

The Effect of Electronic Service Quality on the System Usability of Salam Application at Kppbc Tmp a Marunda with Digital Transformational Leadership as a Moderating Variable

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ARTICLE INFO

Keywords: E-S-QUAL, System Usability Scale (SUS), Digital Transformational Leadership (DTL), Customs and Excise, PLS-SEM

Received : 15 August

Revised : 20 September

Accepted: 06 October

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ABSTRACT

Digital transformation of e-government in the customs sector is frequently challenged by technical instability in centralized infrastructure, leading to operational disruptions in public services. In response to these challenges, the Customs and Excise Operational Office (KPPBC TMP) A Marunda proactively launched a local innovation named the Marunda Service Application System (SALAM). This study aims to empirically examine and analyze the effect of Electronic Service Quality (E-S-QUAL) on the System Usability Scale (SUS) of the SALAM application with Digital Transformational Leadership (DTL) as a moderating variable. A descriptive-causal quantitative approach with a deductive method was employed. Data were collected via structured questionnaires distributed to 59 active SALAM application users at KPPBC TMP A Marunda using a census (saturated sampling) technique. Data analysis utilized Partial Least Squares - Structural Equation Modeling (PLS-SEM) executed through SmartPLS 4 and Simple Slopes Analysis. The results reveal that E-S-QUAL has a significant direct positive effect on System Usability (SUS) ($\beta = 0.413$, $p = 0.001$). Conversely, the overall moderating effect of DTL is statistically non-significant ($\beta = -0.081$, $p = 0.611$); instead, DTL acts as a quasi-moderator with a strong direct effect ($\beta = 0.393$, $p = 0.004$). Simple slopes analysis demonstrates a masking effect: under low DTL, user satisfaction relies significantly on system reliability, whereas under high DTL, the impact of technical errors is buffered by active leadership agility.

INTRODUCTION

Digital transformation in the public sector has fundamentally redefined interaction patterns, service governance, and operational efficiency within government institutions. Under the Bureaucratic Reform framework and the realization of smart governance, modernizing information systems serves as an essential pillar to meet public expectations for fast, transparent, and measurable services (Sedarmayanti, 2026). In Indonesia, this national commitment is reflected in the upward trajectory of the Indonesian Digital Society Index (IMDI), reaching a score of 44.53 in 2025 (Pudjianto et al., 2025). In alignment with this national strategic agenda, the Directorate General of Customs and Excise (DJBC) has transformed from a mere revenue collector into an active trade facilitator through the widespread implementation of the centralized Customs-Excise Information System and Automation (CEISA 4.0) (Rahman & Harianto, 2023).

However, deploying public digital infrastructure on a national scale frequently encounters technical stability challenges and operational capacity asymmetries across vertical regional units (Ariansyah et al., 2024). Issues such as database integration failures, status latency, extended page buffering, and server downtime during peak hours risk distorting promised operational efficiencies. Responding to these challenges, the Customs and Excise Operational Office Type Medium A (KPPBC TMP A) Marunda proactively built the Marunda Service Application System (SALAM) as a crucial buffer portal and single gateway functionally integrated with CEISA 4.0 via Application Programming Interfaces (API) (KPPBC TMP A Marunda, 2025). Since SALAM's official deployment in February 2025, KPPBC TMP A Marunda's Community Satisfaction Survey (SKM) score consistently rose from 3.63 (on a 4.0 scale) to over 3.80 in Q4 2025 (KPPBC TMP A Marunda, 2026).

Despite positive external community satisfaction trends, secondary data logging user complaints throughout 2025 revealed a paradoxical contrast. Service users continuously reported system errors, slow portal response times, and back-end application instability (KPPBC TMP A Marunda, 2026). In modern information systems literature, Tang et al. (2024) identify this phenomenon as the Workaround Paradox. When workplace technology experiences hindrance stressors, employees tend to execute manual workarounds under field leadership direction. Consequently, front-end system usability ratings remain exceptionally high—not purely due to machine reliability (E-S-QUAL), but because technical flaws are 'masked' by human capital agility and leadership intervention (Al Otaibi et al., 2023).

