EVALUATING E-BANKING SERVICE QUALITY AND DEVELOPMENT STRATEGIES USING THE PIESCES AND SWOT FRAMEWORKS: A CASE STUDY OF COMMERCIAL BANKS IN INDONESIA

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Abstract

The rapid digital transformation of the banking industry has positioned electronic banking (e-banking) as a critical service channel for commercial banks, particularly in emerging economies such as Indonesia. Despite its extensive adoption, challenges related to system reliability, service quality, security, and strategic sustainability remain significant. This study aims to comprehensively evaluate e-banking service quality and to formulate development strategies through an integrated application of the PIESCES framework and SWOT analysis. Employing a qualitative case study approach, data were collected through structured questionnaires, semi-structured interviews, and document analysis involving internal stakeholders responsible for managing e-banking services. The PIESCES framework was utilized to assess six key dimensions of information systems performance: performance, information, economy, control, efficiency, and service. Subsequently, SWOT analysis was applied to translate service quality evaluation outcomes into strategic development directions by identifying internal strengths and weaknesses alongside external opportunities and threats. The findings indicate that e-banking services significantly enhance transaction efficiency and accessibility; however, persistent issues related to system stability, cybersecurity control, and responsiveness of supporting services require strategic attention. The integration of PIESCES and SWOT provides a robust analytical foundation for aligning service quality evaluation with strategic planning. This study contributes to the literature by offering an integrative evaluation–strategy model for digital banking services and provides practical implications for bank management in strengthening competitiveness and ensuring sustainable e-banking development.

Keywords : *E-banking service quality; PIESCES framework; SWOT analysis; digital banking strategy; commercial banks; Indonesia*

1. INTRODUCTION

The rapid advancement of information and communication technology has profoundly reshaped the global banking industry, accelerating the transition from conventional service models to digitally driven financial services. Electronic banking (e-banking) has emerged as a fundamental component of this transformation, enabling banks to deliver services through digital channels that facilitate real-time transactions, reduce operational complexity, and enhance customer convenience. In an increasingly competitive financial environment, the quality of e-banking services has become a decisive factor influencing customer satisfaction, trust, and long-term loyalty (Alalwan et al., 2020; Venkatesh et al., 2022).

In emerging economies such as Indonesia, the adoption of e-banking services has expanded rapidly alongside the growth of mobile technology and internet penetration. Commercial banks

have invested substantially in digital infrastructure to meet rising customer expectations for fast, secure, and user-friendly banking services. However, the accelerated pace of digitalization has also introduced new challenges related to system reliability, information accuracy, cybersecurity risks, and service responsiveness. These challenges highlight that technological adoption alone is insufficient; sustained competitiveness depends on the consistent delivery of high-quality digital services (Rahi et al., 2020; Kumar et al., 2021).

Previous studies indicate that deficiencies in e-banking service quality can negatively affect customer perceptions and usage behavior. System downtime, delays in information updates, and security concerns have been shown to reduce customer satisfaction and increase the likelihood of switching to alternative financial service providers, including fintech platforms that offer agile and customer-centric digital solutions (Alalwan et al., 2020). As competition intensifies, commercial banks must not only innovate technologically but also systematically evaluate and continuously improve the quality of their e-banking services.

A structured and multidimensional evaluation framework is therefore essential for understanding the strengths and weaknesses of e-banking systems. The **PIESCES framework**, which encompasses performance, information, economy, control, efficiency, and service, provides a comprehensive approach to evaluating information systems from both technical and service-oriented perspectives. This framework enables organizations to diagnose operational issues, assess service effectiveness, and identify areas requiring improvement in a systematic manner (Whitten & Bentley, 2020). In the context of e-banking, PIESCES offers a valuable lens for capturing the complex interactions between system functionality, service delivery, and customer experience.

