

“E-Service Quality and E-Customer Satisfaction of E-Commerce Companies in Butwal Sub-Metropolitan City, Nepal”

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Abstract

The study aims to explore the impact of efficiency, system availability, reliability, fulfilment and privacy/security on e-customer satisfaction. The study adopted a quantitative approach, gathering responses from 275 users of e-commerce platform in Butwal sub-metropolitan city using a structured questionnaire, following a purposive sampling method. Data was analyzed using PLS-SEM software with different tools like assessment of measurement items, model fit, IPMA and implemented bootstrapping technique for hypothesis testing. The results revealed that fulfilment is the key influencing factor in E-Customer Satisfaction. It is evident that these factors are the major contributors to the dependent variable. Therefore, the management of e-commerce organizations should focus on these aspects to increase e-customer satisfaction. By understanding and reformulating policies based on these factors, there is a higher possibility of improving e-customer satisfaction.

Keywords: *E-Service Quality, E-Customer Satisfaction, E-Commerce, Fulfilment and PLS-SEM*

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I. Introduction

In the digital age, the increased access to internet has transformed the way consumers interact with businesses, making e-commerce an indispensable part of the global economy. As of early 2025, approximately 5.56 billion people worldwide were having access to internet which is equivalent to nearly 68% of the global population, fueling unprecedented growth in online commercial activities (Kemp, 2025). This surge in internet penetration led to the revolutionized the traditional retail paradigms, compelling businesses to prioritize the quality of their electronic services (e-services) to remain competitive. E-service quality (E-SQ) refers to the overall excellence of online service delivery, encompassing various dimensions of e-services (Parasuraman et al., 2005). Meanwhile, e-customer satisfaction (E-CS) is defined as the attainment of consumer's satisfaction resulting from their shopping experience from various e-commerce platforms, reflecting the degree to which their expectations are met or exceeded (Zeithaml et al., 2017). Understanding the dynamic between E-SQ and E-CS is critical, especially in emerging markets like Nepal, where digital commerce is still evolving.

During 1980s, the notion of service quality originated in traditional marketing literature, with influential models such as SERVQUAL by Parasuraman et al. (1985), which recognized dimensions like reliability and responsiveness as pivotal factors impacting customer satisfaction. As commerce transitioned online, researchers adapted these frameworks to digital contexts, coining the term e-service quality to capture the unique attributes of web-based service delivery (Zeithaml et al., 2002). The evolution of E-SQ research highlights the importance of system functionality, security, and customer support in fostering satisfaction among online consumers (Wolfenbarger & Gilly, 2003).

Despite the rapid expansion of e-commerce globally, the quality of e-services remains a pressing concern for many organizations. In highly competitive digital markets, customers have abundant alternatives, making it imperative for businesses to deliver seamless, secure, and efficient online experiences (Anderson & Mittal, 2000). Failure to ensure high E-SQ can result in customer dissatisfaction, reduced loyalty, and ultimately, diminished profitability (Santouridis et al., 2012). This concern is particularly acute in developing countries like Nepal, where infrastructural limitations, varying levels of digital literacy, and consumer apprehensions about data privacy pose significant challenges to achieving optimal E-SQ (Kumar & Kumar, 2018). These contextual factors motivate the present study to investigate how specific dimensions of e-service quality influence e-customer satisfaction in the Butwal Sub-Metropolitan City, a rapidly growing urban center in Nepal.

Several problems hinder the dependent variable, e-customer satisfaction, in Nepal's e-commerce sector. System availability is often compromised by inconsistent internet connectivity and server downtimes, leading to customer frustration (Bhattacharjee, 2001). Reliability issues arise from delayed deliveries and inaccurate product information, undermining consumer trust. Privacy and security concerns are heightened due to limited awareness and regulatory frameworks, causing hesitation in online transactions (Swaid & Wigand, 2007). Furthermore, inefficiencies in website navigation and customer service responsiveness reduce the overall quality of the online shopping experience. These challenges collectively impede the ability of e-commerce companies to satisfy their customers fully, thereby affecting business sustainability.

While extensive research has established the positive correlation between e-service quality and customer satisfaction in various global contexts (Parasuraman et al., 2005; Zeithaml et al., 2002; Zavareh et al., 2012), there remains a significant research gap regarding the nuanced impact of E-

SQ dimensions within Nepal's unique socio-economic and technological environment. Most prior studies have generalized findings from Western or more developed markets, which may not be directly applicable to Nepal due to differences in infrastructure, consumer behavior, and regulatory landscapes (Wolfenbarger & Gilly, 2003). Moreover, existing research often treats e-service quality as a monolithic construct, without dissecting how individual factors such as system availability, fulfillment, and privacy/security distinctly influence e-customer satisfaction in emerging economies. This gap limits the ability of local e-commerce firms to tailor their strategies effectively.

This study aims to fill this gap by focusing specifically on the Butwal Sub-Metropolitan City, a representative hub of Nepal's growing e-commerce market. By examining the direct effects of five critical E-SQ dimensions system availability, reliability, fulfillment, privacy/security, and efficiency on e-customer satisfaction, this research seeks to provide granular insights into the drivers of customer contentment in this context. The findings will contribute to the academic literature by contextualizing global theories within Nepal's digital commerce environment and offer practical guidance for local e-commerce companies striving to enhance their service quality and customer satisfaction.

The justification for this study is multifold. First, it addresses a pressing need for empirical data on e-commerce service quality in Nepal, where online retail is expanding but still faces infrastructural and trust-related barriers (Kumar & Kumar, 2018). Second, by identifying the most influential e-service quality dimensions, the study enables e-commerce businesses in Butwal to prioritize resource allocation and improve customer retention strategies. Third, it supports policymakers and stakeholders in understanding consumer concerns, which can inform regulatory frameworks to bolster consumer protection and digital literacy. Lastly, this research lays a foundation for future studies in similar emerging markets, enriching the global discourse on e-service quality and customer satisfaction.

