An Empirical Assessment of SaaS Service Quality in the Logistics Sector: Application of the SaaS-Qual Model in Ho Chi Minh City

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***Abstract* - With the accelerating pace of digital transformation in Vietnam's logistics industry, Software-as-a-Service (SaaS) has become an essential solution for logistics providers seeking to enhance operational efficiency, flexibility, and service delivery. This study aims to evaluate the confirmation of SaaS service quality among logistics employees in Ho Chi Minh City using the SaaS-Qual framework in combination with the Zone of Tolerance (ZOT) approach. Six core dimensions: Rapport, Responsiveness, Reliability, Features, Security, and Flexibility were adopted to measure users' perceptions and assess how SaaS performance aligns with their minimum acceptable expectations. Data were collected through a structured questionnaire administered to employees of logistics firms across Ho Chi Minh City. The dataset was analyzed using SPSS 20.0 for reliability testing, Exploratory Factor Analysis (EFA), and correlation analysis, and SmartPLS 4 for validating the second-order formative construct of SaaS-Qual and testing path significance. The results confirm the multidimensional nature of SaaS service quality and highlight the key dimensions influencing users' evaluation of SaaS performance. This study extends the empirical application of the SaaS-Qual model to the Vietnamese logistics context and offers practical implications for SaaS providers and logistics firms. The findings provide actionable insights to improve service performance, strengthen user confidence, and enhance the effectiveness of technology adoption in logistics operations.**

Keywords - Software-as-a-Service, SaaS-Qual model, Zone of Tolerance, service quality, logistics, Ho Chi Minh City.

I. INTRODUCTION

Digital transformation has reshaped global business by improving efficiency and competitiveness, with cloud computing providing scalable, cost-effective access to software and data. Software as a Service (SaaS) is widely adopted because it allows online access without local installation, offering flexibility and real-time collaboration, especially for complex industries like logistics.

Vietnam's logistics sector, particularly in Ho Chi Minh City, has grown rapidly, and SaaS platforms have enhanced transportation, warehousing, and customer service. However, service quality remains critical for user satisfaction, system performance, and successful digital transformation.

While frameworks like SaaS-Qual assess cloud service quality internationally, empirical validation in developing logistics contexts is limited. In Vietnam, research mainly focuses on technology adoption, with little attention to users' perspectives, especially employees in third-party logistics firms.

This study applies the SaaS-Qual framework with the Zone of Tolerance approach to evaluate six dimensions Rapport, Responsiveness, Reliability, Features, Security, and Flexibility using Exploratory Factor Analysis and Partial Least Squares modeling. The findings offer practical guidance for improving SaaS delivery and theoretical insights into its multidimensional quality in the Vietnamese logistics sector.

II. LITERATURE OVERVIEW

A. Software-as-a-Service (SaaS) and Its Role in Logistics

Software-as-a-Service (SaaS) is a cloud computing model that allows users to access vendor-hosted applications via the internet, removing the need for local installation or maintenance [1]. Offering subscription-based access, scalability, and automatic updates, SaaS enhances flexibility and cost efficiency compared to traditional systems. Positioned above IaaS and PaaS, it delivers complete applications such as CRM, ERP, and logistics management systems [2]. In logistics, SaaS enables order tracking, transport planning, warehouse management, and real-time data sharing [3]. Leading firms like Maersk use SaaS integrated through APIs to improve visibility and automation [4]. Consequently, SaaS has become a key driver of digital transformation in logistics operations.

B. Service Quality in the SaaS Context

Service quality refers to the difference between customers' expectations and their perceptions of actual performance [5]. Traditional frameworks such as SERVQUAL emphasize tangibility, reliability, responsiveness, assurance, and empathy, but these dimensions are not fully applicable to technology-based services like SaaS, where factors including system reliability, data security, and flexibility play a more significant role [6]. To address limitations of the original SERVQUAL, including reliance on single-point gap scores and vague expectations, [7] Kettinger & Lee incorporated the Zone of Tolerance (ZOT) into IS service quality research, providing a

more diagnostic framework that captures service expectations across a range from adequate to desired levels. Building on these insights, Benlian, Koufaris and Hess (2011) proposed the SaaS Qual model, which comprises six dimensions: Rapport, Responsiveness, Reliability, Features, Security, and Flexibility, capturing both technical and relational aspects of service performance [8]. Empirical evidence indicates that responsiveness and security exert the strongest influence on user satisfaction and adoption, a finding supported by Jagli, Purohit and Subash Chandra (2019) [9] and Chauhan and Jaiswal (2015) in cloud-based enterprise contexts [10].

