure that the items effectively measure the construct being studied and that the instrument is valid. Additionally, to develop rigorous measurement, a pilot test was also conducted. Based on the pilot test results, it is concluded that the validity and reliability of the instrument and constructs are confirmed.

The hypothesis testing in this article was conducted using the Structural Equation Model - Partial Least Squares (SEM-PLS), implemented through the software SmartPLS 3. SEM-PLS offers a robust statistical framework for analyzing complex relationships between variables by assessing measurement and structural models [70]. By examining the convergent and discriminant validity of latent constructs and estimating path coefficients to evaluate the strength and significance of relationships, SEM-PLS enables testing hypotheses and gaining rigorous insights into causal mechanisms. SmartPLS 3, as the software platform used for analysis, provides a user-friendly interface and robust analytical capabilities, facilitating the implementation of SEM-PLS methodology and interpretation of results in the study context.

4. Finding and Discussion

Data coding, data cleaning, missing data handling, monotone response pattern analysis, demographic analysis, and non-response bias evaluation were part of the preparation process. This research included 200 senior Indonesian bankers from 40 banks, and the data analysis used individual responses as the unit. There were 200 (individual) respondents, with 40 (institutional) responses from each bank. The data were computed and calculated from the average responses of each bank. A demographic summary based on gender, age, type of bank, position, and tenure is presented in Table 2.

Table 2.
The Summary of Characteristics of Respondents.

Description		Frequency	Percent	Valid Percent	Cumulative Percent
Gender					
	Male	163	81.5	81.5	81.5
	Female	37	18.5	18.5	100.0
	Total	200	100.0	100.0	
Education					
	Diploma/Certificate	27	13.5	13.5	13.5
	Undergraduate/Bachelor's Degree	100	50.0	50.0	63.5
	Postgraduate/Master's & PhD	73	36.5	36.5	100.0
	Total	200	100.0	100.0	
Type of Bank					
	State-owned Bank	20	10.0	10.0	10.0
	Regional State-owned Bank	80	40.0	40.0	50.0
	Private-owned Bank	100	50.0	50.0	100.0
	Total	200	100.0	100.0	
Position					
	Others (Specialist)	9	4.5	4.5	4.5
	Vice President/Assistant Vice President	77	38.5	38.5	43.0
	Executive Vice President/Senior Vice President	71	35.5	35.5	78.5
	Boards of Directors	43	21.5	21.5	100.0
	Total	200	100.0	100.0	
Tenure					
	Less than 10 years	40	20.0	20.0	20.0
	11 – 20 years	31	15.5	15.5	35.5
	21 – 30 years	91	45.5	45.5	81.0
	More than 30 years	38	19.0	19.0	100.0
	Total	200	100.0	100.0	

Regarding gender, 81% and 19% of the respondents were male and female. Based on education level, 13%, 50%, and 37% held a diploma/certificate, undergraduate/bachelor's degrees, and postgraduate/master's or Ph.D. degrees. Furthermore, 10%, 40%, and 50% of the respondents were from state-owned enterprises (SOE), regional development/state-owned, and privately owned banks. Based on position, 4%, 38%, 36%, and 22% were specialists in digital banking and risk management, vice/assistant vice president, executive/senior vice president, and members of the board of directors. Meanwhile, 20%, 15%, 46%, and 19% had worked for less than ten years, 11–20 years, 20–30 years, and more than 30 years, respectively.

4.1. Assessment of Construct Measurement

A total of two layers of latent constructs were used in the second-order factor model measurement theory. These models added a second-order latent component that caused several first-order latent factors and variables (X). To assess the second-order confirmatory factor analysis, the bootstrapping technique was used to evaluate the inner model. The results of the digital banking adoption construct are presented in Table 3.

Table 3.
Second Order Confirmatory Factor Analysis of Digital Banking Adoption.