The major objective of the study is to identify how different dimensions of personality traits influence employee performance. The specific objectives are as follows:

- To analyse the perception of the respondents with regard to the constructs of the study by examining their average response level.
- To determine which factor, act as necessary conditions for e-customer satisfaction by identifying the minimum levels that must be present for the outcome to occur.

- To analyse the effect of efficiency, System availability, fulfilment and privacy/security on e-satisfaction.

II. Literature Review

This section presents a literature review, focusing on the theoretical and empirical aspects relevant to the current research being pursued. The theoretical review examines related theories that support the link between the variables mentioned in the framework. Moreover, the empirical review incorporates the findings of previous research conducted on the same topic. The following theoretical and empirical reviews support the conceptual framework of the study and form the basis for the development of hypotheses.

Efficiency and E-Customer Satisfaction

Efficiency in e-commerce is primarily assessed through service quality dimensions, which significantly impact on customer satisfaction.

Efficiency in the context of e-service quality (E-SQ) refers to the ability of an online platform to deliver services in a timely and effective manner, ensuring minimal effort is required from the customer (Amin, 2016). Theoretical models in service quality, such as the SERVQUAL model proposed by Parasuraman, Zeithaml, and Berry (1988), highlight that service efficiency is critical in shaping customer perceptions and satisfaction. In the digital realm, efficiency is often assessed through dimensions such as website usability, navigation speed, and the ability to complete transactions without complication (Brady & Cronin, 2001). In the digital economy, efficiency has evolved to encompass user experience (UX) dimensions; this includes the seamlessness of the online shopping journey, the speed of information retrieval, and the clarity of service processes. According to Brady and Cronin (2001), the dimensions of service quality, especially efficiency, significantly influence customer satisfaction, leading to enhanced loyalty and repurchase intentions.

Empirical studies have consistently found a positive correlation between perceived efficiency of an e-commerce platform and e-customer satisfaction (E-CS). A study by Amin (2016), which analyzed the banking sector in Pakistan, concluded that efficiency was a significant predictor of both E-CS and e-customer loyalty (E-CL). Similarly, research conducted by Al-Dweeri et al. (2017) among Amazon users found that efficient service delivery directly impacted E-CS, reinforcing the notion that efficiency forms a critical component of E-SQ in online shopping environments. Furthermore, recent findings by Izogo and Jayawardhena (2018) suggest that

enhancing the efficiency of e-commerce platforms not only increases customer satisfaction but also enhances positive word-of-mouth referrals, which is crucial for attracting new customers to these platforms. As e-retailers continue to optimize their processes, efficiency remains a focal area for improving overall service quality and consumer experiences (Izogo & Jayawardhena, 2018).

Efficiency has a well-established role in forming E-CS, according to theoretical frameworks and empirical evidence. Retailers looking to improve their online products can benefit from knowing how efficiency affects consumer happiness.

H₁: There is a significant relationship between efficiency and e-customer satisfaction.

System Availability and E-Customer Satisfaction

System availability refers to the degree to which an e-commerce platform is accessible and functional without interruptions. High availability is essential for customer retention, as downtime can lead to lost revenue and diminished brand reputation (Kumar & Reinartz, 2018). Theories such as the Technology Acceptance Model (TAM) and DeLone and McLean's Information System Success Model (D&M IS Success Model) provide frameworks for understanding how system availability affects user behavior and satisfaction (Davis, 1989; DeLone & McLean, 2003).

- **Technology Acceptance Model (TAM):** This model posits that perceived ease of use and perceived usefulness influence a user's acceptance of technology (Davis, 1989). If an e-commerce system is frequently down, it negatively affects its perceived ease of use, reducing customer satisfaction.
- **D&M IS Success Model:** This model identifies system quality, information quality, and service quality as key determinants of information system success. System availability directly impacts system quality, thereby influencing user satisfaction and loyalty (DeLone & McLean, 2003).

Empirical studies indicate a strong correlation between system availability and customer satisfaction in e-commerce (Wirtz & Lovelock, 2018). A highly available system enhances user experiences by providing uninterrupted access to products and services, whereas frequent downtimes erode trust and deter potential purchases (Gefen et al., 2003). Recovery mechanisms such as real-time customer support and alternative purchasing channels can mitigate the negative impact of system failures (Pavlou & Fygenson, 2006).

System availability plays an important role in influencing e-customer satisfaction in e-commerce companies. Ensuring high system availability through strong infrastructure and proactive

maintenance techniques can significantly enhance customer trust, retention, and overall business success. Based on these studies, the following hypothesis can be formulated:

H₂: There is a significant relationship between system availability and e-customer satisfaction.

Reliability and E-Customer satisfaction

The foundation of understanding reliability in the context of e-customer satisfaction can be traced back to the SERVQUAL model proposed by Zeithaml, Parasuraman, and Berry (1990). This model identifies reliability as one of the key dimensions of service quality that affects customer perceptions and satisfaction. Reliability is conceptualized as the service provider's ability to perform the promised service dependably and accurately.

According to Parasuraman et al. (2005), customers expect e-commerce platforms to have reliable systems that ensure order accuracy, timely delivery, and overall service consistency. The theoretical discussion posits that when e-service providers exhibit high reliability, it fosters trust and enhances customer satisfaction, resulting in repeat purchases and loyalty (Kumar & Reinartz, 2018). Empirical studies have consistently validated the positive relationship between reliability and e-customer satisfaction. For instance, Shankar et al. (2002) found that in both online and traditional shopping contexts, reliability significantly impacts customer satisfaction. Additionally, a study by Wolfinbarger and Gilly (2003) specifically examined eTailQ dimensions and highlighted reliability as a vital determinant of e-service quality, which in turn affects customer satisfaction levels.