C. SaaS Adoption and Theoretical Foundation

Technology adoption studies have often employed models such as the Technology Acceptance Model (TAM) [11], the Diffusion of Innovations (DOI) theory [12], and the Technology - Organization - Environment (TOE) framework [13]. These frameworks explain how perceived usefulness, ease of use, organizational readiness, and environmental pressures shape technology adoption decisions. Research combining DOI and TOE frameworks, such as Amini and Jahanbakhsh Javid [14], demonstrates that relative advantages, compatibility, and security concerns significantly influence the adoption of cloud computing technologies among small and medium enterprises (SMEs).

However, while these frameworks explain why organizations adopt SaaS, they provide limited insights into how users evaluate its ongoing service quality once implemented. The SaaS-Qual model extends these theories by focusing on users' post-adoption assessments of service performance, thereby revealing which dimensions among responsiveness, reliability, security, and flexibility most strongly influence perceived SaaS service quality.

To address this need, the SaaS-Qual model built upon the Zone of Tolerance (ZOT) concept provides a structured way to assess users' perceived service quality in SaaS environments.

Zone of Tolerance (ZOT) is a service quality concept that defines the range of service levels customers find acceptable [7]. It sits between two expectation levels:

- Desired service → the level customers ideally want
- Adequate service → the minimum level they are willing to accept

ZOT helps identify where service performance aligns with expectations and where it breaks down. By mapping actual SaaS performance against this tolerance range, the ZOT approach reveals whether service delivery falls below, meets, or exceeds user expectations.

D. Empirical Studies on SaaS Service Quality

Several empirical studies have examined SaaS service quality. Empirical studies on SaaS service quality highlight key drivers such as customer support, reliability, flexibility, and security [15], [16]. In logistics, SaaS platforms enhance visibility and integration, but their service quality aspects remain underexamined [17]. In Vietnam, research mainly focuses on technological and infrastructure development [18], [19], with limited attention to user perspectives particularly among logistics employees underscoring the need for context-specific assessment of SaaS service quality.

III. Research Model and Hypothesis Development

This study focuses on assessing the service quality of Software-as-a-Service (SaaS) platforms used by logistics firms in Ho Chi Minh City. To capture the multidimensional nature of SaaS service quality, the research adopts the SaaS-Qual framework [20], [21] (Ma et al., 2005; Parasuraman et al., 2005) in combination with the Zone of Tolerance (ZOT) approach [7]. The SaaS-Qual framework conceptualizes SaaS service quality as a formative second-order construct composed of six reflective first-order dimensions: Rapport, Responsiveness, Reliability, Features, Security, and Flexibility representing both the relational and technical aspects of service delivery. Meanwhile, the ZOT approach allows for a nuanced evaluation of service confirmation by measuring the difference between perceived and minimum acceptable service levels (P–M), thus reflecting users' tolerance ranges and satisfaction thresholds. By integrating ZOT with the multidimensional SaaS-Qual structure, this study enables a more precise evaluation of service quality across key dimensions. Consequently, SaaS-Qual combined with ZOT offers a diagnostic lens for identifying specific areas where service performance aligns with or diverges from what users consider acceptable or ideal, providing a clearer understanding of the overall service experience from the user's perspective.

