

Banking System Security and Efficiency as Drivers of Perceived Service Quality: The Mediating Role of Responsiveness

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Abstract

Background: In Nepal, the growing reliance on electronic banking has increased the importance of ensuring security, efficiency, and responsiveness in service delivery. Hence, this study investigates how banking system security (BSS) and efficiency (EEF) influence perceived service quality (PSQ), with responsiveness (RES) as a mediating factor.

Methods: A quantitative cross-sectional survey design was employed using primary data collected from 289 banking customers in Kathmandu metropolitan city together with three municipalities in the northern part of Kathmandu district. The constructs for BSS, EEF, RES,

and PSQ were measured using validated scales from previous literature, and data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test direct and mediating effects.

Results: The findings reveal that banking system security significantly influences both responsiveness and perceived service quality. Efficiency positively affects responsiveness but does not directly impact perceived service quality. Responsiveness significantly enhances perceived service quality and mediates the effects of both banking system security and efficiency on perceived service quality, with stronger mediation observed for banking system security. Overall, banking system security emerges as the most influential predictor of perceived service quality.

Conclusion: The study finds that security acts both as a direct assurance factor and an indirect experiential factor through responsiveness, while efficiency enhances service quality mainly when its benefits are reflected in responsiveness. For Nepalese banks, key strategies include ensuring visible security, embedding responsiveness into service design, and aligning efficiency with customer-facing outcomes. The findings advance SERVQUAL model by revealing the asymmetric roles of security and efficiency and confirming the mediating role of responsiveness in an emerging market context.

Novelty: The research introduces a unified mediation framework integrating security, efficiency, responsiveness, and service quality. Moreover, by merging elements from multiple theories, the study offers a comprehensive model that deepens understanding of service quality in emerging economies.

JEL Classification: G21, M31, D83, C38

Keywords: banking system security, efficiency, perceived service quality, PLS-SEM, responsiveness

Introduction

The advancement of information and communication technology (ICT) has fundamentally transformed banking service delivery worldwide, positioning electronic banking as a vital channel for financial transactions ([Khan et al., 2023](#); [Redda, 2023](#)). In emerging economies such as Nepal, this transformation has been particularly visible in Kathmandu Valley, the nation's financial hub where major banks, regulatory institutions, and customers converge. Despite the promise of faster and more secure services, persistent concerns over system security, operational efficiency, and responsiveness continue to shape customer experiences ([Islam et al., 2023](#); [Jeya, 2024](#)). Globally, service quality is widely acknowledged as a determinant of satisfaction and loyalty ([Parasuraman et al., 1985](#); [Zeithaml, 1988](#)), and in the digital era, dimensions such as security, efficiency, reliability, responsiveness, and usability remain critical ([Kaur & Arora, 2021](#); [Sunitha, 2024](#)). However, evidence from South Asia suggests that these factors influence service perceptions unevenly, with security exerting a direct effect on trust and assurance ([Nordin et al., 2024](#)), while efficiency tends to enhance quality only when complemented by responsiveness ([Islam et al., 2023](#); [Khan et al., 2023](#)).

In Nepal, the drive toward digital-first banking strategies has been spurred by escalating competitive pressures, regulatory directives from Nepal Rastra Bank, including the introduction of national payment gateways, and rapidly shifting consumer preferences toward convenience ([Dhakal, 2025](#)). At the same time, the country continues to face infrastructural vulnerabilities, most notably frequent power outages, unstable internet connectivity, and rising instances of phishing and ATM fraud, all of which heighten customer sensitivity to issues of security and responsiveness in banking services ([Gautam & Poudel, 2025](#)). Although service quality has been extensively studied in developed and large emerging markets such as Malaysia, India, and South Africa ([Nordin et al., 2024](#); [Gupta, 2012](#); [Reddy & Reddy, 2015](#); [Vetrivel et al., 2020](#); [Redda, 2023](#)), empirical investigations in Nepal remain limited, particularly those that explicitly model responsiveness as a mediating mechanism between system-level antecedents and perceived service quality, despite its recognition as a critical experiential pathway ([Parasuraman et al., 1988](#); [Ladhari, 2009](#)).

To address this gap, the present study investigates how banking system security (BSS) and banking system efficiency (EEF) influence perceived service quality (PSQ) in the Nepalese banking sector, with a particular focus on Kathmandu District, namely Budhanilkantha, Tokha, and Tarakeshwar. Specifically, the study examines the mediating role of responsiveness (RES) in these relationships. Drawing on SERVQUAL and the technology acceptance model, the research seeks to clarify the asymmetric effects of security and efficiency on service quality where security is expected to exert both direct and indirect effects, while efficiency is anticipated to contribute to service quality primarily through responsiveness.

The study also provides context specific evidence from Nepal, where infrastructural challenges, regulatory directives, and rising digital adoption uniquely shape customer expectations and perceptions. Ultimately, the study aims to contribute to theory by advancing a multi-theoretical framework of service quality in e-banking and to practice by offering actionable recommendations for commercial banks and policymakers to enhance service quality through visible security measures, institutionalized responsiveness, and customer-centered efficiency improvements.

The remainder of the article is structured as follows: Section 2 reviews the relevant literature and hypotheses; Section 3 outlines research methods, including sampling, measures, and data analysis approach; Section 4 presents the empirical results; Section 5 discusses findings; and Section 6 concludes with limitations and avenues for future research.