Grounded in these operational dynamics, this study empirically investigates the direct influence of Electronic Service Quality (E-S-QUAL) on System Usability (SUS) for the SALAM application from the perspective of internal customs officers at KPPBC TMP A Marunda (Bux et al., 2025; Qurrotul'ain et al., 2025). Furthermore, it examines the contingent moderating role of Digital Transformational Leadership (DTL) to verify whether digital leadership acts as a protective buffer maintaining employee operational efficacy when systems experience performance fluctuations (Afriyie et al., 2019; Saeed et

al., 2025). This research enriches evidence-based policy literature by separating objective machine reliability from subjective user psychological perception.

LITERATURE REVIEW

1. Grand Theory: Information Systems Success Model (ISSM)

The Information Systems Success Model (ISSM) formulated by DeLone and McLean (1992, 2003) serves as the primary grand theory of this study. ISSM postulates that information system quality and reliability sequentially predict user acceptance, system usage, and functional user satisfaction (Aldholay et al., 2020). In the context of the SALAM application, ISSM links back-end infrastructure reliability—measured objectively through Electronic Service Quality (E-S-QUAL)—with front-end user experience evaluated via the System Usability Scale (SUS).

2. Middle-Range Theory: Digital Transformational Leadership (DTL)

To expand ISSM's explanatory power in turbulent bureaucratic ecosystems, it is integrated with Digital Transformational Leadership (DTL) as a middle-range theory. DTL refers to a leader's capacity equipped with a digital mindset to inspire, foster psychological safety, and guide subordinates in maximizing technology potential (AlNuaimi et al., 2022). DTL operates through four core dimensions (The 4 I's): Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration (Chen et al., 2026; Rehmani et al., 2023; Yukl, 2013). Here, DTL is positioned to test contingent buffering effects when technical infrastructure encounters operational failures (Tang et al., 2024).

3. Variable Constructs and Hypotheses Development

Electronic Service Quality (E-S-QUAL) is adapted from Parasuraman et al. (2005). To ensure precise measurement on mandatory government operational applications, this study retains two pure technical dimensions: System Availability and Fulfillment (Orientani & Jumhur, 2017; Tedjakusuma et al., 2025). The Efficiency dimension is excluded to prevent construct overlap with SUS, while Privacy is excluded because SALAM's security is centralized and nationally certified by the Finance Ministry's Pusintek (KPPBC TMP A Marunda, 2025).

System Usability is evaluated using John Brooke's (1986) System Usability Scale (SUS), an international 10-item psychometric instrument measuring effectiveness, efficiency, and user satisfaction with composite scores ranging from 0 to 100 (Del Rocio Sevilla-Gonzalez et al., 2020). Based on these theoretical foundations, the hypotheses are formulated as follows:

H1: Electronic Service Quality (E-S-QUAL) has a positive and significant direct effect on the System Usability Scale (SUS) of the SALAM application at KPPBC TMP A Marunda.

H2: Digital Transformational Leadership (DTL) moderates (strengthens) the effect of Electronic Service Quality on the System Usability Scale of the SALAM application at KPPBC TMP A Marunda.