Research by Lee and Lin (2005) further supports this by demonstrating that reliable service delivery, such as accurate product description and efficient order processing, positively correlates with higher customer satisfaction in e-commerce settings. These studies highlight the significance of reliability as a foundational element for achieving e-customer satisfaction. Businesses operating in the digital marketplace must prioritize improving their reliability to enhance customer experience.

H₃: There is a significant relationship between reliability and e-customer satisfaction.

Fulfilment and E-Customer Satisfaction

Fulfilment in e-commerce, which includes order processing, inventory control, packaging, and prompt delivery, is a key factor in determining how satisfied online shoppers are. According to the Expectation-Confirmation Theory (ECT) (Oliver, 1980), customers assess satisfaction based on

whether fulfillment meets or exceeds their expectations, influencing trust and repeat purchases. The SERVQUAL Model (Parasuraman et al., 1988) emphasizes reliability, responsiveness, and assurance, highlighting how accurate order fulfillment and on-time delivery enhances perceived service quality. Additionally, the DeLone & McLean IS Success Model (DeLone & McLean, 2003) suggests that system quality and service efficiency such as real-time tracking and automated inventory management directly impact customer satisfaction.

Empirical studies support these theoretical perspectives; for instance, Ramanathan (2011) found that order accuracy and prompt delivery significantly impact customer retention, while Xing and Grant (2006) reported that poor fulfillment experiences lead to diminished trust and reduced repeat business. Overall, Fulfilment plays a critical role in e-customer satisfaction by ensuring reliability, accuracy, and efficiency in order processing.

H₄: There is a significant relationship between fulfilment and e-customer satisfaction.

Privacy/Security and E-Customer Satisfaction

In the context of e-commerce, privacy refers to the protection of personal information provided by customers during online transactions, while security encompasses the measures that businesses take to safeguard that information from unauthorized access, breaches, or fraud (Fortes & Rita, 2016). According to the literature, privacy and security are critical components of e-service quality that influence customer perceptions and overall satisfaction (Wang et al., 2015).

Moreover, the relationship between privacy/security and E-CS can be explained through the lens of social exchange theory, which posits that positive service encounters such as feeling secure and respected regarding personal information foster customer satisfaction (Homans, 1958). The emphasis on privacy and security is especially pronounced in e-commerce, where customers are often required to share sensitive information (Tsao et al., 2016). Empirical studies have consistently shown a strong relationship between privacy/security and e-customer satisfaction, substantiating its significance in the online retail environment.

1. Previous research in the context of Pakistan has also confirmed that concerns about security and privacy in online transactions are one of the key factors that negatively impact consumers' intentions to use e-commerce websites (Ahmed & Lodhi, 2015; Bhatti et al., 2018; Ur Rahman et al., 2018).
2. A meta-analysis by Blut et al. (2015) consolidated findings across various sectors, illustrating that both privacy and security are vital determinants of E-CS. This analysis

indicated that organizations that prioritize these elements within their service strategies tend to see higher levels of customer loyalty, leading to sustainable business growth.

3. In the banking sector, a study highlighted by Elsharnouby and Mahrous (2015) found that customers who feel their data is secure are significantly more likely to express satisfaction and return for future transactions. Moreover, a study conducted by Tandon et al. (2017) in the context of e-commerce confirmed that security measures not only boost E-CS but also serve as a competitive advantage in attracting new customers.

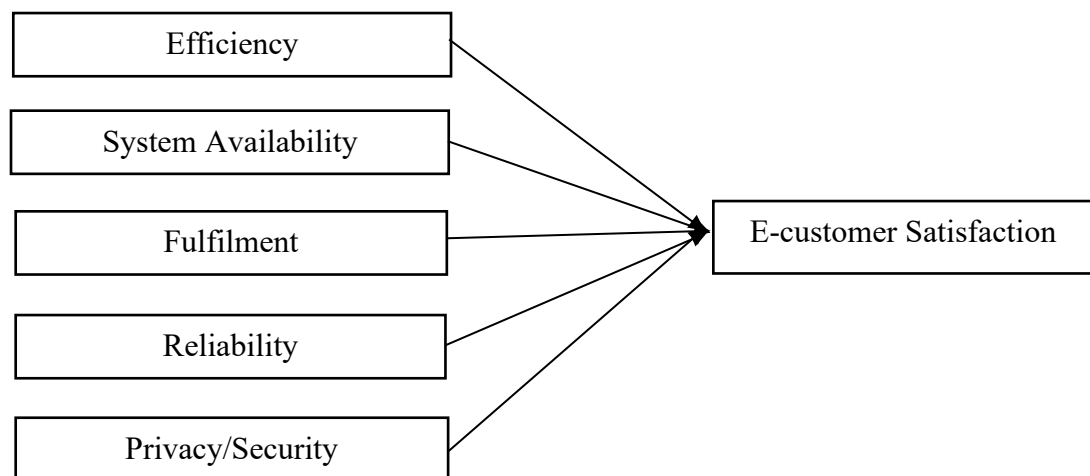
The interplay between privacy/security and E-CS is well-supported by both theoretical frameworks and empirical research. By prioritizing privacy and security in their service offerings, e-retailers can enhance customer satisfaction.

H₅: There is a significant relationship between privacy/security and e-customer satisfaction.

Research Framework

The research framework is the structure that illustrates the relationship among various variables. In this context, six variables are employed. Efficiency, System availability, Reliability, Fulfilment and Privacy/Security as independent variables. E-Customer Satisfaction serves as the dependent variable. The research framework of the study is outlined below:

Figure 1 - Research Framework



Note: Adopted from Shared (2019); Mayasari & Audina (2020)

III. Methodology

Under this section, the research methodology opted for the study has been discussed. It discusses the various methodologies and procedures of the research study applied in conducting the study

in an attempt to react and reply to the research questions and problems outlined by the researcher. Here, It deals with different components of research design which guides researcher to decide the population and sample from the research area to be targeted, ways of reaching the sampled respondent, sources of data collection, research instrument used to gather data and different types of tools used to analyze the gathered data. The answers given below are as follows: So, this section is structured as follows: research structure, population, sample size, sampling method, data gathering sources, data collection methods used, data analysis instruments.