Literature Review and Hypotheses Development

The SERVQUAL model proposed by [Parasuraman et al., \(1988\)](#) is widely used to assess service quality by comparing customer expectations with their actual experiences. The SERVQUAL model is one of the most influential frameworks for assessing service quality. It proposes five dimensions namely tangibility, reliability, responsiveness, assurance, and empathy as the core determinants of perceived service quality. Among these, responsiveness is explicitly highlighted as the ability to provide prompt and helpful service, which is central to this study. In addition, assurance incorporates security and trustworthiness, making the SERVQUAL model directly relevant to banking system security. SERVQUAL has been widely applied in

banking research across contexts, including developing economies where security, efficiency, and responsiveness determine customer evaluations ([Ladhari, 2009](#); [Amin, 2016](#)). In this study, SERVQUAL provides the conceptual foundation for linking security and efficiency to perceived service quality through responsiveness.

The technology acceptance model ([Davis, 1989](#)) explains how users' perceptions of usefulness and ease of use influence their intention to adopt and utilize new technologies. The technology acceptance model (TAM) emphasizes perceived ease of use and perceived usefulness as drivers of technology adoption. Banking system efficiency closely aligns with perceived ease of use, while system security relates to perceived usefulness through risk reduction and trust. Responsiveness, though not originally in TAM, connects to perceived usefulness by enhancing customers' experience of banking technology. Studies in online and mobile banking adoption highlight that trust and responsiveness significantly shape perceived usefulness and subsequent satisfaction ([Islam et al., 2023](#); [Khan & Alhumoudi, 2022](#)).

Thus, TAM provides a lens to understand how security and efficiency shape perceptions of quality through responsiveness. Hence, the theoretical foundations of this study are supported by SERVQUAL, which highlights responsiveness and assurance and TAM, which explains efficiency and security in adoption. Together, these frameworks provide a robust theoretical justification for investigating how banking system security and efficiency influence perceived service quality through responsiveness in the context of Kathmandu.

Banking system security

Security in banking refers to the technical and institutional mechanisms that protect financial data, prevent fraud, and ensure reliable transactions. Customers expect assurance that their assets and personal information are safeguarded against threats such as phishing, hacking, or unauthorized access ([Al-Smadi, 2012](#); [Jeya, 2024](#)). Security influences perceptions of service quality in two ways: directly, by enhancing trust and assurance; and indirectly, by enabling banks to respond effectively to customer concerns ([Islam et al., 2023](#)).

Studies across contexts confirm this dual role. For example, in Bangladesh, perceived security risk was found to be a major determinant of satisfaction with online banking ([Islam et al., 2023](#)). Similarly, in Madurai District, India, security ranked as the most critical determinant of service quality in online banking, surpassing convenience, accessibility, and usefulness ([Jeya, 2024](#)). In South Africa, [Redda \(2023\)](#) also identified privacy and security as fundamental dimensions of e-banking quality. These findings converge on the view that customers prioritize security as the foundation of service quality, especially in contexts where cybercrime and fraud risks are salient. In Nepal, media reports of ATM skimming and phishing scams have heightened public awareness of banking security risks. Customers in Kathmandu therefore attach high importance to secure platforms, encrypted transactions, and transparent incident-handling protocols.

Based on the above literature review, this study proposes the following hypothesis:

H1: Banking system security has a positive effect on responsiveness.

H2: Banking system security has a positive effect on perceived service quality.

Efficiency

Efficiency in banking refers to the ability of institutions to deliver services quickly, accurately, and with minimal resource use. In digital banking, efficiency encompasses system speed, ease of navigation, reduced transaction times, and reliable service availability ([Gupta & Yadav, 2020](#)). Efficient platforms are expected to shape customer perceptions positively, as they reduce friction and enhance convenience ([Sunitha, 2024](#)).

Empirical studies highlight efficiency as a critical determinant of online service satisfaction. In Malaysia, [Nordin et al., \(2024\)](#) found that efficiency, alongside website quality and privacy, significantly predicted customer loyalty through satisfaction. Similarly, in Bangladesh, perceived ease of use (a proxy for efficiency) was positively associated with satisfaction in online banking ([Islam et al., 2023](#)). However, other studies suggest that efficiency alone may not guarantee perceived service quality; its impact is contingent upon customer-facing responsiveness. For example, [Khan et al., \(2023\)](#) showed that during the COVID-19 pandemic in Pakistan, efficiency only enhanced e-loyalty when coupled with effective communication and responsiveness. In Kathmandu, efficiency challenges are intensified by infrastructural constraints such as intermittent internet connectivity and frequent power cuts. Customers expect banks not only to build efficient systems but also to translate efficiency into visible outcomes like faster transactions and reduced waiting times.

Based on the above literature review, this study proposes the following hypothesis:

H3: Efficiency has a positive effect on responsiveness.

H4: Efficiency has a positive effect on perceived service quality.

Responsiveness as a mediator

Responsiveness is the ability to provide timely, helpful, and problem-solving service and it is a central dimension of the SERVQUAL model ([Parasuraman et al., 1988](#)). In e-banking, responsiveness refers to the promptness of online platforms and staff in addressing issues such as failed transactions, system downtimes, or fraud alerts ([Islam et al., 2023](#)).

The mediating role of responsiveness has been confirmed in multiple studies. For instance, [Khan et al., \(2023\)](#) demonstrated that responsiveness significantly mediated the relationship between e-service quality and e-loyalty in Pakistan during COVID-19. Similarly, [Islam et al., \(2023\)](#) found responsiveness to be a significant determinant of online satisfaction in Bangladesh. In Malaysia, [Nordin et al., \(2024\)](#) emphasized responsiveness as a key factor translating efficiency into customer loyalty.