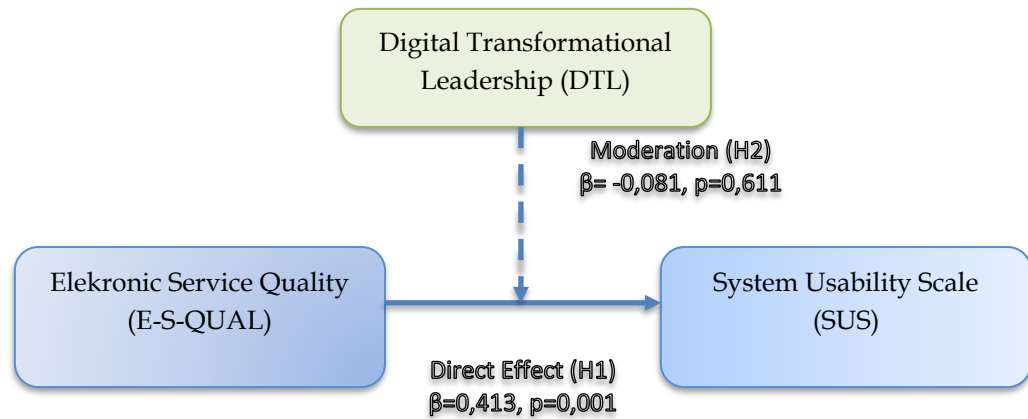


Figure 1. Conceptual Framework of the Research Model

Source: output processed by the researcher (2026)

Description: The conceptual framework illustrates the direct causal pathway from Electronic Service Quality (X) to System Usability Scale (Y) grounded in ISSM, intersected by the moderating intervention line from Digital Transformational Leadership (Z). System Availability and Fulfillment serve as core technical antecedents, while DTL provides managerial contingency buffering against technical fluctuations.

METHODOLOGY

This study is classified as descriptive-causal quantitative research adopting a hypothetico-deductive approach under the post-positivism paradigm. The survey strategy was conducted with individual customs officers at KPPBC TMP A Marunda as the unit of analysis in a cross-sectional non-contrived field setting.

The target population comprised 157 organic officers. Purposive sampling was applied based on inclusion criteria: (1) officers actively using or having managerial access to SALAM, and (2) possessing a minimum tenure of 6 months. Purposive filtering yielded 112 target officers who were sampled using a saturated/census approach (Sekaran & Bougie, 2016). The electronic questionnaire was officially distributed via the Office Automation platform (Satu Kemenkeu) under official memo ND-720/KBC.0802/2026. A total of 70 responses were received (62.5% response rate). After screening for non-users and tenure criteria, a clean sample of 59 active SALAM user officers was finalized.

Variables were measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Instrument content validity was confirmed by a 5-expert panel yielding perfect Content Validity Index scores (I-CVI = 1.00; S-CVI/Ave = 1.00). Data were analyzed using Partial Least Squares - Structural Equation Modeling (PLS-SEM) via SmartPLS 4 (Hair et al., 2021). Evaluation followed a two-stage approach: (1) Measurement Model (Outer Model) assessment checking convergent validity, discriminant validity (HTMT & Fornell-Larcker), and internal consistency; and (2) Structural Model (Inner Model) assessment evaluating VIF, R², f², 10.000 bootstrapping subsamples, and Simple Slopes Analysis (Hair et al., 2021).

RESULTS AND DISCUSSION

1. Respondent Demographic Profile

Demographic characteristics of the 59 clean active SALAM user respondents display a highly representative distribution across operational units and staff tiers.

Table 1. Demographic Characteristics of Clean Sample (N = 59)

Demographic Category	Sub-Category / Range	Headcount (Staff)	Percentage (%)
Gender	Male / Female	43 / 16	72.88% / 27.12%
Age Range	25–34 yrs / 35–44 yrs / 45–54 yrs / ≥55 yrs	18 / 16 / 20 / 5	30.51% / 27.12% / 33.90% / 8.47%
Primary Work Unit	Customs Service (PKC) / Functional / PDAD / Other	34 / 11 / 6 / 8	57.63% / 18.64% / 10.17% / 13.56%
Office Tenure	More than 6 Months (Inclusion Criteria)	59	100.00%
Usage Frequency	Active Daily Users (Regular / Routine)	39	66.10%

Source: SmartPLS 4 output processed by the researcher (2026)

Note: Gender is dominated by male officers (72.88%). Age distribution shows balanced representation between tech-savvy staff (<45 years = 57.63%) and senior operational officers (>45 years = 42.37%). Section distribution accurately reflects core operational units, primarily Customs & Excise Services (PKC = 57.63%) and Functional Officers (18.64%). Active daily users constitute 66.10% of the sample, guaranteeing mature experiential knowledge.