Nevertheless, evaluation outcomes must be translated into strategic actions to support sustainable digital development. Service quality assessment alone does not automatically result in organizational improvement unless it is integrated with strategic decision-making processes. In this regard, **SWOT analysis** serves as a well-established strategic management tool for identifying internal strengths and weaknesses alongside external opportunities and threats. By contextualizing evaluation findings within the broader organizational and environmental landscape, SWOT analysis facilitates the formulation of development strategies that are both realistic and adaptive (Gürel & Tat, 2017; Phadermrod et al., 2019).

Despite the extensive application of e-banking service quality models in prior research, there remains a limited number of studies that explicitly integrate information systems evaluation frameworks with strategic analysis tools. Many studies focus either on measuring service quality or on formulating strategic recommendations without establishing a clear analytical linkage between the two. This gap reduces the practical applicability of research findings for managerial decision-making, particularly in the dynamic digital banking environment.

To address this gap, the present study adopts an integrative approach by combining the PIESCES framework with SWOT analysis to evaluate e-banking service quality and formulate development strategies within a commercial banking context in Indonesia. By employing a qualitative case study design, this research seeks to provide an in-depth and context-sensitive understanding of e-banking service performance and strategic challenges. The findings are expected to contribute theoretically by extending the application of integrated evaluation–strategy models in digital banking research and practically by offering actionable insights for bank management in enhancing service quality, strengthening competitiveness, and ensuring sustainable e-banking development.

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Electronic Banking and Digital Banking Transformation

Electronic banking (e-banking) represents a critical innovation in modern banking systems, enabling financial institutions to deliver services through digital platforms without the constraints of time and physical location. E-banking encompasses a range of services, including internet banking, mobile banking, and electronic payment systems, which collectively aim to improve service accessibility, operational efficiency, and customer convenience. The global banking industry has increasingly adopted e-banking as a strategic response to technological advancement and evolving customer expectations (Venkatesh et al., 2022).

In emerging economies, e-banking adoption has been driven by rapid growth in mobile technology and internet usage. Indonesia, in particular, has experienced significant expansion in digital financial services as commercial banks compete to offer innovative and user-friendly e-banking platforms. However, prior research indicates that rapid digital expansion often introduces challenges related to system reliability, service consistency, and security management. These challenges underline the importance of not only deploying digital banking systems but also continuously evaluating their quality and effectiveness (Rahi et al., 2020; Kumar et al., 2021).

Previous studies have demonstrated that e-banking service quality significantly influences customer satisfaction, trust, and loyalty. Alalwan et al. (2020) found that system reliability and security are among the most influential factors affecting customers' intentions to adopt and continue using e-banking services. Similarly, research by Rahi et al. (2020) emphasized that information accuracy and perceived system trust play a crucial role in shaping users' behavioral intentions. These findings suggest that e-banking success depends on a holistic approach that integrates technological performance with service quality management.

2.2 Service Quality Evaluation in E-Banking

Service quality evaluation has been a central theme in e-banking research, with scholars proposing various models to measure customer perceptions and system performance. Traditional service quality models, such as SERVQUAL, have been widely applied; however, their applicability to digital and information system–based services has been questioned due to their limited focus on technical system characteristics. As a result, information systems–oriented evaluation frameworks have gained increasing attention in digital banking research.

Information systems evaluation frameworks emphasize both technical performance and service delivery aspects. According to Whitten and Bentley (2020), effective system evaluation must consider system functionality, information quality, operational efficiency, control mechanisms, and service support. In the context of e-banking, these dimensions are particularly relevant due to the complexity of digital platforms and the critical role of system reliability and security in customer trust.

Empirical evidence suggests that banks that systematically evaluate and improve e-banking service quality are better positioned to retain customers and enhance competitive advantage. However, many prior studies focus primarily on measuring service quality outcomes without explicitly linking evaluation results to organizational strategy. This limitation reduces the managerial relevance of evaluation findings, particularly in highly competitive digital banking environments.