Responsiveness is especially critical in Kathmandu, where infrastructural limitations often cause service disruptions. Customers may tolerate technical failures if banks provide transparent communication, quick resolution, and empathetic support, but absent responsiveness, even efficient and secure systems may be undervalued. Thus, responsiveness acts as the experiential bridge through which system-level features are translated into customer evaluations.

Based on the above literature review, this study proposes the following hypothesis:

H5: Responsiveness positively affects perceived service quality.

H6: Responsiveness mediates the relationship between banking system security and perceived service quality.

H7: Responsiveness mediates the relationship between banking system efficiency and perceived service quality.

Perceived Service Quality as an Outcome

Perceived service quality (PSQ) represents customers' overall evaluation of the excellence of a service ([Zeithaml, 1988](#)). In banking, PSQ encompasses both system-level attributes (security, efficiency, website quality) and relational attributes (responsiveness, empathy, assurance) ([Parasuraman et al., 1988](#)). Recent empirical studies underscore the multidimensionality of PSQ. [Redda \(2023\)](#) highlighted eight dimensions of e-banking quality, including privacy, system availability, efficiency, and responsiveness, all contributing to satisfaction and loyalty. [Khan et al., \(2023\)](#) confirmed that e-service quality positively influenced loyalty through satisfaction, while [Islam et al., \(2023\)](#) emphasized responsiveness, security, and ease of use as determinants of satisfaction in Bangladesh. In India, [Jeya \(2024\)](#) ranked security as the most critical determinant, while efficiency and accessibility played secondary roles. For Kathmandu, PSQ is shaped by both assurance from secure systems and visible responsiveness, especially given Nepal's infrastructural challenges ([Aryal et al., 2024](#)). By modeling PSQ as the dependent variable, this study integrates both technical and relational dimensions of service quality.

Research Methods

Instrument development and operationalization

Data were collected using a self-administered, structured questionnaire derived from widely used e-banking service quality scales and tailored to the Nepalese context. All statements were rated on a five-point Likert scale, where 1 indicated Strongly Disagree and 5 indicated Strongly Agree, enabling consistent measurement across respondents. Table 1 exhibits each construct, its operational definition, and the specific source instruments from which items were adapted. The table also lists citation details to help trace the origin of measures and confirm their validity. This approach ensures conceptual alignment with prior research while maintaining local relevance and clarity.

Table 1

Variable and its Operationalization

Construct	Variable Notation	Explanation	Source (s)
Banking System Security	BSS1	There are secured infrastructure platforms in e-banking systems.	Li et al., 2021 ; Nguyen & Nguyen, 2017 ; Khan & Alhumoudi, 2022
	BSS2	Stability in the way services are provided in banking systems creates security.	Li et al., 2021 ; Nguyen & Nguyen, 2017
	BSS3	The use of electronic and off-bank services is safe.	Li et al., 2021 ; Khan & Alhumoudi, 2022
	BSS4	Confidentiality of information is protected in electronic banking systems.	Li et al., 2021 ; Nguyen & Nguyen, 2017
	BSS5	The presence of digital signatures increases the security of electronic banking systems.	Li et al., 2021 ; Khan & Alhumoudi, 2022
Efficiency	EEF1	This site makes it easy to find what I need.	Raza et al., 2020 ; Parasuraman et al., 2005
	EEF2	It is easy to get anywhere on the website.	Parasuraman et al., 2005 ; Khan & Alhumoudi, 2022
	EEF3	I can complete a transaction quickly.	Raza et al., 2020 ; Parasuraman et al., 2005
	EEF4	Information at this site is well organized.	Parasuraman et al., 2005 ; Raza et al., 2020
	EEF5	It loads its pages fast.	Parasuraman et al., 2005 ; Raza et al., 2020
Responsiveness	RES1	I think the online banking gives prompt service.	Raza et al., 2020 ; Parasuraman et al., 2005
	RES2	I believe the online banking server is not too busy to respond to customer requests.	Parasuraman et al., 2005 ; Janahi & Al Mubarak, 2015
	RES3	The online banking should inform customers exactly when services will be performed.	Parasuraman et al., 2005 ; Ramayah et al., 2021
	RES4	It tells me what to do if my transaction is not processed.	Raza et al., 2020 ; Parasuraman et al., 2005
	RES5	It takes care of problems promptly.	Janahi & Al Mubarak, 2015 ; Ramayah et al., 2021
Perceived Service Quality	PSQ1	The speed of service delivery in e-banking systems is satisfactory.	Li et al., 2021 ; Narteh, 2013
	PSQ2	Electronic banking systems technology reduces the cost of providing banking services.	Li et al., 2021 ; Islam et al., 2023
	PSQ3	Electronic banking systems technology increases competition between banks and improves service quality.	Li et al., 2021 ; Islam et al., 2023

PSQ4	Electronic banking systems are easy to use, accessible, and user-friendly.	Li et al., 2021 ; Narteh, 2013
PSQ5	The quality of technical services provided is satisfactory and well supported.	Li et al., 2021 ; Islam et al., 2023

Research Design

This study adopts a quantitative, cross-sectional survey design to examine the relationships between banking system security (BSS), banking system efficiency (EEF), responsiveness (RES), and perceived service quality (PSQ). The design is consistent with prior studies that employed survey-based methods to assess service quality in online banking ([Khan et al., 2023](#); [Islam et al., 2023](#); [Redda, 2023](#)). Structural Equation Modeling using the Partial Least Squares (PLS-SEM) technique was chosen for data analysis because of its suitability for testing mediation, handling complex models with multiple constructs, and its predictive orientation ([Hair et al., 2022](#)). The target population for this study consisted of banking customers residing in Kathmandu Metropolitan City together with three municipalities in the northern part of Kathmandu District, namely Budhanilkantha, Tokha, and Tarakeshwar. These areas were selected because they represent the core urban and semi-urban centers of the Valley where internet and electronic banking usage has grown rapidly. The respondents were required to have experience using either online or mobile banking services, ensuring their ability to evaluate the constructs under investigation.