2. Measurement Model Assessment (Outer Model)

Convergent validity was evaluated via Outer Loadings and Average Variance Extracted (AVE). Indicators ESQ1, ESQ5, and ESQ6 were removed due to low loadings (< 0.40). The 5 retained E-S-QUAL indicators yielded loadings between 0.712 and 0.873 with AVE = 0.636 (> 0.50). For DTL, 6 indicators yielded loadings between 0.752 and 0.926 with AVE = 0.769 (> 0.50). All 10 standard SUS indicators were retained to preserve instrument integrity (loadings 0.514 to 0.836). Although SUS AVE was 0.486, Composite Reliability reached 0.903 (> 0.70), theoretically confirming adequate convergent validity (Fornell & Larcker, 1981).

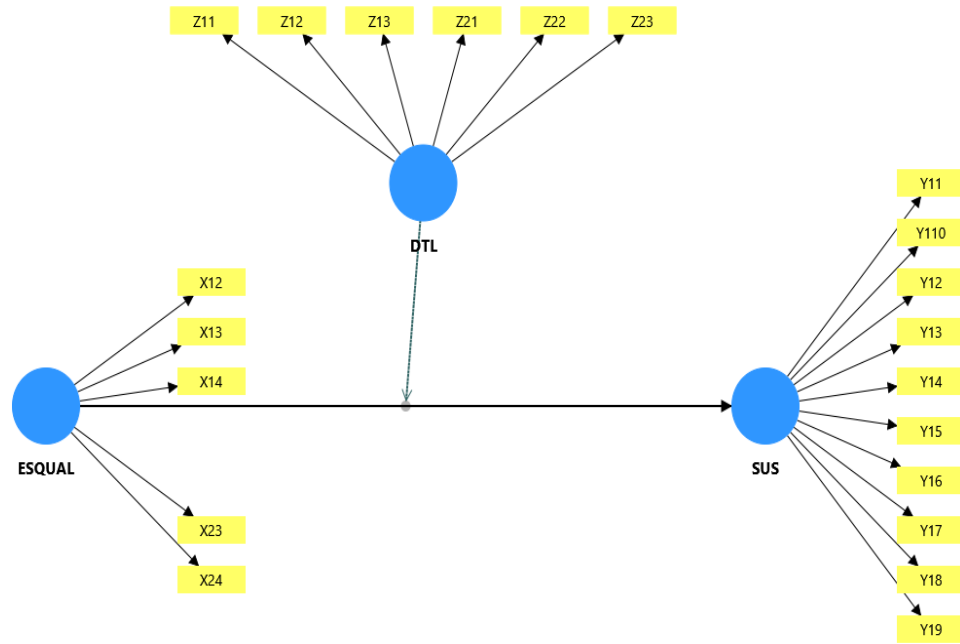


Figure 2. Research Model

Source: SmartPLS 4 output processed by the researcher (2026)

Table 2. Measurement Model Evaluation (Outer Model) Results

Latent Variable	Indicator Count	Cronbach's Alpha (α)	Composite Reliability (ρ_c)	AVE	Validity Status
Digital Transformational Leadership (DTL)	6 (Z11-Z23)	0.939	0.952	0.769	Valid (Excellent)
Electronic Service Quality (E-S-QUAL)	5 (ESQ2,3,4,7,8)	0.857	0.897	0.636	Valid (Excellent)
System Usability Scale (SUS)	10 (Y11-Y110)	0.881	0.903	0.486*	Valid (Adequate, CR>0.70)

Source: SmartPLS 4 output processed by the researcher (2026)

Note: *Grounded in Fornell & Larcker (1981), SUS AVE of 0.486 is fully accepted because Composite Reliability (0.903) significantly exceeds the 0.70 threshold. Discriminant validity is confirmed with all HTMT ratios well below the conservative 0.85 threshold (HTMT DTL-SUS = 0.534; E-S-QUAL-SUS = 0.517).