First Order Construct	Second Order Construct	Item	Loadings	CR	AVE
Perceived Usefulness		DBA01	0.902	0.857	0.750
		DBA02	0.829		
Perceived Ease of Use		DBA03	0.797	0.832	0.712
		DBA04	0.888		
		DBA05	0.873	0.886	0.795
Security, Trust, Privacy		DBA06	0.91		
Transaction Cost		DBA07	0.753	0.792	0.657
		DBA08	0.865		
Awareness		DBA09	0.921	0.878	0.783
		DBA10	0.847		
Web Features		DBA11	0.785	0.777	0.636
		DBA12	0.810		
	Digital Banking Adoption	Perceived Usefulness	0.539	0.861	0.651
		Perceived Ease of Use	0.592		
		Security, Trust, Privacy	0.838		
		Transaction Cost	0.731		
		Awareness	0.775		
		Web Features	0.651		

The results of the Second order confirmatory Factor analysis of the risk management construct are presented in Table 4.

Table 4.
Second-Order Confirmatory Factor Analysis of Risk Management.

First Order Construct	Second Order Construct	Item	Loadings	CR	AVE
Internal Environment		RM01	0.535	0.724	0.585
		RM02	0.940		
Objective Setting		RM03	0.890	0.884	0.793
		RM04	0.890		
Event identification		RM05	0.923	0.907	0.830
		RM06	0.899		
Risk Assessment		RM07	0.721	0.850	0.682
		RM08	0.666		
Risk Responses		RM09	0.795	0.802	0.670
		RM10	0.841		
Control Activities		RM11	0.943	0.888	0.799
		RM12	0.842		
		RM13	0.930	0.776	0.641
Info & Communication		RM14	0.646		
Monitoring		RM15	0.864	0.875	0.778
		RM16	0.900		
	Risk Management	Internal Environment	0.603	0.875	0.729
		Objective Setting	0.809		
		Event identification	0.709		
		Risk Assessment	0.598		
		Risk Responses	0.592		
		Control Activities	0.750		
		Info & Comm	0.700		
		Monitoring	0.799		

The results of the Second Order Confirmatory Factor Analysis of the balanced scorecard construct are shown in Table 5.

Table 5.
Second-Order Confirmatory Factor Analysis of Balanced Scorecard.

First Order Construct	Second Order Construct	Item	Loadings	CR	AVE
Financial Perspectives		BSC01	0.689	0.867	0.530
		BSC02	0.612		
		BSC03	0.527		
		BSC04	0.560		
		BSC05	0.685		
		BSC06	0.701		
		BSC07	0.769		
		BSC08	0.740		
		BSC09	0.808		
Customer Perspectives		BSC10	0.771	0.883	0.560
		BSC11	0.847		
		BSC12	0.797		
		BSC13	0.719		
		BSC14	0.681		
		BSC15	0.658		
Internal Business Process		BSC16	0.665	0.809	0.521
		BSC17	0.545		
		BSC18	0.856		
		BSC19	0.782		
Learning & Growth		BSC20	0.816	0.878	0.647
		BSC21	0.890		
		BSC22	0.886		
		BSC23	0.589		
	Balanced Scorecard	Financial Perspectives	0.866	0.928	0.772
		Customer Perspectives	0.894		
		Internal Bus Process	0.873		
		Learning & Growth	0.754		

The results of the Second Order Confirmatory Factor analysis of bank performance are shown in Table 6.

Table 6.
Second Order Confirmatory Factor analysis of bank performance.

First Order Construct	Second Order Construct	Item	Loadings	CR	AVE
Financial Perspectives		PERF01	0.863	0.823	0.543
		PERF02	0.590		
		PERF03	0.799		
		PERF04	0.662		
Customer Perspectives		PERF05	0.732	0.805	0.560
		PERF06	0.657		
		PERF07	0.625		
		PERF08	0.827		
Internal Bus Process		PERF09	0.705	0.825	0.545
		PERF10	0.840		
		PERF11	0.807		
		PERF12	0.573		
Learning & Growth		PERF13	0.767	0.867	0.568
		PERF14	0.872		
		PERF15	0.606		
		PERF16	0.597		
	Bank Performance	Financial Perspectives	0.897	0.908	0.690
		Customer Perspectives	0.878		
		Internal Bus Process	0.902		
		Learning & Growth	0.790		

Based on the Second-Order Confirmatory Factor analysis of the bank performance construct, the dimensions reflected the construct with significant values below 0.05. Therefore, the dimensions significantly manifested and reflected the Construct of Bank Performance.