A non-probability, purposive sampling technique was employed to target customers due to the absence of a comprehensive sampling frame. A total of 320 structured questionnaires were distributed across banks, branches, and digital touchpoints in these municipalities. The minimum sample size requirement for PLS-SEM is at least ten times the largest number of structural paths directed at a construct ([Hair et al., 2019](#)), but after screening for completeness and consistency, 289 valid responses were retained for analysis exceeding the threshold level to ensure robustness, explanatory power, and generalizability within of the study context. The questionnaires were distributed through two modes: online via Google Forms and in-person using printed copies. Data collection was carried out over a period of two months, from December 2024 to January 2025. Participation was entirely voluntary, and respondents were assured of full confidentiality. Ethical considerations were carefully observed throughout the process; hence participants were explicitly informed that no personally identifying information would be recorded or disclosed.

Results

Respondent Profile

A total of 289 valid responses were analyzed to assess the demographic characteristics of internet and electronic banking users in Kathmandu Metropolitan City, Budhanilkantha, Tokha, and Tarakeshwar municipalities. Table 2 presents the distribution of respondents by gender, age, marital status, education level, employment status, and frequency of internet banking usage. The results indicate that two-thirds of the respondents were male, while females accounted for 33.91 percent reflecting the gender composition of urban digital banking users in Nepal. Age distribution shows that the majority were below 45 years with 40.14 percent in

the 25–45 age group and 36.68 percent below 25, suggesting that younger and middle-aged adults are more active users of internet banking. Respondents aged 45 years and above represented 23.18 percent indicating that senior citizens are comparatively less engaged with e-banking in the Kathmandu context.

Table 2

Respondents' Demographic Profile

Title	Category	Frequency	Percentage
Gender	Male	191	66.09
	Female	98	33.91
Age Category	Under 25 years	106	36.68
	25 - 45 years	116	40.14
	45 years and above	67	23.18
Marital Status	Married	156	53.98
	Single	133	46.02
Level of Education	School Level and below	140	48.44
	Bachelor Level	123	42.56
	Master Level and above	26	9.00
Employment Status	Student	110	38.06
	Employed	142	49.13
	Self-employed	37	12.80
Frequency of Internet Banking Usage	Daily	167	57.79
	Weekly	87	30.10
	Monthly	35	12.11

Regarding marital status, married respondents was slightly higher than single respondents, reflecting the active participation of household decision-makers in digital banking. In terms of education, almost half had school-level education or below, while 42.56 percent held a bachelor's degree and only 9 percent had postgraduate qualifications. This distribution highlights the growing penetration of e-banking even among those with lower formal education. Employment status further reveals that 49.13 percent were employed, 38.06 percent were students, and 12.80 percent were self-employed. The strong representation of students reflects increasing youth reliance on mobile and internet banking for convenience.

Finally, the frequency of internet banking usage underscores widespread engagement: 57.79 percent reported daily usage, 30.10 percent used services weekly, and 12.11 percent monthly. The predominance of daily users reflects growing trust in digital transactions and the integration of e-banking into daily routines. The demographic analysis demonstrates that urban Nepali banking customers are predominantly younger, educated, employed, and male. They are increasingly adopting e-banking services on a daily basis. This user profile is crucial for understanding variations in perceptions of banking system security, efficiency, responsiveness, and ultimately, perceived service quality.

Measurement Model Assessment

The study employed reflective measurement models which required an evaluation of construct reliability, convergent validity, and discriminant validity. For internal consistency, Cronbach's

alpha (CA) and composite reliability (CR) were assessed. According to [Barclay et al., \(1995\)](#), a Cronbach's alpha value of 0.70 or higher is generally considered acceptable, while values above 0.80 are preferable for confirming internal consistency.

Table 3

Internal Consistent Reliability

	Cronbach's Alpha (CA)	Composite Reliability (CR)
Banking System Security (BSS)	0.813	0.870
Efficiency (EEF)	0.753	0.858
Perceived Service Quality (PSQ)	0.789	0.855
Responsiveness (RES)	0.859	0.934

The results in table 3 indicated that CA values ranged from 0.753 to 0.859, and CR values ranged from 0.855 to 0.934, thus exceeding the minimum threshold of 0.70. Specifically, banking system security (CA = 0.813, CR = 0.870), efficiency (CA = 0.753, CR = 0.858), responsiveness (CA = 0.859, CR = 0.934), and perceived service quality (CA = 0.789, CR = 0.855) all demonstrated satisfactory internal consistency reliability. The findings confirm that the scales used in this research are reliable and valid, and are comparable with prior studies in digital banking contexts across South Asia and Africa. For instance, [Islam et al. \(2023\)](#) reported similar levels of internal reliability in Bangladesh, [Jeya \(2024\)](#) in India, [Nordin et al., \(2024\)](#) in Malaysia, and [Redda \(2023\)](#) in South Africa.