Data analysis was conducted using SmartPLS 4, following a two-stage analytical procedure. In the first stage, the measurement model was assessed to ensure the reliability and validity of the six first-order constructs. Each construct was measured through multiple indicators adapted from prior validated scales and adjusted to fit the SaaS and logistics service context. Indicator loadings, Composite Reliability (CR), and Average Variance Extracted (AVE) were examined to confirm convergent validity and internal consistency. In the second stage, the six reflective first-order constructs were modeled as formative indicators of the second-order latent variable SaaS-Qual, representing the overall service quality perception. The following hypotheses were proposed to examine the relative importance and perceived performance of each dimension within the SaaS-Qual framework:

- H1: Rapport positively contributes to the confirmation of SaaS service quality.
- H2: Responsiveness positively contributes to the confirmation of SaaS service quality.
- H3: Reliability positively contributes to the confirmation of SaaS service quality.
- H4: Flexibility positively contributes to the confirmation of SaaS service quality.
- H5: Features positively contribute to the confirmation of SaaS service quality.
- H6: Security positively contributes to the confirmation of SaaS service quality.

Using the ZOT and SaaS-Qual approaches, we aim to quantify both the importance and performance of these service quality dimensions, providing actionable insights for SaaS providers to enhance their service offerings in alignment with logistics operational needs.

IV. RESEARCH METHODOLOGY

A. Data collection

To measure SaaS service quality using the SaaS-Qual scale and ZOT approach, we conducted a single survey targeting employees randomly selected from logistics firms across Ho Chi Minh City. Participants were asked to evaluate a specific SaaS application used in their firm (e.g., ERP, CRM) to ensure focused and relevant responses. A total of 291 usable responses were collected. The surveyed employees represented diverse roles and experience levels within their firms, and no significant nonresponse bias was detected based on firm size or industry (TABLE I). This sample provided a reliable basis for validating the SaaS-Qual scale and calculating SaaS service quality using the ZOT approach.

TABLE I. Sample Descriptives for Research Study (N=291)

Category	Quantity	Percent
Number of employees of SaaS using firms		
> 100	162	55.67%
51 - 100	88	30.24%
21 – 50	37	12.71%
≤ 20	4	1.38%
Years of experience at work		
≤ 5	168	57.74%
5 - 10	70	24.05%
10 - 20	31	10.65%
> 20	22	7.56%

Source: Results summarized by the author from SPSS

B. Measurement Scale Development

Measurement items for each construct were adapted from previously validated SaaS-Qual scales developed by Benlian, Koufaris, and Hess (2011) [8] and Jagli, Purohit, and Subash Chandra (2019) [9]. Each dimension was operationalized through multiple indicators and measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

A pilot test involving 291 respondents from logistics firms was conducted prior to the main survey to refine wording, remove ambiguous items, and ensure content validity. Results from the pilot confirmed satisfactory reliability across all constructs, supporting the readiness of the instrument for full-scale data collection. This multi-dimensional measurement framework provided a reliable and valid foundation for assessing SaaS service quality confirmation through the ZOT (P–M) methodology in the logistics sector.

- Rapport: measures the quality of communication, empathy, and support between SaaS users and providers.
- Responsiveness: captures the timeliness and adequacy of technical support and issue resolution.
- Reliability: reflects system stability, uptime, and consistency in performance.
- Features: evaluates the completeness and usefulness of system functionalities.
- Security: examines users' trust in data protection, privacy, and system integrity.
- Flexibility: assesses the adaptability of the SaaS platform to changing business needs.

V. RESEARCH RESULTS

The SaaS-Qual measurement model consists of six first-order reflective constructs: Rapport (RA), Responsiveness (RES), Reliability (REL), Features (FE), Security (SEC), and Flexibility (FL). Each construct was measured using Zone of Tolerance (ZOT)-based difference scores (P-M), calculated as the difference between perceived service quality and the minimum acceptable level. This approach captures the confirmation of SaaS service quality from the user perspective.

Internal consistency reliability was assessed using Cronbach's Alpha (TABLE II). All constructs exceeded the threshold value of 0.7 [22], confirming adequate reliability. These results indicate that all six first-order constructs exhibit strong internal consistency, providing a solid foundation for further validity assessment [23].

TABLE II. Reliability Testing (Cronbach's Alpha)

Construct	Cronbach's Alpha
Rapport (RA)	0,827
Responsiveness (RES)	0,778
Reliability (REL)	0,826
Features (FE)	0,776
Security (SEC)	0,826
Flexibility (FL)	0,836

Source: Results summarized by the author from SPSS

Exploratory factor analysis confirmed the dimensionality of the constructs. The rotated component matrix showed strong loadings for items on their respective factors, ranging from 0.48 to 0.76, supporting discriminant validity (TABLE III).