Research Design:

This study adopts Descriptive Research Design and Explanatory Research Design to achieve its objectives.

Descriptive Research Design systematically presents characteristics, behaviors, or phenomena without altering variables. It identifies trends, patterns, and relationships within a population (Creswell, 2014). Explanatory research design is a method used to investigate cause-and-effect relationships between variables. It aims to explain patterns, relationships, or trends by testing hypotheses and establishing why a particular phenomenon occurs (Creswell, 2014; Babbie, 2020). Likewise, Kerlinger (1986) highlights ex post facto research, where past independent variables are analyzed to assess their effects on dependent variables (Kerlinger, 1986; Pant, 2012, p. 117).

By combining descriptive and explanatory research designs, this study effectively examines variable relationships and their impact (Kerlinger, 1986), ensuring a structured and systematic approach.

Population and sample size

The research area for this study is Butwal Sub-Metropolitan City. The population consists of customers who uses ecommerce platforms for shopping in Butwal. However, the total number of customers using these services cannot be precisely determined, making the population unknown. To address this, the sample size for an unknown population is calculated using Cochran's formula (Cochran, 1977).

$$n = \frac{Z^2 p (1 - p)}{e^2}$$

Where,

Z = Given Z value based on confidence level ($z = 2.576$ for 99% level of confidence, 1.96 for 95% level of confidence, 1.645 for 90% level of confidence.

- p = Proportion of event of interest for the study (0.5)

- e = margin of error (it depends upon confidence level)

Thus, the calculated sample size of the study $n = 384$

Sampling Method

The sampling method helps to choose the right people from a targeted population to gather information. In this research, which is about how e-service quality affects e-customer satisfaction in e-commerce companies in Butwal Sub-Metropolitan City, the purposive sampling method is used. This is a non-probability sampling technique, but it is considered good as it enables the researcher to pick people who are familiar with e-commerce services and can comment meaningfully on their online purchases. By targeting people who are regular users of e-commerce sites, this method helps ensure that the data gathered is useful and dependable.

Nature and sources of data collection

This study relies primarily on quantitative data, which was collected from primary sources. A well-structured questionnaire was designed to collect first-hand information directly from respondents.

Survey Instrument

A self-developed questionnaire was utilized as the data collection tool for the survey, developed from operational definitions based on previous literature. The questionnaire utilizes a seven-point Likert scale (7 = Strongly disagree, 6 = disagree, 5 = Somewhat disagree, 4 = Neutral, 3 = Somewhat agree, 2 = Agree, and 1 = Strongly Agree) to collect responses from participants.

Statistical Tool

The study employed various statistical tools appropriate to the nature of the collected data. Descriptive statistics, including mean and standard deviation (SD), were calculated to summarize and interpret respondents' answers. Analytical procedures included the assessment of measurement items, evaluation of model fit, Importance-Performance Map Analysis (IPMA), and bootstrapping techniques to test the proposed hypotheses regarding the relationship between digital financial platforms and investment intentions.

IV. Result and Analysis

Measurement Items Assessment

Table 1 - Assessment of measurement scale items

Variables	Items	Outer loadings	VIF	Mean	Standard deviation
Efficiency	E1	0.719	1.485	5.156	1.704
	E2	0.888	3.159	5.167	1.535

	E3	0.797	2.185	4.76	1.779
	E4	0.867	2.647	5.131	1.503
	E5	0.719	1.56	4.833	1.771
System Availability	SA1	0.868	2.849	3.644	1.985
	SA2	0.842	2.306	3.629	2.082
	SA3	0.838	2.385	4.109	1.955
	SA4	0.911	3.835	3.767	1.975
	SA5	0.731	1.623	4.425	1.951
Reliability	R1	0.784	2.294	3.575	1.951
	R2	0.783	2.796	3.138	1.871
	R3	0.865	2.976	3.811	1.971
	R4	0.859	3.078	4.753	1.895
	R5	0.78	2.555	4.945	2.02
Fulfilment	F1	0.873	2.993	5.96	1.415
	F2	0.91	3.945	5.8	1.509
	F3	0.916	4.194	5.687	1.648
	F4	0.732	1.818	5.015	1.793
	F5	0.767	1.742	5.505	1.717
Privacy/Security	P_S1	0.84	2.144	5.127	1.685
	P_S2	0.799	2.022	5.185	1.803
	P_S3	0.844	2.291	5.469	1.505
	P_S4	0.769	1.805	5.789	1.532
	P_S5	0.788	1.766	5.182	1.578
E-Customer Satisfaction	E_CS1	0.806	1.936	5.564	1.537
	E_CS2	0.814	2.38	5.724	1.522
	E_CS3	0.878	2.989	5.593	1.531
	E_CS4	0.862	3.652	4.931	1.741
	E_CS5	0.774	2.73	4.593	1.744

Note. Derived from SmartPLS 4 Software

Table 1 displays the standardized outer loadings and Variance Inflation Factor (VIF) values for the scale items used to measure the variables in this study. Following Sarstedt et al. (2022), an item's outer loading should be above 0.708 to confirm its significant contribution to assessing the respective variable. As shown in the table, all 35 items meet this criterion and are retained for further analysis. Additionally, the VIF values for each item are below 5, indicating no multicollinearity issues among the scale items. The mean values for most items fall on the higher

end of the scale, indicating respondents' general agreement with the statements. The small standard deviation values suggest minimal variation in responses, confirming the data's suitability for further analysis. All mean and standard deviation values align with expected ranges for a 7-point Likert scale. These results demonstrate that the measurement items meet the necessary reliability and validity standards for subsequent analysis.