Convergent validity was examined through average variance extracted (AVE) and the outer loadings of individual indicators as shown in table 4. Following the guideline of [Hair et al., \(2019\)](#), an AVE value of 0.50 or higher indicates adequate convergent validity, as it shows that at least 50 percent of the variance in the indicators is captured by the latent construct. In this study, AVE values ranged from 0.542 to 0.877, confirming convergent validity across all constructs. Furthermore, the outer loadings of retained items all exceeded the recommended threshold of 0.70 ([Sarstedt & Cheah, 2019](#)). For instance, banking system security indicators loaded between 0.706 and 0.791, efficiency indicators between 0.806 and 0.827, perceived service quality indicators between 0.711 and 0.750, and responsiveness indicators loaded strongly at 0.935 and 0.938. These results establish that the measurement model adequately reflects the theoretical constructs under study.

Table 4

Convergent Validity

Construct	Indicators	Outer Loading	AVE
Banking System Security	BSS1	0.791	0.572
	BSS2	0.749	
	BSS3	0.770	
	BSS4	0.764	
	BSS5	0.706	
Efficiency	EEF2	0.827	0.669
	EEF3	0.806	
	EEF5	0.820	

Perceived Service Quality	PSQ1	0.711	0.542
	PSQ2	0.738	
	PSQ3	0.737	
	PSQ4	0.75	
	PSQ5	0.743	
Responsiveness	RES2	0.935	0.877
	RES4	0.938	

Particularly, the very strong loadings for responsiveness indicators highlight its centrality in mediating the relationship between system-level antecedents and perceived service quality, which is consistent with the SERVQUAL framework ([Parasuraman et al., 1988](#)) and its applications in e-banking research. Hence, the measurement model demonstrates satisfactory reliability and validity, thereby providing a robust foundation for proceeding to the structural model analysis.

Discriminant validity was assessed using the cross-loading criterion as depicted in table 5, the Fornell–Larcker criterion, and the Heterotrait–Monotrait (HTMT) ratio as shown in Table 6. According to [Hair et al., \(2019\)](#), an indicator demonstrates adequate discriminant validity when its outer loading on the intended construct is higher than its loadings on other constructs. The results showed that all items loaded more strongly on their associated latent construct than on alternative constructs. The loadings of banking system security indicators (ranging from 0.706 to 0.791) were consistently greater on the BSS construct than on efficiency, responsiveness, or perceived service quality, thereby confirming that no serious cross-loading problems exist.

Table 5

Factor Cross-Loading

	BSS	EEF	PSQ	RES
BSS1	0.791	0.507	0.562	0.534
BSS2	0.749	0.604	0.514	0.588
BSS3	0.770	0.554	0.563	0.508
BSS4	0.764	0.52	0.524	0.562
BSS5	0.706	0.486	0.461	0.428
EEF2	0.606	0.827	0.512	0.539
EEF3	0.543	0.806	0.408	0.445
EEF5	0.581	0.820	0.506	0.423
PSQ1	0.506	0.408	0.711	0.39
PSQ2	0.485	0.436	0.738	0.527
PSQ3	0.513	0.428	0.737	0.450
PSQ4	0.545	0.459	0.750	0.568
PSQ5	0.509	0.417	0.743	0.394
RES2	0.651	0.553	0.582	0.935
RES4	0.654	0.529	0.614	0.938

The HTMT ratio was further used as a robust criterion for discriminant validity. As suggested by [Henseler et al., \(2015\)](#), HTMT values below 0.90 indicate the absence of discriminant validity concerns. The HTMT results in this study ranged from 0.712 to 0.899, all falling below

the critical threshold of 0.90, thereby confirming that discriminant validity is not violated. For instance, the HTMT value between banking system security and Efficiency was 0.899, while that between responsiveness and perceived service quality was 0.768, both within acceptable limits.

Table 6

Inter-Construct Correlations, the Square Root of AVE and HTMT Results

	HTMT Result			Fornell-Larcker Criterion			
	BSS	EEF	PSQ	BSS	EEF	PSQ	RES
BSS				0.756			
EEF	0.899			0.707	0.818		
PSQ	0.865	0.752		0.696	0.585	0.736	
RES	0.829	0.712	0.768	0.697	0.578	0.639	0.936

The Fornell–Larcker criterion as depicted in table 6 was also examined by comparing the square root of each construct’s average variance extracted (AVE) with its correlations with other constructs ([Fornell & Larcker, 1981](#)). The results indicated that the square root of AVE for each latent variable exceeded the corresponding inter-construct correlations. For example, the square root of AVE for banking system security (0.756) was higher than its correlations with efficiency (0.707), responsiveness (0.697), and perceived service quality (0.696). Similarly, the square root of AVE for efficiency (0.818), responsiveness (0.936), and perceived service quality (0.736) were greater than their inter-construct correlations. This demonstrates that the constructs are empirically distinct and that discriminant validity is established in line with the criterion recommended by [Hamid et al., \(2017\)](#).

For multicollinearity testing among the indicators, the variance inflation factor (VIF) and tolerance values were calculated. As recommended by [Hair et al., \(2022\)](#), VIF values below the critical threshold of 5.0 indicate the absence of problematic multicollinearity. The results of this study showed that the VIF values ranged from 1.44 to 2.31, with corresponding tolerance levels above 0.40. These values are well within the acceptable limits, thereby confirming that multicollinearity does not pose a concern in the measurement model. Notably, the highest VIF value was observed for responsiveness indicators (2.313), which still falls safely below the critical cut-off point, while most other constructs demonstrated values close to 1.5. This further indicates that the explanatory variables are not excessively correlated with each other.