TABLE III. Rotated Component Matrix

	1	2	3	4	5	6
RE2	0.712					
RE5	0.678					
RE4	0.671					
RE3	0.653					
RE1	0.563					
FLE2		0.725				
FLE3		0.713				
FLE1		0.681				
FLE4		0.653				
RA1			0.711			

RA2			0.666			
RA5			0.662			
RA4			0.629			
RA3			0.541			
RES5				0.764		
RES1				0.654		
RES4				0.652		
RES2				0.566		
RES3				0.536		
SEC2					0.753	
SEC3					0.746	
SEC1					0.706	
SEC4					0.686	
FE2						0.748
FE3						0.669
FE1						0.639
FE5						0.515
FE4						0.484

Source: Results summarized by the author from SPSS

In this study, SaaS service quality (SaaS-Qual) was conceptualized as a formative second-order construct, comprising six reflective first-order dimensions: Rapport, Responsiveness, Reliability, Features, Security, and Flexibility. Each first-order dimension was measured using the difference between perceived service quality (P) and minimum accepted service quality (M), following the Zones of Tolerance (ZOT) approach [7]. This operationalization ensures that the measured service performance meets at least the minimum expected quality level, reflecting customer expectations accurately.

The psychometric properties of the six first-order dimensions were assessed through factor loadings, internal consistency, and convergent validity. As shown in TABLE IV, factor loadings for all indicators were significant and above the recommended threshold (0.60–0.70), supporting indicator reliability. Composite reliability (CR) ranged from 0.85 to 0.89, indicating strong internal consistency, while average variance extracted (AVE) values ranged from 0.73 to 0.82, confirming convergent validity (TABLE IV).

TABLE IV. Reliability and Validity of SaaS-Qual Constructs (P-M)

Constructs	#of index	Range of Loadings	Composite Reliability	AVE
Rapport (PM)	5	0.73 - 0.83	0.86	0.77
Responsiveness (PM)	5	0.69 - 0.76	0.85	0.73
Reliability (PM)	5	0.74 - 0.79	0.86	0.77
Features (PM)	5	0.70 - 0.78	0.85	0.73
Security (PM)	4	0.79 - 0.82	0.85	0.81
Flexibility (PM)	4	0.80 - 0.83	0.89	0.82

PM=P-M

P=Perceived Service Quality Level

M=Minimum Adequate Service Quality Level

Source: Results summarized by the author from SmartPLS

The correlation matrix shows all first-order dimensions are positively correlated, with values below 0.90, indicating discriminant validity; each dimension captures a distinct facet of SaaS service quality while contributing to the overall construct (TABLE V).

TABLE V. Correlation matrix

	RA	RES	RE	FE	SEC	FL
RA	0.77					
RES	0.59*	0.73				
RE	0.59*	0.61*	0.77			
FE	0.59*	0.55*	0.61*	0.73		
SEC	0.60*	0.48*	0.47*	0.46*	0.81	
FL	0.59*	0.50*	0.55*	0.60*	0.57*	0.82

Source: Results summarized by the author from SPSS

The six first-order dimensions were combined to form the formative second-order construct, SaaS-Qual. Item weights (β-values) and t-values from PLS analysis confirm that each dimension significantly contributes to the overall construct, supporting the validity of the second-order formulation.

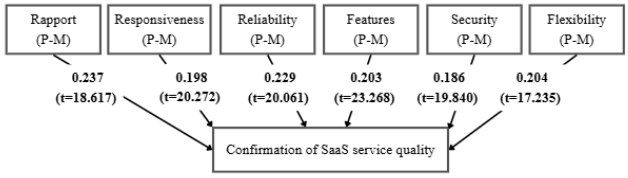

Fig. 1. Second-order formative construct (SaaS-Qual)