Quality Criteria Assessment

Table 2 - Construct Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Efficiency	0.858	0.865	0.899	0.642
System Availability	0.894	0.904	0.923	0.706
Reliability	0.874	0.892	0.908	0.665
Fulfilment	0.896	0.903	0.924	0.711
Privacy/Security	0.868	0.873	0.904	0.654
E-Customer Satisfaction	0.885	0.89	0.916	0.685

Note. Derived from SmartPLS 4 Software

The reliability and validity of the measurement model were assessed using Cronbach's alpha, composite reliability (rho_a and rho_c), and average variance extracted (AVE), as presented in Table 2. All constructs demonstrated excellent internal consistency, with Cronbach's alpha values ranging from 0.858 to 0.896, significantly exceeding the recommended threshold of 0.70. Similarly, both composite reliability measures (rho_a and rho_c) showed strong consistency, with values between 0.865-0.904 and 0.899-0.924 respectively, well above the minimum standard of 0.70. The AVE values, which ranged from 0.642 to 0.711, all surpassed the critical 0.50 benchmark, indicating that each construct accounted for more than half of the variance in its indicators. These results collectively confirm that the measurement model exhibits strong reliability and convergent validity, meeting all necessary psychometric requirements for further structural analysis (Bland & Altman, 1997; Hair et al., 2022). The high consistency across all metrics suggests that the constructs were well-measured and suitable for testing the hypothesized relationships in the study.

Discriminant Validity

Table 3 - Heterotrait-Monotrait (HTMT) Ratio Matrix

	E-Customer Satisfaction	Efficiency	Fulfilment	Privacy / Security	Reliability	System Availability
E-Customer Satisfaction						
Efficiency	0.741					
Fulfilment	0.719	0.762				
Privacy/Sec urity	0.688	0.779	0.712			
Reliability	0.461	0.417	0.506	0.58		
System Availability	0.43	0.407	0.505	0.569	0.768	

Note. Derived from SmartPLS 4 Software

The discriminant validity of the measurement model was examined through the Heterotrait-Monotrait (HTMT) ratio, with results presented in Table 3. The HTMT values ranged from 0.407 to 0.779, all below the recommended threshold of 0.85 (Henseler et al., 2015), confirming adequate discriminant validity among constructs. The analysis revealed particularly strong correlations between Efficiency and Privacy/Security (0.779) and between Efficiency and Fulfilment (0.762). Moderate relationships were observed for E-Customer Satisfaction with Efficiency (0.741) and Fulfilment (0.719), as well as between Privacy/Security and Fulfilment (0.712). Constructs involving Reliability and System Availability showed the weakest associations, with values between 0.407 and 0.569. These findings demonstrate that all constructs maintain sufficient distinctiveness (Hair & Alamer, 2022), supporting their discriminant validity and appropriateness for subsequent structural equation modeling. The results provide empirical evidence that the measurement model effectively differentiates between theoretically distinct constructs.

Table 4 - Fornell-Larcker Criterion

Variable	E-Customer Satisfaction	Efficiency	Fulfilment	Privacy / Security	Reliability	System Availability
E-Customer Satisfaction	0.828					
Efficiency	0.77	0.801				
Fulfilment	0.81	0.667	0.843			
Privacy/Sec urity	0.783	0.798	0.721	0.808		
Reliability	0.42	0.37	0.466	0.516	0.815	
System Availability	-0.391	-0.362	-0.462	-0.505	-0.897	0.84

Note. Derived from SmartPLS 4 Software

Table 4 presents the discriminant validity assessment using the Fornell-Larcker criterion (Fornell & Larcker, 1981), which requires that the square root of each construct's Average Variance Extracted (AVE, shown diagonally) exceeds its correlations with other constructs. The results demonstrate excellent discriminant validity, as all diagonal values - E-Customer Satisfaction (0.828), Efficiency (0.801), Fulfilment (0.843), Privacy/Security (0.808), Reliability (0.815), and System Availability (0.840) - are greater than their respective off-diagonal correlations.

Notably, while strong correlations exist between certain constructs (e.g., E-Customer Satisfaction and Fulfilment at 0.81, Privacy/Security and Efficiency at 0.798), their AVE square roots remain higher, confirming distinctiveness. The weaker and negative correlations involving Reliability and System Availability (ranging from -0.897 to 0.516) further reinforce the constructs' uniqueness. These findings satisfy the Fornell-Larcker criterion, confirming that each latent variable captures distinct variance and that the measurement model demonstrates adequate discriminant validity (Hair et al., 2022). This validation ensures the constructs are sufficiently differentiated for subsequent structural model analysis.

Model Fit Assessment

The model demonstrates good fit, as evidenced by an SRMR value of 0.08, which meets the acceptable threshold (Bollen & Stine, 1992). This indicates the hypothesized model adequately represents the observed data.

The structural relationships within the model reveal varying effect sizes: Fulfilment demonstrates the strongest influence on E-Customer Satisfaction (0.417), followed by Efficiency (0.113) and Privacy/Security (0.071), while Reliability and System Availability exhibit relatively minor effects (0.037 and 0.024, respectively) (Cohen, 1988).

The model's explanatory power is further supported by the R-square values, with E-Customer Satisfaction showing robust predictive capability ($R^2 = 0.77$, adjusted $R^2 = 0.766$). These results collectively confirm that the model possesses adequate explanatory efficacy, with key constructs significantly contributing to the prediction of E-Customer Satisfaction (Hair et al., 2013).