4.2. Assessment of Structural Measurement

The outer and inner model testing phases were two stages in the PLS analysis. The validity and reliability of the indicators in assessing constructs were tested during the outer model testing phase (Figure 2), while the hypotheses were analyzed in the inner model.

The subsequent stage was to determine the internal consistency reliability of each construct. Although Cronbach's alpha is a popular measure for evaluating reliability, individual indicators cannot be weighted in the calculations. Since composite reliability weights individual indicators based on their loadings, this limitation cannot be overcome; therefore, it is the preferable reliability technique.

The assessment of reflective measurement models includes composite reliability and average variance extracted (AVE) to evaluate internal consistency, individual indicator reliability, and convergent validity.

Table 7.
Assessment of Constructs Validity and Reliability.

	Cronbach's alpha	Composite Reliability	(AVE)
Digital Banking Adoption	0.807	0.850	0.534
Risk Management	0.843	0.872	0.502
Balanced Scorecard	0.902	0.915	0.524
Bank Performance	0.839	0.870	0.506

Digital banking adoption, risk management, balanced scorecard, and bank performance constructs have Cronbach's Alpha, rho Alpha, and Composite Reliability scores ranging from 0.70 to 0.95, indicating that the reliability of the constructs is satisfactory to a reasonable level. The discriminant or convergent validity of the constructs, as shown by AVE, was above 0.5.

4.3. The Inner Model Test

The inner model test includes a direct influence significance test, an indirect effect test, and the measurement of the influence of each exogenous variable. The results of the model estimation serve as a reference for testing the hypotheses shown in Figure 2.

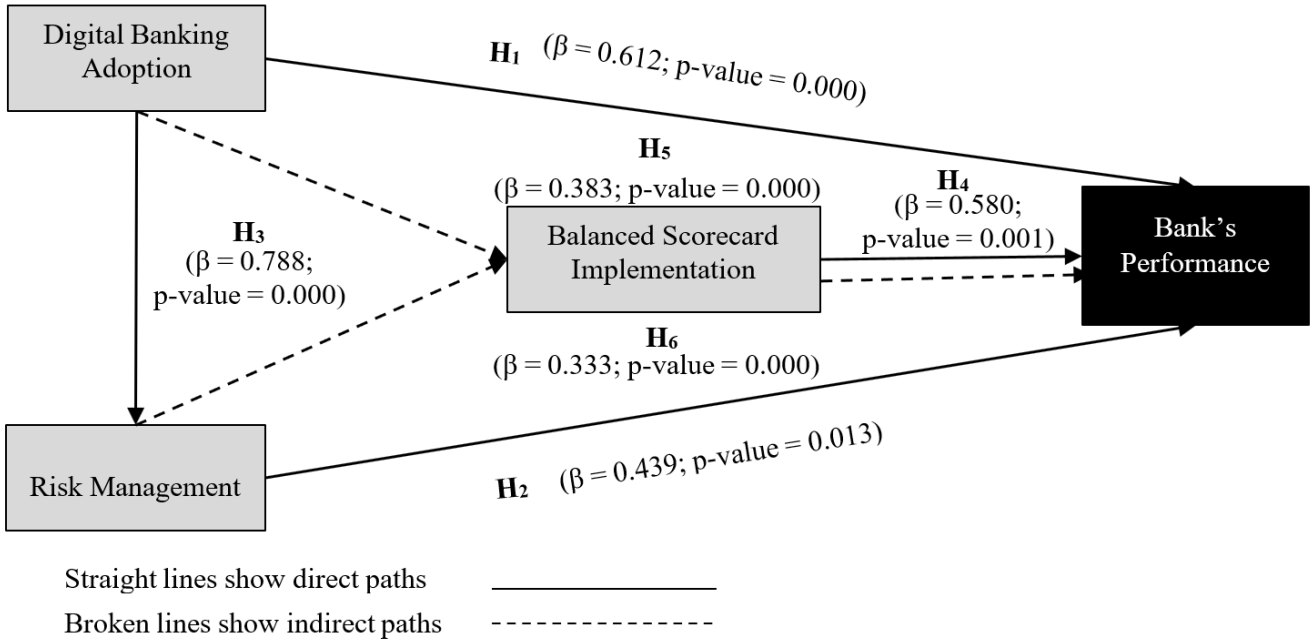

Figure 2.
Results of Model Estimation with Bootstrapping Technique.