3. Structural Model Assessment (Inner Model) and Hypothesis Testing

Inner VIF values ranged between 1.111 and 1.218 (< 3.0), ruling out multicollinearity. The coefficient of determination (R^2) for endogenous SUS reached 0.404 (Adjusted $R^2 = 0.371$), indicating that E-S-QUAL, DTL, and their interaction jointly explain 40.40% of SALAM usability variance (moderate explanatory power). Effect size f^2 recorded DTL → SUS $f^2 = 0.264$, E-S-QUAL → SUS $f^2 = 0.245$, and DTL × E-S-QUAL → SUS $f^2 = 0.013$.

Table 3. Structural Model Assessment and Hypothesis Testing Results

Hypothesis	Structural Path	Original Sample (β)	Sample Mean (M)	T-Statistic	P-Value	Decision
H1	E-S-QUAL → SUS	0.413	0.419	3.273	0.001**	ACCEPTED
Prerequisite	DTL → SUS (Direct)	0.393	0.431	2.842	0.004**	ACCEPTED
H2	DTL × E-S-QUAL → SUS	-0.081	-0.093	0.509	0.611(ns)	REJECTED

Note: ** $p < 0.01$, ns = not significant. Bootstrapping executed with 10,000 subsamples. H1 is strongly accepted ($\beta = 0.413$, $p = 0.001$), proving that service quality directly drives system usability. H2 is rejected on the aggregate model, but direct DTL is strongly significant ($\beta = 0.393$, $p = 0.004$), confirming DTL acts as a Quasi-Moderator.

Table 4. System Usability Scale (SUS) Indicator Scores & Composite Rating

Indicator Code	Operational Statement Description	Mean Score (1-5)	Converted Usability Contribution
SUS1 (Y1.1)	Routine usage intention for customs services	4.78	3.78 (Odd item: $R - 1$)
SUS2 (Y1.2)	Perception of non-complexity (Inverted)	4.53	3.66 (Even item: $5 - R$)
SUS3 (Y1.3)	Perceived ease of use	4.78	3.78 (Odd item: $R - 1$)
SUS4 (Y1.4)	Independence from IT technical support (Inverted)	4.27	3.44 (Even item: $5 - R$)

SUS5 (Y1.5)	Feature integration and harmony	4.47	3.47 (Odd item: R - 1)
SUS6 (Y1.6)	Perception of system consistency (Inverted)	4.24	3.58 (Even item: 5 - R)
SUS7 (Y1.7)	Perceived rapid learnability	4.73	3.73 (Odd item: R - 1)
SUS8 (Y1.8)	Absence of awkwardness/confusion (Inverted)	4.66	3.66 (Even item: 5 - R)
SUS9 (Y1.9)	Operating confidence & self-efficacy	4.59	3.59 (Odd item: R - 1)
SUS10 (Y1.10)	Low pre-learning overhead (Inverted)	4.00	3.31 (Even item: 5 - R)

Source: SmartPLS 4 output processed by the researcher (2026)

Note: Composite calculation formula: Total Score = (Sum Odd + Sum Even) * 2.5 = (18.36 + 17.64) * 2.5 = 90.00 / 100. Based on Bangor et al. (2009) criteria, 90.00 maps to Grade Scale A, Acceptable Range: Acceptable, and Adjective Rating: Excellent.