The findings also suggest that the data are free from common method bias, which is often indicated when VIF values exceed recommended thresholds. The absence of multicollinearity ensures that the estimates of regression weights are stable and that the relationships tested in the structural model can be interpreted with confidence. This aligns with earlier empirical studies in digital banking where similar VIF ranges were reported ([Islam et al., 2023](#); [Nordin et al., 2024](#); [Redda, 2023](#)). Consequently, the study fulfills a key methodological assumption, strengthening the reliability of subsequent path analysis and mediation testing.

Finally, model fit was evaluated using the standardized root mean square residual (SRMR). According to [Hu and Bentler \(1998\)](#), an SRMR value below 0.08 indicates acceptable model fit, while [Ramayah et al., \(2017\)](#) further confirm its suitability for PLS-SEM applications. The

SRMR value in this study was 0.053, which is below the recommended threshold, thereby indicating that the estimated model fits the data well.

Structural Model Assessment

The structural model was further assessed by examining the path coefficients, standard errors, and significance values obtained through bootstrapping with 10,000 resamples in SmartPLS 4.1.1.4. As recommended by [Preacher and Hayes \(2008\)](#) and [Hair et al. \(2019\)](#), a path coefficient is considered statistically significant when the t-value exceeds 1.96 at the 5% level ($p < 0.05$).

Figure 1

Diagram of Structural Model

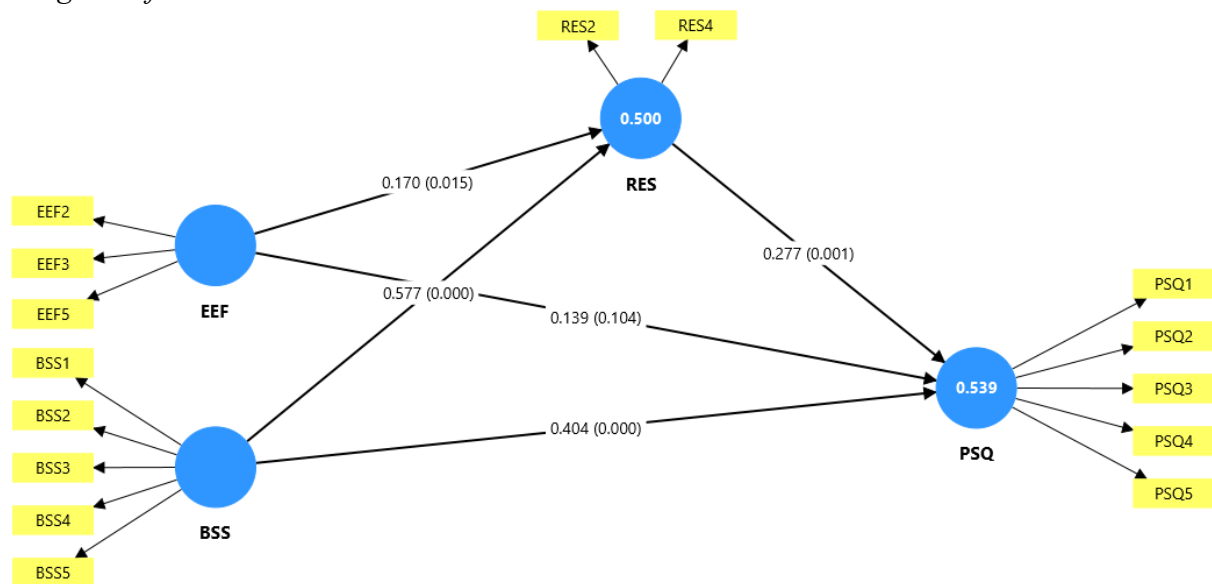


Table 7

Hypothesis Test

	Beta Coefficients	SD	T Values	P Values	2.50%	97.50%	Decision
BSS → PSQ	0.404	0.109	3.709	0.000	0.180	0.607	Supported
BSS → RES	0.577	0.064	8.957	0.000	0.442	0.695	Supported
EEF → PSQ	0.139	0.086	1.627	0.104	-0.031	0.306	Not Supported
EEF → RES	0.170	0.070	2.438	0.015	0.036	0.310	Supported
RES → PSQ	0.277	0.083	3.347	0.001	0.116	0.439	Supported

Table 7 reveals that banking system security (BSS) exerts a strong and significant influence on both responsiveness (RES) and perceived service quality (PSQ). The path from BSS to RES was highly significant ($\beta = 0.577$, $t = 8.957$, $p < 0.001$), and the direct effect of BSS on PSQ was also positive and significant ($\beta = 0.404$, $t = 3.709$, $p < 0.001$). These findings confirm that greater security in banking systems not only directly enhances perceptions of service quality but also facilitates responsiveness, thereby aligning with the SERVQUAL framework which identifies assurance and trust as central to quality perceptions ([Parasuraman et al., 1988](#); [Ladhari, 2009](#)).

In contrast, efficiency (EEF) displayed mixed effects. The relationship between EEF and RES was significant ($\beta = 0.170$, $t = 2.438$, $p = 0.015$), indicating that operational efficiency strengthens responsiveness. However, the direct effect of EEF on PSQ was statistically insignificant ($\beta = 0.139$, $t = 1.627$, $p = 0.104$), suggesting that efficiency alone does not meaningfully enhance customer perceptions of service quality. This supports the argument made by previous scholars that efficiency contributes to service quality primarily through responsiveness rather than direct customer evaluation ([Khan et al., 2023](#); [Nordin et al., 2024](#)). Furthermore, the mediating variable responsiveness showed a significant positive impact on PSQ ($\beta = 0.277$, $t = 3.347$, $p = 0.001$). This validates responsiveness as the experiential mechanism through which system-level features translate into perceived service outcomes. In line with prior studies ([Islam et al., 2023](#); [Redda, 2023](#)), the evidence confirms that customers in emerging markets value not only technical efficiency but also the timely and empathetic resolution of issues, which shapes their ultimate assessment of service quality.