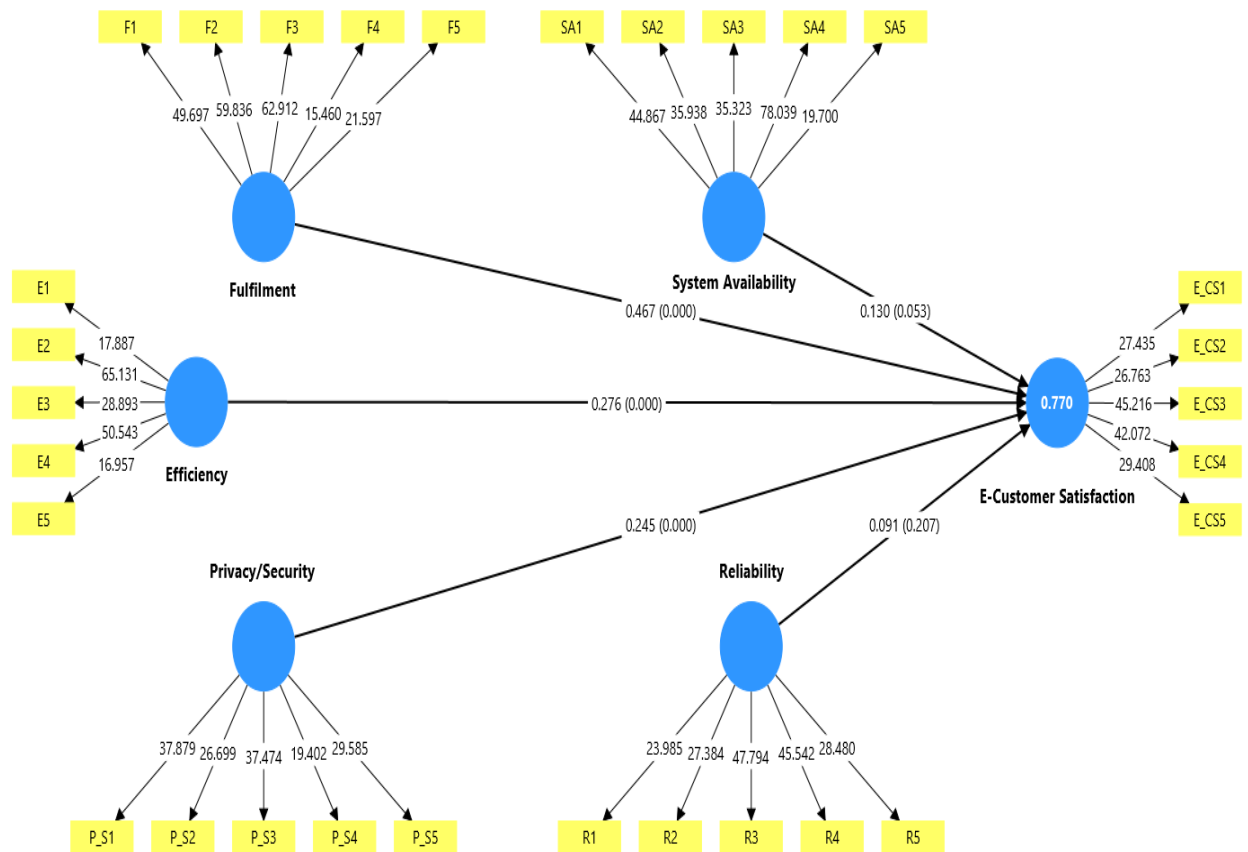


Figure 1: Path Relationship Diagram

Table 5 - Hypothesis Testing using Bootstrapping

Hypothesis	β	Sample mean (M)	Standard deviation (STDEV)	Confidence Interval		T statistics (O/STDEV)	P values	Decision
				2.50%	97.50%			
H1: Efficiency -> E-Customer Satisfaction	0.276	0.274	0.061	0.155	0.391	4.561	0	Accepted
H2: System Availability -> E-Customer Satisfaction	0.13	0.129	0.067	0.002	0.267	1.937	0.053	Rejected
H3: Reliability -> E-Customer Satisfaction	0.091	0.088	0.072	-0.047	0.235	1.262	0.207	Rejected
H4: Fulfilment -> E-Customer Satisfaction	0.467	0.472	0.066	0.346	0.599	7.106	0	Accepted
H5: Privacy/Security -> E-Customer Satisfaction	0.245	0.244	0.066	0.116	0.373	3.741	0	Accepted

Note. Derived from SmartPLS 4 Software

The bootstrapping test, run with 10,000 subsamples, tested the proposed hypotheses, as presented in Figure 1 and Table 5. As seen in the results, hypotheses H1, H4, and H5 were accepted at a 0.05 significance level. In particular, H1 (Efficiency -> E-Customer Satisfaction) had a strong positive

correlation with a beta coefficient of 0.276, a T statistic of 4.561, and a p-value of 0, thereby confirming its significance. In the same manner, H4 (Fulfilment -> E-Customer Satisfaction) showed the greatest effect among all of the hypotheses, as shown in a beta coefficient of 0.467, T statistic of 7.106, and p-value of 0. Moreover, H5 (Privacy/Security -> E-Customer Satisfaction) also showed a positive significant effect, as demonstrated in a beta value of 0.245, T statistic of 3.741, and p-value of 0.

Conversely, hypotheses H2 and H3 were not supported as their p-values were above the 0.05 level. Hypothesis H2 (System Availability -> E-Customer Satisfaction) recorded a beta coefficient of 0.13, a T statistic of 1.937, and a p-value of 0.053, indicating a level of marginal insignificance. Additionally, H3 (Reliability -> E-Customer Satisfaction) recorded the least correlation, with a beta of 0.091, a T statistic of 1.262, and a p-value of 0.207, thereby showing no statistically significant effect on e-customer satisfaction.

As a whole, the analysis identifies efficiency, fulfillment, and privacy/security as key drivers of e-customer satisfaction, with system availability and reliability not showing significant impacts.