Based on the data analysis and hypothesis testing, a summary of the testing is presented in Table 8.

Table 8.
The Summary of Hypothesis Testing.

Hypotheses		Coefficient	Std. Dev Deviation	T Statistic (|O/STDEV|)	P Values	Result
Direct Effect						
H1	DBA → Bank Performance	0.612	0.114	5.348	0.000	Supported
H2	RM → Bank Performance	0.439	0.175	2.506	0.013	Supported
H3	DBA → Risk Management	0.788	0.100	7.875	0.000	Supported
H4	BSC → Bank Performance	0.580	0.166	3.483	0.001	Supported
NH	DBA → Balanced Scorecard	0.660	0.168	3.930	0.000	(+) Significant
NH	RM → Balanced Scorecard	0.574	0.172	3.342	0.001	(+) Significant
Indirect Effect (Mediation)						
H5	DBA → BSC → BP	0.383	0.028	13.726	0.000	Supported
H6	RM → BSC → BP	0.333	0.029	11.660	0.000	Supported
Control Variable						
NH	Type of Bank → Bank Performance	0.072	0.124	0.585	0.559	Insignificant
NH	Moderating Effect of Type of Bank on RM → BP	-0.113	0.095	1.196	1.196	Insignificant

Note: NH (Not hypothesized); DBA (Digital Banking Adoption); RM (Risk Management); BSC (Balanced Scorecard); BP (Bank Performance).

5. Discussion

The testing results show that digital banking adoption positively and significantly affects bank performance. These findings confirm several prior related studies, Kahveci and Wolfs [71], that the implementation of digital banking provides convenience for consumers and indirectly creates effectiveness and encourages banking performance [36]. This study also confirms the positive and significant relationship between risk management and banking performance [12]. This finding aligns with Harb et al. [72] and Rithmaya et al. [73], who believe risk management practices can minimize risks affecting the bank's overall strategy and business objectives. This study also found a positive relationship between digital banking adoption and risk management. Adopting digital banking can encourage the automation of risk management processes to be more effective and optimal [60]. Moreover, this study affirms that the balanced scorecard positively and significantly affected bank performance. Tuan [65] stated that one of the fundamental components of managerial accounting is the BSC, which assists managers in measuring and evaluating business performance. Therefore, the BSC is one of the instruments that significantly affect the financial performance of banks [74].

Furthermore, this research confirms the relationship between digital banking adoption and banking performance by implementing BSC as a mediator. These findings confirm that banks that use IT strategies accompanied by BSC implementation can maximize profits and gain more competitive advantages [25]. The BSC approach in digital banking adoption will set more structured goals and align efforts across the organizational landscape [28]. Therefore, the BSC becomes an essential mediator in translating digital banking adoption to improve sustainable performance results. Moreover, the hypothesis testing results show that the BSC mediates the impact of risk management on bank performance. The BSC can effectively incorporate risk management policies into strategy development and implementation [56]. Organizations can use holistic performance frameworks to achieve integrated strategic risk management. According to Elkhouly et al. [47], BSC's risk management philosophy faces practical challenges in data collection, processing, and analysis. The literature confirms the basic assumption that BSC is a solid approach for analyzing committed and realistic risk management. Specifically, the adoption of risk management, along with the implementation of BSC, will result in a more structured and strategic framework across all organizational elements, which will continually improve banking performance [52].