These findings provide strong support for four of the hypothesized relationships, while one hypothesis (EEF $\rightarrow$ PSQ) was not supported. The results underscore that banking system security plays both a direct and indirect role in shaping perceived service quality, efficiency enhances service quality only when channeled through responsiveness, and responsiveness itself remains a decisive determinant of customer-perceived service excellence in Kathmandu Valley.

Table 8

Mediating Analysis

	Beta Coefficients	SD	T Values	P Values	2.50%	97.50%	Decision
BSS $\rightarrow$ RES $\rightarrow$ PSQ	0.1590	0.0500	3.1660	0.0020	0.0670	0.2650	Supported
EEF $\rightarrow$ RES $\rightarrow$ PSQ	0.0470	0.0240	1.9530	0.0510	0.0120	0.1120	Supported

The results in Table 8 confirm a significant mediation effect for the path BSS, RES and PSQ. The indirect effect was positive and statistically significant ($\beta = 0.159$, $t = 3.166$, $p = 0.002$), with the 95% confidence interval [0.067, 0.265] excluding zero. This demonstrates that responsiveness mediates the influence of banking system security on perceived service quality, thereby strengthening the argument that secure systems not only enhance perceptions of safety and trust directly but also empower responsiveness, which further elevates customer evaluations of service quality. This finding resonates with earlier work emphasizing security as both an assurance factor and an enabler of experiential service responsiveness ([Islam et al., 2023](#); [Jeya, 2024](#)).

For the path EEF, RES, PSQ, the indirect effect was also positive but weaker ($\beta = 0.047$, $t = 1.953$, $p = 0.051$). Although the p-value is slightly above the conventional 0.05 threshold, the 95% confidence interval [0.012, 0.112] does not include zero, thereby confirming statistical support for mediation ([Henseler et al., 2015](#)). This suggests that while efficiency does not directly influence service quality, it contributes indirectly when efficiency gains are translated into responsiveness. In other words, customers perceive efficiency-driven improvements as meaningful only when reflected in quicker responses and problem resolution.

The mediation analysis highlights the critical bridging role of responsiveness in Nepal's digital banking context. Security contributes to service quality both directly and indirectly through responsiveness, whereas efficiency enhances service quality primarily through this mediating pathway. These findings are consistent with recent studies in South Asia and Africa, which underscore responsiveness as the essential experiential link between technical attributes and customer service evaluations ([Redda, 2023](#); [Nordin et al., 2024](#)).

The explanatory power of the model was assessed using the coefficient of determination (R^2) for the endogenous constructs. The results demonstrated that responsiveness (RES) recorded an R^2 value of 0.500, implying that 50% of the variance in responsiveness was explained by banking system security (BSS) and efficiency (EEF). Likewise, perceived service quality (PSQ) yielded an R^2 of 0.539, which indicates that BSS, EEF, and RES collectively explained 53.9% of the variation in perceived service quality. According to [Hair et al., \(2019\)](#), R^2 values of 0.75, 0.50, and 0.25 can be interpreted as substantial, moderate, and weak respectively. Hence, the R^2 values obtained in this study demonstrate moderate explanatory capacity, confirming that the proposed model is good in capturing the dynamics of service quality evaluation in Nepal's digital banking sector. This strengthens confidence in the subsequent interpretation of structural relationships and mediation effects.

Discussion

This study set out to examine the effects of banking system security (BSS) and efficiency (EEF) on perceived service quality (PSQ) in Kathmandu Valley, Nepal, with responsiveness (RES) conceptualized as a mediating mechanism. Drawing upon SERVQUAL ([Parasuraman et al., 1988](#)), the Technology acceptance model ([Davis, 1989](#)), the study provides both theoretical and empirical insights into how customers evaluate digital banking services in emerging market contexts.

The findings show that BSS has a strong and significant positive effect on responsiveness, thereby supporting H1. This aligns with the SERVQUAL model, where assurance manifested in trust and security directly influences perceptions of service quality and service delivery. The result is consistent with prior studies in Bangladesh ([Islam et al., 2023](#)), India ([Jeya, 2024](#)), and South Africa ([Redda, 2023](#)), which highlighted that secure platforms not only strengthen customer trust but also enhance a bank's ability to respond effectively to issues. Theoretically, this supports the TAM view, as robust security systems can be seen as valuable organizational resources that enable effective responsiveness, giving banks a competitive edge. The direct effect of BSS on PSQ was also significant, supporting H2. This is consistent with the SERVQUAL, as secure systems meet or exceed customers' expectations of safety, thereby enhancing perceived quality. Empirical support comes from [Jeya \(2024\)](#), who found security to be the most important determinant of service quality in Indian online banking, and from [Nordin et al., \(2024\)](#), who emphasized its role in Malaysian digital banking. These findings also resonate with Nepal's context, where media reports of ATM skimming and phishing frauds ([Gautam & Poudel, 2025](#)) have heightened the salience of security in shaping quality perceptions.

Furthermore, the path from EEF to RES was found significant, confirming H3. This supports the technology acceptance model, where efficiency corresponds to perceived ease of use, which enhances the usefulness of the system through responsiveness. The finding is consistent with [Khan et al., \(2023\)](#), who reported that efficiency improves e-service quality only when it results in responsive customer interaction, and with [Nordin et al., \(2024\)](#), who found that efficiency contributed to loyalty in Malaysia primarily through service delivery mechanisms.