Table 6 - Importance Performance Map Analysis

Variable	LV performance	Importance
Efficiency	67.189	0.276
Fulfilment	77.323	0.467
Privacy/Security	72.498	0.245
Reliability	51.703	0.091
System Availability	48.23	0.13
Mean	63.3886	0.2418

Note. Derived from SmartPLS 4 Software

Table 6 shows the total effects of efficiency, fulfillment, privacy/security, reliability and system availability on e-customer satisfaction for the unstandardized effects. These effects are the same as the unstandardized weights of ordinary least square regression modelling (Hair et al. 2010). Furthermore, the performance of e-customer satisfaction was calculated as 72.328.

Notably, we derived the four quadrants successfully based on the mean values of the constructs' importance and performance value. As per Fig. 2, if we increase 1 unit in fulfillment performance from 77.323 to 78.323, e-customer satisfaction increases from 72.328 to 72.795. Similarly, if we increased 1 unit in performance of system availability from 48.23 to 49.23, then e-customer satisfaction increases from 72.328 to 72.458. Therefore, out of the five determinants of e-customer satisfaction, the most critical factor was noted to be fulfillment.

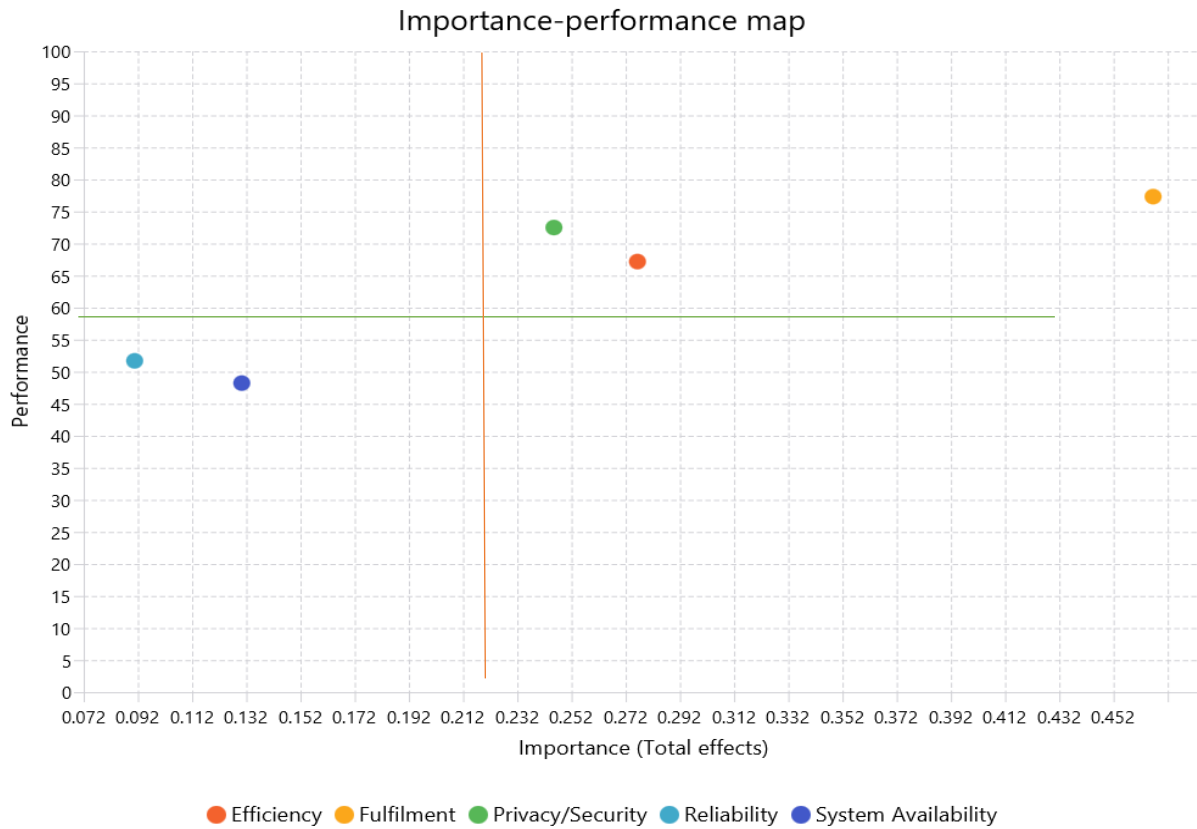


Figure 2: *Importance Performance Map Analysis*

Table 7 - Necessary Condition Analysis (NCA)- Bottleneck Variables

	LV scores – E-Customer Satisfaction	LV scores – Efficiency	LV scores - Fulfilment	LV scores – Privacy / Security	LV scores - Reliability	LV scores - System Availability
0.00%	20%	NN	NN	NN	NN	NN
10.00%	28%	27%	NN	33%	NN	NN
20.00%	36%	29%	NN	34%	NN	NN
30.00%	44%	29%	31%	35%	NN	NN
40.00%	52%	29%	31%	35%	NN	NN
50.00%	60%	29%	31%	42%	NN	NN
60.00%	68%	29%	31%	42%	NN	NN
70.00%	76%	35%	31%	44%	NN	NN
80.00%	84%	42%	31%	55%	NN	NN
90.00%	92%	59%	31%	55%	NN	NN
100.00%	100%	80%	31%	82%	21%	NN

Note. Derived from SmartPLS 4 Software

Table 7 represents bottleneck values of latent variables using necessary condition analysis. It reveals that Efficiency and Privacy/Security are fundamental constraints to achieving high levels of E-Customer Satisfaction (ECS). Of these, Efficiency requires a minimum of 35% to reach 70% ECS and needs to rise to 80% to reach 100% ECS. Meanwhile, Privacy/Security demands a baseline of 55% for 90% ECS and rises to 82% for total satisfaction. Fulfillment is a low but constant need (31% for the majority of ECS levels), whereas Reliability is only slightly critical (21%) at 100% ECS, and System Availability is never required ("NN"). This implies that organizations should emphasize improving Efficiency and Privacy/Security to buffer satisfaction constraints, maintain Fulfillment at basic levels, and minimize the focus on Reliability and System Availability unless pursuing maximum satisfaction. This supports previous research that identified Fulfillment, Efficiency, and Privacy/Security as key drivers of ECS.