Fig. 1 illustrates the results of the second-order formative construct analysis for SaaS service quality (SaaS-Qual) using SmartPLS. The model conceptualizes SaaS-Qual as an overarching construct formed by six first-order dimensions: Rapport, Responsiveness, Reliability, Features, Security, and Flexibility, each operationalized as the perceived-minus-minimum (P–M) score representing the Zone of Tolerance. All path coefficients (β) are statistically significant, with t-values ranging from 17.235 to 23.268, confirming the formative validity of the construct. Among these dimensions, Rapport (β = 0.237, t = 18.617) and Reliability (β = 0.229, t = 20.061) exhibit the strongest contributions, suggesting that the quality of relationship management and consistent system dependability play dominant roles in defining users' overall service quality perceptions. Features (β = 0.203) and Flexibility (β = 0.204) also have notable impacts, emphasizing the importance of functionality and adaptability in SaaS platforms. Meanwhile, Responsiveness (β = 0.198) and Security (β = 0.186), though slightly lower, remain significant, indicating that prompt support and data protection continue to influence user evaluations. Overall, the findings validate the multidimensional nature of SaaS-Qual, confirming that users' perceptions of service quality are shaped by both relational and technical aspects of SaaS performance within logistics firms.

VI. Discussion And Limitation

The primary objective of this study was to validate the confirmation of SaaS service quality through the Zone of Tolerance (ZOT) framework.

The strongest predictor of confirmation in this study is Rapport, highlighting that relational capital plays a dominant role in shaping service evaluations in business-to-business logistics contexts. Unlike many consumer-focused SaaS studies [15], [16], [17], [18], [19] that emphasize technological attributes, this finding reinforces the notion that logistics buyers depend heavily on the provider's advisory support, communication responsiveness, and willingness to collaboratively resolve operational disruptions. Perceived vendor commitment and trust in human support serve as risk-reducing mechanisms, particularly in high-dependency settings where operational continuity is critical.

Reliability emerges as another foundational performance determinant with nearly equivalent influence. Predictable, error-free system execution is essential for logistics firms where downtime, inaccurate data flows, or transaction failures can produce immediate cascading losses. Together, Rapport and Reliability suggest a two-layer logic for confirming SaaS service quality: dependable system performance establishes a baseline of confidence, while provider engagement solidifies users' belief that value will be consistently protected over time.

Responsiveness and Security exhibit comparatively lower influence, likely because users perceive them as essential "hygiene" attributes necessary to prevent dissatisfaction but offering limited additional confirmation once basic expectations are met. This aligns with expectation - confirmation theory [24], which posits that mandatory attributes provide little incremental value when adequately delivered. However, their importance remains critical from a risk perspective, as weaknesses in support responsiveness or data protection can rapidly erode perceived service quality.

Overall, the findings reinforce the validity of a six-dimensional SaaS-Qual framework in the logistics context and highlight that relational and operational aspects exert greater influence on confirmation than purely technical system characteristics.

While this study provides valuable insights, it is bounded by context. The sample focuses on logistics firms in Ho Chi Minh City, where operational risks and vendor relationships may differ from other regional or industry environments. Moreover, the present analysis examines only confirmation; future research should extend the model to include post-confirmation outcomes such as satisfaction, trust, continuance intention, and switching behaviors.

VII. Conclusion

Drawing from survey data collected among employees of logistics firms in Ho Chi Minh City, this study offers empirical insights into how business users evaluate SaaS service quality dimensions. The results highlight Responsiveness and System Reliability as the most critical determinants of perceived service quality. Notably, these are also the areas where performance frequently falls short of user expectations, underscoring the need for SaaS providers to enhance operational efficiency and service delivery.

The findings have several practical implications. By applying the validated SaaS-Qual framework and the ZOT-based measurement approach, SaaS vendors can better identify and manage service quality gaps, refine service-level agreements (SLAs), and allocate resources to dimensions that most strongly influence user perceptions. As SaaS adoption continues to expand in the logistics sector, periodic assessment of service quality confirmation using standardized scales will be essential for sustaining customer trust and long-term engagement.

Future research could extend this work by examining how these dimensions evolve across different industries or technological contexts, and by linking service quality confirmation with user satisfaction, system usage, or business performance. Such extensions would provide a more holistic understanding of how SaaS service quality translates into strategic value for organizations.

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