2.3 The PIESCES Framework in Information Systems Evaluation

The PIESCES framework Performance, Information, Economy, Control, Efficiency, and Service—was developed as a comprehensive tool for evaluating information systems within organizational contexts. Performance refers to system reliability, response time, and availability; Information focuses on accuracy, relevance, and timeliness; Economy examines cost efficiency and economic value; Control addresses security, access management, and risk mitigation; Efficiency evaluates resource utilization and process optimization; and Service assesses support quality and user satisfaction (Whitten & Bentley, 2020).

The strength of the PIESCES framework lies in its ability to integrate technical, economic, and service-oriented dimensions into a single evaluation model. This holistic perspective makes PIESCES particularly suitable for assessing complex digital systems such as e-banking platforms, where technical performance and service delivery are closely intertwined. Previous studies applying PIESCES in information systems evaluation have demonstrated its effectiveness in identifying system weaknesses and guiding improvement initiatives.

In the banking context, PIESCES enables organizations to move beyond surface-level assessments of customer satisfaction and examine underlying system and service processes. By capturing both internal operational performance and external service outcomes, the framework provides a robust foundation for evidence-based decision-making in digital banking development.

2.4 SWOT Analysis and Strategic Management in Banking

Strategic management literature widely recognizes **SWOT analysis** as an effective tool for organizational assessment and strategy formulation. SWOT analysis facilitates the identification of internal strengths and weaknesses, as well as external opportunities and threats that influence organizational performance. In the banking sector, SWOT analysis has been extensively used to support strategic planning in response to technological change, regulatory dynamics, and competitive pressures (Gürel & Tat, 2017).

Phadermrod et al. (2019) argue that SWOT analysis becomes particularly powerful when it is grounded in empirical performance evaluation rather than subjective judgment alone. By integrating quantitative or qualitative evaluation results into SWOT analysis, organizations can develop more realistic and actionable strategies. In digital banking, this integration allows banks to align service quality strengths with market opportunities while addressing weaknesses and mitigating external threats such as fintech competition and cybersecurity risks.

Despite its widespread use, SWOT analysis is often applied in isolation from systematic service quality evaluation. This separation limits its effectiveness, as strategic recommendations may not be firmly grounded in actual system performance data. Therefore, integrating SWOT analysis with a structured evaluation framework such as PIESCES represents a meaningful advancement in digital banking strategy formulation.

2.5 Conceptual Framework and Research Gap

Based on the reviewed literature, it is evident that e-banking service quality plays a critical role in determining customer satisfaction and competitive advantage. While numerous studies have examined e-banking adoption and service quality, relatively few have integrated information systems evaluation frameworks with strategic management tools in a cohesive analytical model. This gap limits the ability of research to provide actionable strategic insights for banking practitioners.

To address this limitation, the present study proposes an integrated conceptual framework that combines the PIESCES framework and SWOT analysis. In this framework, PIESCES is used to evaluate e-banking service quality across six dimensions, generating empirical insights into system and service performance. These insights are subsequently mapped into SWOT analysis to identify internal strengths and weaknesses and to contextualize them within external opportunities and threats. The integration of these frameworks enables the formulation of development strategies that are both evidence-based and strategically aligned.

By adopting this integrated approach, the study contributes to the digital banking literature by bridging the gap between service quality evaluation and strategic planning. The proposed framework provides a comprehensive basis for analyzing e-banking services and offers practical value for bank management seeking to enhance service quality and sustain competitiveness in an increasingly digital financial landscape.

3. RESEARCH METHODOLOGY

3.1 Research Design and Approach

This study adopts a **qualitative research approach** using a **case study design** to examine e-banking service quality and development strategies within the real organizational context of a commercial bank in Indonesia. A qualitative case study is particularly appropriate for exploring complex phenomena embedded in organizational settings, where contextual factors play a significant role and where the boundaries between the phenomenon and its context are not clearly defined (Yin, 2018).