Findings - The result of this study indicates that fulfillment has positive and significant impact on e-customer satisfaction. Similarly, efficiency and privacy/security also positively and significantly impacted the e-customer satisfaction. Further, although reliability and system availability are positively correlated with e-customer satisfaction, the influence is not statistically significant.

V. Discussion

The findings, based on e-commerce firms in Butwal Sub-Metropolitan City, Nepal, confirm that fulfillment is significantly and positively associated with e-customer satisfaction. This supports the previous literature in Nepalese urban settings, where timely delivery, correct order fulfillment, and meeting customer expectations are always cited as key determinants of satisfaction in online buying situations. For instance, Upadhyay and Adhikari (2024) identified that timely delivery and supply of the ordered good or service plays the most crucial role in boosting customer satisfaction and purchase intention in Nepal's online marketplaces. Likewise, Rai and Kadariya (2024) suggest that timely delivery and good packaging are the main drivers of customer satisfaction since they are direct addresses to consumer needs for convenience and confidence in online shopping.

Efficiency, in the sense of ease and quickness of access to and usage of a website, also has a positive effect on e-customer satisfaction. Ganie and Bhat (2023) noted that efficiency is among the determinants of customer satisfaction in online retailing. Their empirical study confirmed that efficiency, together with privacy and system availability, positively and significantly affects customer satisfaction. This calls for the offering of user-friendly interfaces and simplified processes in e-commerce websites. The positive influence of privacy and security on e-customer

satisfaction demonstrates customers' concern for secure transactions and data protection. Rita et al. (2019) illustrated that security/privacy is positively related to the overall e-service quality, which is applicable to customer satisfaction. Maintenance of strong security features and clear privacy policies can therefore increase customers' trust and satisfaction in online business contexts.

However, while reliability and system availability are positively correlated with e-customer satisfaction in this research, their impacts are not significant. This implies that although customers appreciate smooth website functionality and availability, these may not be adequate by themselves to spur satisfaction unless supported by good fulfillment, efficiency, and security. Upadhyay and Adhikari (2024) further added that although reliability is crucial, its effect is best realized when combined with other service quality dimensions like responsiveness and trust. This suggests that Nepalese consumers online would expect reliability and system availability as fundamentals, prioritizing other dimensions to be satisfactory in overall terms.

These results indicate that e-commerce businesses in Butwal and comparable cities need to concentrate on three significant issues in order to retain their customers satisfied. To begin with, they must ensure that orders are delivered properly and timely, a factor that contributes to building trust. Secondly, they must ensure that their websites are user-friendly and enable fast and effortless shopping experiences. Third, maintaining privacy and security for customers' personal and financial data is crucial since individuals like to shop where they feel safe. By focusing on delivery, efficiency, and privacy/security, these companies can make consumers more satisfied and more likely to purchase again, allowing them to thrive in a competitive online marketplace.

VI. Conclusion and Implications

Conclusion

The study concludes that fulfilment, efficiency, and privacy/security are the most critical dimensions influencing e-customer satisfaction in e-commerce. Fulfilment emerged as the strongest driver, highlighting the importance of timely and accurate delivery as the cornerstone of customer experience. Efficiency was also significant, acting as a bottleneck variable that requires consistent improvement to sustain satisfaction levels. Privacy and security further reinforced their role as essential conditions, emphasizing that safeguarding customer data and ensuring secure transactions are indispensable for building trust and loyalty. The findings provide clear guidance on where to prioritize resources and managerial efforts. E-commerce firms should focus on strengthening fulfilment processes, streamlining efficiency, and enhancing privacy/security

measures, as these areas yield the greatest impact on satisfaction. Reliability and system availability should not be ignored but can be treated as supporting conditions rather than primary drivers. Researchers can build on these results by exploring how contextual factors such as cultural differences, product categories, or technological innovations moderate the importance of these dimensions. Practitioners, meanwhile, can use the Importance-Performance Map Analysis and Necessary Condition Analysis as practical tools to identify bottlenecks and strategically allocate investments to maximize customer satisfaction.

Implications

This study explores e-service quality and customer satisfaction in Butwal Sub-Metropolitan City, Nepal. It has considerable theoretical and practical contributions. The study combines the SERVQUAL model, Technology Acceptance Model (TAM), and DeLone and McLean's Information System Success Model. This combination enables the understanding of different dimensions of e-service quality in Nepal. This combined view adds to the literature by showing how the traditional service quality dimensions augment technology acceptance and information system success in the new digital economy. The results augment the e-service quality discussion by confirming that fulfillment, efficiency, and privacy/security have a significant impact on e-customer satisfaction. While reliability and system availability are related but have no significant effect in this particular cultural and economic setting.

This research provides practical information for online companies in Nepal's secondary cities such as Butwal. Managers need to allocate resources in a way that will improve delivery time and order accuracy, make sites more functional, and offer privacy and security. These have the most impacts on customer satisfaction. The implications are that e-businesses in Nepal must develop strong order fulfillment processes, make navigation of the websites simpler, and have obvious security features in place in order to gain the trust of customers. Further, while customers expect reliability and availability of systems, organizations must ensure good performance in these dimensions as well as invest in areas directly contributing to customer satisfaction. Knowing this background is very important since Nepal's e-commerce business is growing in spite of special infrastructure and societal challenges.

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