5.1. Theoretical and Practical Implications

This study offers both theoretical and practical implications. Theoretically, the findings of this study address the inconsistencies in study results regarding the influence of digital banking adoption and risk management on bank performance. Empirical evidence from this research indicates that BSC is a prerequisite for bank performance, based on the development of digital banking and risk management. BSC is a strategy that banks formulate to achieve more targeted performance. Additionally, the research findings partially confirm the premise of the Resource-Based View (RBV) theory formulated by Barney [29] regarding the crucial role of resources in achieving superior profits. On this basis, it can be interpreted that primary resources are the key to formulating company strategy and diversification. These resources can be “anything” with a possible capacity and include existing and new ones. In this case, the BSC is a resource and a management strategy tool that an organization needs to use to manage all its departments. This is also following [31], which highlights that the BSC can organize all layers of management that continuously provide close supervision of all organizational processes. Thus, to create companies that are "smarter" and more flexible than their competitors, sustainable strategies or potentials are needed, such as adopting BSC, digital banking, and risk management simultaneously.

The practical implications of the research are manifold and hold significant relevance for various stakeholders in the Indonesian banking sector and beyond. First, this research provides banks in Indonesia with valuable strategic insights into the factors influencing their performance in the digital era. By examining the effects of digital banking adoption and risk management practices on bank performance, the study offers banks a deeper understanding of the mechanisms driving success in the evolving banking landscape. This knowledge can inform strategic decision-making processes, helping banks

prioritize investments in digital infrastructure, refine risk management strategies, and optimize performance outcomes. Second, this research underscores the importance of effective risk management practices in mitigating risks associated with digital banking adoption and enhancing overall bank performance. By highlighting the mediating role of the Balanced Scorecard framework, the study emphasizes the need for banks to systematically integrate risk management considerations into their strategic planning and performance measurement processes. This insight can guide banks in strengthening their risk management frameworks, enhancing resilience to digital-related risks, and safeguarding financial stability.

Third, the findings have implications for policymakers and regulators tasked with overseeing the banking sector in Indonesia. By identifying the factors influencing bank performance, including digital banking adoption and risk management practices, the research offers policymakers insights into areas where regulatory interventions may be needed to support the sustainable growth and stability of the banking industry. Policymakers can use this evidence-based research to formulate policies and regulatory frameworks that incentivize banks to adopt best practices in digital banking and risk management, fostering a more robust and resilient banking sector. Fourth, from an academic perspective, this research contributes to the knowledge of the interplay between digital banking, risk management, and bank performance. The study advances theoretical understanding and methodological approaches in banking and finance by empirically testing hypotheses and employing the Balanced Scorecard as a mediating variable. The findings can serve as a basis for further scholarly inquiry and empirical research on similar topics in other geographical contexts or industries. Finally, this research offers practical guidance for industry practitioners seeking to enhance performance and competitiveness in the Indonesian banking sector, including bank executives, risk managers, and financial analysts. By elucidating the mechanisms through which digital banking adoption and risk management practices influence bank performance, the study provides actionable insights that practitioners can use to optimize strategic decision-making, allocate resources effectively, and improve organizational performance outcomes.

6. Conclusion

In conclusion, adopting digital banking and risk management positively influenced bank performance. In addition, digital banking adoption positively and significantly affected risk management. In digital disruption and transformation, the model was consistent with adopting digital banking technology. BSC positively and significantly impacted bank performance as a prominent management tool. Also, the BSC mediated the relationship between digital banking adoption, risk management, and bank performance. As a control variable, the type of bank did not influence the impact of risk management on bank performance.

The limitations of this research will be explored with future recommendations. First, regarding the number of unit analyses, the study included 200 senior Indonesian bankers from 40 banks (4 state-owned banks, 16 regional development/regional state-owned banks, and 20 private-owned banks). The unit of analysis used was institutional responses, consisting of 40 banks calculated from the average score of individual respondents. Since the structural equation model is sensitive to the number of samples, the results differ when tested using individual responses, and the proposed hypotheses were supported. Future research is suggested to use more samples. Second, the results are limited to the period since the study is cross-sectional. Longitudinal research could evaluate the long-term impacts, causality, and interrelationships between digital banking adoption characteristics.

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