The case study design allows for an in-depth and holistic examination of e-banking services by capturing multiple perspectives from internal stakeholders and organizational documentation. This approach is suitable for understanding not only how e-banking systems operate but also how service quality evaluation outcomes can be translated into strategic development initiatives. By focusing on a single case, this study emphasizes analytical depth rather than statistical generalization, which aligns with the exploratory and evaluative objectives of the research.

3.2 Research Context and Case Description

The research was conducted at a commercial bank operating in Indonesia that has implemented e-banking services as a core component of its digital banking strategy. The bank provides a range of e-banking services, including mobile banking and internet banking platforms, which are used by customers for daily financial transactions such as fund transfers, bill payments, and account monitoring.

The selected case represents a typical commercial bank facing competitive pressure from both traditional banking institutions and emerging fintech companies. The bank has invested in digital infrastructure to enhance service accessibility and efficiency, making it a relevant context for examining e-banking service quality and strategic development. To preserve confidentiality and comply with ethical considerations, the identity of the bank is anonymized.

3.3 Research Participants

Research participants consisted of internal stakeholders directly involved in the management, operation, and support of e-banking services. These participants included information technology personnel, customer service officers, and managerial staff responsible for digital banking operations and strategic planning. Participants were selected using **purposive sampling**, based on their expertise, roles, and direct involvement with the e-banking system.

Purposive sampling was employed to ensure that the collected data reflected informed and contextually rich perspectives on e-banking service quality and development challenges. This sampling strategy is commonly used in qualitative case study research to enhance the relevance and credibility of findings (Creswell & Poth, 2018).

3.4 Data Types and Sources

This study utilized both **primary and secondary data** to ensure comprehensive analysis and triangulation. Primary data were obtained through structured questionnaires and semi-structured interviews with selected participants. The questionnaires were designed based on the six dimensions of the PIESCES framework to systematically capture perceptions of e-banking service quality.

Secondary data were collected from internal organizational documents, including service guidelines, system reports, and annual reports, as well as from relevant academic literature. The integration of primary and secondary data sources enhanced the depth of analysis and supported the validation of research findings through data triangulation (Lincoln & Guba, 1985).

3.5 Data Collection Procedures

Data collection was conducted in several stages. First, questionnaires based on the PIESCES dimensions were distributed to participants to obtain structured insights into system performance, information quality, economic value, control mechanisms, efficiency, and service support. Second, semi-structured interviews were conducted to explore participants' experiences, perceptions, and strategic views regarding e-banking services and their development.

Additionally, document analysis was performed to examine internal policies, system documentation, and performance reports related to e-banking operations. This method enabled the researcher to contextualize primary data within organizational practices and strategic objectives. The combination of questionnaires, interviews, and documentation strengthened the credibility and robustness of the data collection process.

3.6 Data Analysis Techniques

Data analysis was carried out in two main stages. The first stage involved **PIESCES analysis**, which was used to evaluate e-banking service quality across six dimensions: performance, information, economy, control, efficiency, and service. Data obtained from questionnaires, interviews, and documentation were systematically categorized and analyzed according to these dimensions to identify strengths and weaknesses in the e-banking system.

The second stage involved **SWOT analysis**, which was employed to translate the results of the PIESCES evaluation into strategic insights. Internal factors identified through PIESCES analysis were mapped as strengths and weaknesses, while external factors derived from the organizational environment were categorized as opportunities and threats. This integration enabled the formulation of development strategies that are grounded in empirical evaluation and aligned with environmental conditions (Gürel & Tat, 2017; Phadermrod et al., 2019).

3.7 Trustworthiness and Research Rigor

To ensure the trustworthiness of the qualitative findings, this study applied established criteria for qualitative research rigor, including **credibility, dependability, and confirmability**. Credibility was enhanced through data triangulation across multiple sources and methods. Dependability was supported by maintaining a clear audit trail of research procedures, while confirmability was

ensured by grounding interpretations in empirical data rather than researcher bias (Lincoln & Guba, 1985).