In Kathmandu, this finding reflects customer expectations that operational efficiency such as system speed must manifest in practical responsiveness, especially given infrastructural challenges like unstable internet and frequent power cuts. Contrary to expectations, the direct relationship between EEF and PSQ was statistically insignificant, leading to the rejection of H4. This suggests that efficiency alone does not directly enhance perceived service quality in Nepal. This result is inconsistent with studies in Malaysia [Nordin et al., \(2024\)](#) and Bangladesh ([Islam et al., 2023](#)), where efficiency was reported as a significant determinant of service satisfaction. Instead, the result supports arguments from [Khan et al., \(2023\)](#), who found that efficiency impacts quality only indirectly when combined with responsiveness. In the Nepalese context, this asymmetry may be explained by infrastructural limitations, which prevent efficiency gains from being consistently experienced by customers unless accompanied by rapid responses to disruptions.

In addition, responsiveness has a significant positive effect on PSQ, supporting H5. This outcome reaffirms SERVQUAL's identification of responsiveness as a core determinant of service quality which integrates service quality into overall user satisfaction. Empirically, this finding mirrors results from Pakistan ([Khan et al., 2023](#)), Bangladesh ([Islam et al., 2023](#)), and South Africa ([Redda, 2023](#)), all of which showed responsiveness to be central to customers' evaluation of e-banking services. For Kathmandu Valley, where system downtimes and transaction delays are common, responsiveness emerges as a critical experiential dimension of quality. The mediation analysis revealed that responsiveness significantly mediated the relationship between BSS and PSQ, supporting H6. This indicates that security influences service quality both directly and indirectly by enabling responsive service delivery. This finding is consistent with [Islam et al., \(2023\)](#), who reported that security enhances satisfaction when combined with responsiveness, and with [Jeya \(2024\)](#), who highlighted security as an antecedent of both direct assurance and responsive outcomes.

For H7, responsiveness was found to mediate the effect of EEF on PSQ. Although the direct effect of efficiency on service quality was insignificant, the indirect effect through responsiveness was supported, consistent with [Henseler et al., \(2015\)](#), who argue that mediation can exist even when the direct effect is weak or nonsignificant. This confirms that efficiency contributes to service quality primarily by being translated into responsiveness, echoing findings from Pakistan ([Khan et al., 2023](#)) and Malaysia ([Nordin et al., 2024](#)).

Taken together, the results provide evidence for an asymmetric influence of BSS and EEF on PSQ, mediated by responsiveness. BSS demonstrated both direct and indirect effects, whereas EEF influenced PSQ only indirectly through responsiveness. This asymmetry reflects the contextual realities of Nepal's digital banking sector, where security concerns are paramount

in shaping perceptions, while efficiency gains are not visible unless translated into responsive outcomes. The findings extend the applicability of SERVQUAL and TAM in emerging economies, showing that responsiveness is the experiential pathway through which technical attributes (security, efficiency) are evaluated as service quality.

Conclusion

This study set out to explore how banking system security and efficiency influence perceived service quality in Nepal's digital banking sector, with responsiveness examined as a mediating factor. The analysis, based on data collected from banking customers in Kathmandu Valley and surrounding municipalities, provides important insights into the asymmetric roles of technical and experiential factors in shaping customer perceptions of service quality.

The findings demonstrate that banking system security is the most decisive factor in influencing how customers evaluate service quality. Security not only contributes directly by assuring trust and confidence in transactions but also indirectly by enabling responsiveness. In Nepal's context, where concerns over cyber threats, data privacy, and fraudulent activities are heightened, customers place strong emphasis on the presence of visible and reliable security systems. Security therefore becomes both a technical safeguard and an experiential foundation upon which responsiveness is built.

Efficiency, on the other hand, showed a more nuanced role. While efficiency did not directly enhance perceived service quality, its contribution became meaningful when mediated through responsiveness. This outcome highlights that customers do not perceive efficiency as a stand-alone determinant of quality but value it when it is translated into faster resolution of problems, timely responses, and smoother service interactions. This distinction is especially relevant for Nepal, where infrastructural limitations such as unstable internet connectivity and frequent power outages often disrupt efficiency gains. Customers expect that banks transform efficiency into responsiveness that is visible and beneficial to them.

Responsiveness itself emerged as a critical experiential pathway in linking system-level factors with service quality. Customers evaluate the quality of banking services not only through the technical reliability of systems but also through their lived experiences of how quickly and effectively banks respond to service disruptions. This reinforces the idea that responsiveness acts as the bridge between technology-driven improvements and customer satisfaction.

The study highlights that service quality in Nepalese digital banking is not shaped by technical attributes alone but by their integration with human-centered responsiveness. Security and efficiency provide the foundation, but responsiveness translates these features into customer-perceived value. For banks operating in Kathmandu Valley and beyond, this means that investments in digital infrastructure must go hand in hand with strategies that prioritize responsiveness as an institutional culture. By doing so, banks can strengthen trust, build resilience in service delivery, and foster long-term customer loyalty in a rapidly evolving financial landscape.

This study is limited by its cross-sectional design, reliance on self-reported perceptions, and focus on customers within core Kathmandu along with three northern adjoining municipalities, which may restrict broader generalization. Future research could adopt longitudinal or

comparative cross-country designs to capture evolving dynamics of digital banking service quality. Expanding the model to include additional constructs such as trust, satisfaction, or loyalty would further enrich understanding of customer behavior in emerging economies.

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