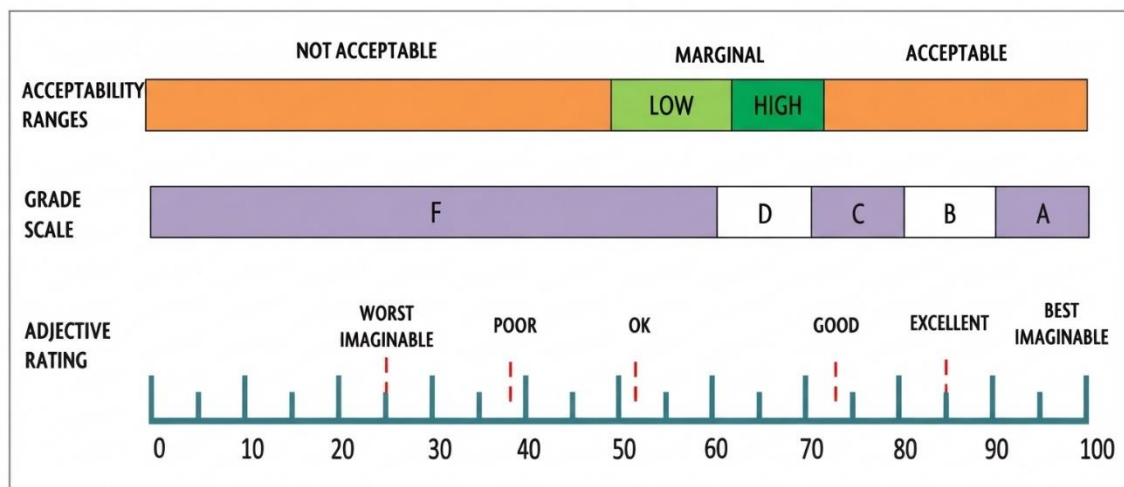


Figure 2. System Usability Scale (SUS) Universal Benchmark and SALAM Positioning

Source: output processed by the researcher (2026)

Description: SALAM achieves a composite SUS score of 90.00, placing it squarely in Grade A, Acceptable range, and Excellent adjective rating according to Bangor et al. (2009) global benchmarks (Welda et al., 2020; Zahratul, 2023).

4. Simple Slopes Analysis and the 'Masking Effect'

Although H2 was non-significant on the aggregate model, Simple Slopes Analysis revealed crucial findings regarding leadership dynamics at KPPBC TMP A Marunda.

Table 5. Simple Slopes Analysis of E-S-QUAL on SUS across DTL Levels

Leadership Support Condition (DTL)	Path Coefficient (β)	T-Statistic	P-Value	Effect Significance
Low DTL (-1 SD)	0.391	1.856	0.063	Marginally Significant ($p < 0.10$)
Mean DTL (Average)	0.359	3.113	0.002	Highly Significant ($p < 0.01$)
High DTL (+1 SD)	0.328	1.600	0.110	Not Significant ($p > 0.05$)

Source: SmartPLS 4 output processed by the researcher (2026)

Note: Simple slopes prove the 'Masking Effect'. Under Low DTL, user experience is highly vulnerable to system quality ($\beta = 0.391$). Under High DTL, the slope flattens and becomes non-significant ($\beta = 0.328$, $p = 0.110$), proving that active leadership support buffers and masks technical infrastructure defects.