Ethical considerations were addressed by obtaining informed consent from participants and ensuring confidentiality of organizational and individual information. These measures contribute to the integrity and reliability of the research process and outcomes.

4. Result anda Discussion

4.1 Overview of E-Banking Service Quality Evaluation

This section presents the empirical results of the e-banking service quality evaluation conducted using the PIESCES framework. The findings are derived from questionnaires, interviews, and document analysis involving internal stakeholders responsible for e-banking operations and management. The results are organized according to the six dimensions of PIESCES: performance, information, economy, control, efficiency, and service. Subsequently, the results are synthesized into internal and external factors using SWOT analysis.

Overall, the findings indicate that e-banking services provide substantial benefits in terms of transaction efficiency and accessibility. However, several operational and service-related limitations were identified across specific PIESCES dimensions, indicating areas requiring strategic improvement.

4.2 Performance Dimension

The **performance** dimension assesses system reliability, response time, and service availability. The results indicate that the e-banking system demonstrates generally stable performance under normal operating conditions. System availability is maintained for most daily transactions, and users are able to access core banking functions without significant difficulty.

Nevertheless, data from interviews and system documentation reveal that performance issues occasionally arise during peak transaction periods, such as at the end of the month or during promotional campaigns. These issues include slower response times and temporary service interruptions. While such incidents are not frequent, they represent critical performance constraints that affect user experience and operational continuity.

4.3 Information Dimension

The **information** dimension evaluates the accuracy, relevance, and timeliness of information provided through the e-banking platform. The results show that transaction-related information, including account balances, transaction histories, and payment confirmations, is generally accurate and consistent with internal records. However, findings indicate that real-time information updates are not always achieved under certain conditions. Delays in updating transaction statuses and notifications were reported, particularly during high system load. Although these delays are typically short, they have the potential to reduce user confidence in the reliability of the information system.

4.4 Economy Dimension

The **economy** dimension examines the cost efficiency and economic value generated by e-banking services. The results indicate that e-banking significantly reduces operational costs for the bank by minimizing the need for physical branch services and manual transaction processing. From the customer perspective, e-banking services reduce transaction costs and travel expenses while saving time. Internal documentation further indicates that digital transactions are more cost-

effective compared to traditional counter-based services. These findings demonstrate that e-banking contributes positively to the bank's cost structure and supports resource optimization objectives.

4.5 Control Dimension

The **control** dimension focuses on security mechanisms, access control, and risk management. The results show that the e-banking system is equipped with multiple security features, including user authentication, authorization controls, and transaction notifications. These mechanisms are designed to protect customer data and prevent unauthorized access. Despite these measures, interview data and internal reports indicate ongoing challenges related to cybersecurity risk management. Potential vulnerabilities associated with phishing attempts and external cyber threats were identified, emphasizing the need for continuous monitoring and enhancement of control mechanisms.

4.6 Efficiency Dimension

The **efficiency** dimension assesses the extent to which e-banking services optimize processes and resource utilization. The results indicate that e-banking enables customers to complete transactions independently without requiring direct assistance from bank staff. This self-service capability reduces processing time and improves overall operational efficiency. Internal process documentation confirms that e-banking has streamlined transaction workflows and reduced service queues at physical branches. These outcomes demonstrate that the system effectively supports efficiency objectives at both the organizational and customer levels.

4.7 Service Dimension

The **service** dimension evaluates the quality of service support associated with e-banking, including responsiveness and problem resolution. The results indicate that customer support services related to e-banking are available through multiple channels. However, limitations were identified in response time and resolution speed, particularly for technical issues reported by users. Interview findings suggest that delays in service response may affect customer perceptions of service quality, even when core system functionality remains intact. These findings highlight the importance of aligning technical system performance with effective service support mechanisms.

4.8 SWOT Analysis Results

Based on the PIESCES evaluation results and environmental analysis, internal and external factors were identified using SWOT analysis.

Strengths include system accessibility, transaction efficiency, and cost effectiveness. **Weaknesses** include occasional system performance issues during peak periods, delays in information updates, and limited responsiveness of service support. **Opportunities** are associated with increasing digital literacy, growing adoption of digital financial services, and regulatory support for banking digitalization. **Threats** include intensified competition from fintech providers, evolving cybersecurity risks, and increasing customer expectations for seamless digital services. The SWOT analysis provides a structured summary of the internal and external factors influencing e-banking service development and serves as a foundation for strategic discussion.

The findings of this study demonstrate that e-banking services in Indonesian commercial banks generally provide substantial benefits in terms of efficiency, accessibility, and cost reduction. However, the results also reveal uneven performance across the six PIESCES dimensions,

indicating that digital banking success is contingent not only on technological adoption but also on consistent system reliability, effective security control, and responsive service support. These findings reinforce prior research emphasizing that service quality remains a critical determinant of digital banking sustainability and customer trust (Alalwan et al., 2020; Venkatesh et al., 2022).

The performance-related findings highlight that while e-banking systems are largely stable under normal conditions, occasional disruptions during peak transaction periods continue to pose challenges. This result is consistent with previous studies indicating that system availability and response time significantly influence user satisfaction and continued usage intentions in digital banking environments (Rahi et al., 2020). Performance limitations during high-demand periods suggest the need for scalable system architecture and proactive capacity management to ensure consistent service delivery.

In terms of information quality, the findings indicate that accuracy and relevance of transactional information are generally maintained, yet delays in real-time updates persist under certain conditions. This aligns with prior research showing that timely and reliable information delivery is essential for sustaining user confidence in digital banking systems (Kumar et al., 2021). Even minor delays in information updates may negatively affect user perceptions of system reliability, particularly in high-frequency transaction contexts.

The economy and efficiency dimensions demonstrate the strongest performance among the PIESCES components. The results confirm that e-banking services contribute significantly to cost efficiency and process optimization for both banks and customers. These findings support earlier studies suggesting that digital banking platforms enable banks to streamline operations, reduce reliance on physical branches, and enhance service reach at lower marginal costs (Whitten & Bentley, 2020). However, efficiency gains at the system level must be complemented by adequate service support to ensure that operational benefits translate into positive customer experiences.

Security and control remain critical areas of concern, as indicated by the control dimension findings. Although the e-banking system is equipped with multiple security mechanisms, ongoing cybersecurity risks continue to challenge digital banking operations. This finding is consistent with the literature emphasizing that security concerns are among the primary barriers to sustained e-banking usage, particularly in emerging digital markets (Alalwan et al., 2020; Rahi et al., 2020). Continuous enhancement of security controls and user awareness is therefore essential to maintaining trust in e-banking services.

The service dimension results reveal limitations in the responsiveness and effectiveness of customer support services. This finding underscores the importance of integrating technical system performance with high-quality service support. Prior studies have shown that service failures and delayed responses can significantly undermine customer satisfaction, even when core system functionality is adequate (Venkatesh et al., 2022). Accordingly, improving service responsiveness should be considered a strategic priority in e-banking development.

The integration of PIESCES evaluation results into SWOT analysis provides a strategic perspective that extends beyond descriptive assessment. By mapping internal strengths and weaknesses derived from PIESCES onto external opportunities and threats, the study offers a structured basis for strategic decision-making. This approach aligns with strategic management literature advocating the integration of empirical performance evaluation with strategic analysis to generate actionable and context-sensitive development strategies (Gürel & Tat, 2017; Phadermrod et al., 2019).

Overall, the discussion highlights that the combined application of PIESCES and SWOT enables banks to systematically evaluate e-banking service quality while simultaneously

formulating strategic responses to competitive and environmental challenges. This integrative approach contributes to the digital banking literature by bridging the gap between information systems evaluation and strategic management, thereby enhancing the practical relevance of research findings for banking practitioners.

5. CONCLUSION, IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

5.1 Conclusion

This study provides a comprehensive evaluation of e-banking service quality and development strategies in Indonesian commercial banks through the integrated application of the PIESCES framework and SWOT analysis. The findings indicate that e-banking services have significantly enhanced transaction efficiency, accessibility, and cost effectiveness for both banks and customers. These outcomes confirm the strategic role of digital banking as a core service channel in the contemporary banking environment.

However, the results also demonstrate that service quality performance is not uniform across all PIESCES dimensions. Persistent challenges related to system reliability during peak usage periods, real-time information delivery, cybersecurity control, and responsiveness of service support remain critical issues. These findings reinforce existing evidence that technological adoption alone is insufficient to ensure sustainable digital banking performance without continuous quality evaluation and service improvement (Alalwan et al., 2020; Rahi et al., 2020).

By integrating PIESCES-based service quality evaluation with SWOT analysis, this study moves beyond descriptive assessment and provides a strategic framework for translating evaluation outcomes into actionable development strategies. This integrated approach enables banks to align internal capabilities with external environmental dynamics, thereby supporting more informed and adaptive strategic decision-making (Gürel & Tat, 2017; Phadermrod et al., 2019).

5.2 Theoretical Implications

From a theoretical perspective, this study contributes to the digital banking and information systems literature in several ways. First, it extends the application of the PIESCES framework to the context of e-banking service evaluation, demonstrating its relevance for assessing both technical system performance and service delivery quality in complex digital environments (Whitten & Bentley, 2020).

Second, the study advances existing research by integrating an information systems evaluation framework with a strategic management tool. While prior studies often treat service quality evaluation and strategic analysis as separate processes, this research demonstrates the value of combining PIESCES and SWOT into a cohesive analytical model. This integration addresses a gap in the literature by linking empirical evaluation results directly to strategic development planning, thereby enhancing the explanatory and practical relevance of service quality research.

5.3 Practical Implications

The findings of this study offer several practical implications for bank management and digital banking practitioners. First, the results highlight the importance of prioritizing system scalability and reliability to address performance issues during peak transaction periods. Investments in infrastructure optimization and capacity management are essential to ensuring consistent service delivery and maintaining customer trust.

Second, the identification of security and control challenges underscores the need for continuous enhancement of cybersecurity measures, including proactive risk monitoring and user

awareness initiatives. Strengthening control mechanisms is critical to mitigating external threats and sustaining confidence in e-banking services.

Third, the limitations identified in service responsiveness suggest that banks should integrate technical system improvements with enhanced customer support strategies. Improving service response times and problem resolution processes can significantly enhance customer experience and strengthen service quality perceptions. The integrated PIESCES–SWOT framework can serve as a practical tool for guiding these strategic initiatives in a structured and evidence-based manner.

5.4 Limitations

Despite its contributions, this study has several limitations that should be acknowledged. First, the research adopts a single-case study design, which limits the generalizability of the findings across different banking institutions and contexts. The results are analytically generalizable but may not fully capture variations in e-banking implementation across the broader banking sector.

Second, the study relies primarily on internal stakeholder perspectives and organizational documentation. While this approach provides in-depth insights into system and service performance, incorporating customer perspectives could further enrich the analysis and provide a more comprehensive assessment of service quality outcomes.

5.5 Future Research Directions

Future research may address these limitations by extending the integrated PIESCES–SWOT framework to multiple banking institutions or conducting comparative studies across different banking segments. Such approaches would enhance the generalizability and robustness of findings. Additionally, future studies could adopt mixed-method research designs that combine qualitative evaluation with quantitative analysis of customer perceptions and usage behavior. Incorporating longitudinal data may also provide valuable insights into how e-banking service quality and strategic effectiveness evolve over time in response to technological advancement and market dynamics.

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