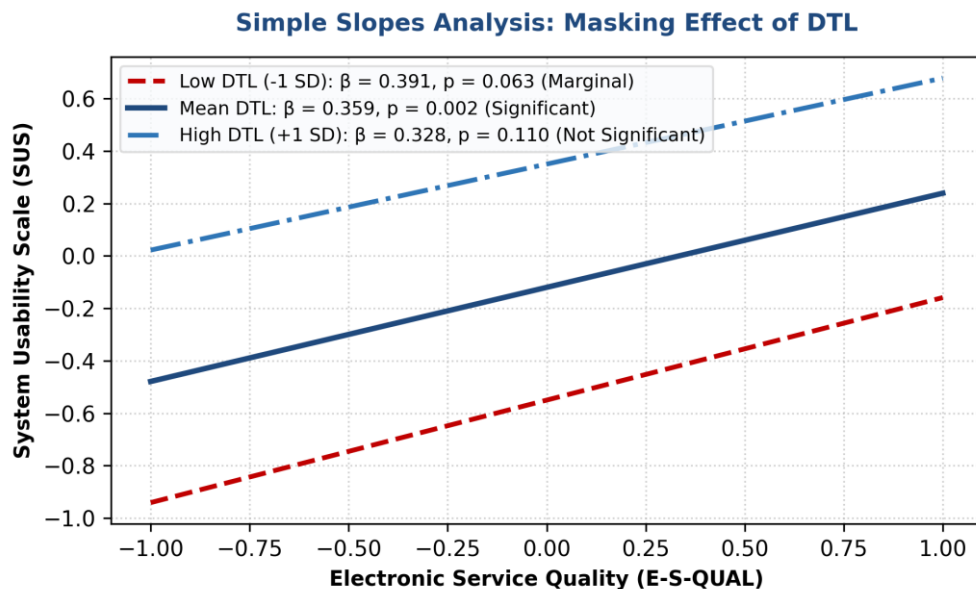


Figure 3. Simple Slopes Analysis Plot Illustrating the Leadership Masking Effect

Source: SmartPLS 4 output processed by the researcher (2026)

Description: The simple slopes plot demonstrates how increasing levels of Digital Transformational Leadership dampen the sensitivity of user usability scores to back-end technical errors, shielding employee satisfaction from infrastructure downtime.

5. Discussion & Exploration of Pseudo-Satisfaction Paradox

These empirical findings align with global Workaround Paradox theory (Tang et al., 2024). When leaders exhibit strong transformational digital leadership (providing clear vision, motivating teamwork, and offering safe emergency workaround guidance during outages), technical infrastructure flaws no longer significantly impair employee satisfaction because machine weaknesses are buffered by human capital agility (Tang et al., 2024; Wibowo & Mariani, 2026).

Furthermore, integrating age demographics explains why SUS scores reached 90.00 despite freedom-from-crash indicators (ESQ3 = 4.068) being lowest. At Marunda, operational staff is heavily populated by senior officers aged >45 years (42.37%). Under the Objective Performance - Subjective Satisfaction Paradox (Harrati et al., 2016), older users face objective operational hurdles but report exceptionally high subjective satisfaction due to the relief from clerical paper-pushing (ESQ8 = 4.576). However, management must recognize that a 90.00 SUS score contains 'Pseudo-Satisfaction'. Left unaddressed without routine back-end maintenance, perpetual reliance on manual workarounds risks extreme employee burnout.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the empirical analysis and structural model testing executed via PKS-SEM and Simple Slopes Analysis, the core conclusions of this research are synthesized as follows:

- a. Direct Impact of E-S-QUAL on System Usability: Electronic Service Quality (E-S-QUAL) exerts a positive, direct, and statistically significant impact on the System Usability Scale (SUS) of the SALAM application ($\beta = 0.413$, $p = 0.001$), confirming Hypothesis H1. System availability and operational fulfillment—specifically server stability, continuous uptime, accurate data processing, and error-free form navigation—serve as the indispensable technical foundation that directly governs officer workplace usability and customs service clearance efficiency. Overall, the composite System Usability Scale (SUS) score reached 90.00, placing the SALAM application firmly in Grade A ("Excellent" / "Acceptable").
- b. Quasi-Moderation and the "Leadership Masking Effect": Moderating hypothesis H2 is statistically rejected on the aggregate structural model ($\beta = -0.081$, $p = 0.611$). However, Digital Transformational Leadership (DTL) operates as a powerful Quasi-Moderator with a strong direct effect on System Usability ($\beta = 0.393$, $p = 0.004$). Simple Slopes Analysis uncovers a critical "Leadership Masking Effect": under low digital leadership intensity, user experience and usability are highly sensitive to back-end technical errors ($\beta = 0.391$), whereas under high digital leadership, active leadership agility, problem-solving support, and emergency guidance cushion officer frustration ($\beta = 0.328$, $p = 0.110$). While proactive leadership buffers technical defects in the short term, over-reliance on leadership agility creates a state of "pseudo-satisfaction" that masks

underlying infrastructure vulnerabilities and drives officers toward risky informal workarounds.

Recommendations

Operational management must prioritize and institutionalize routine back-end technical maintenance to establish genuine system resilience for the SALAM application. Although the application achieved an exceptional composite System Usability Scale (SUS) score of 90.00 (Grade A), empirical item analysis reveals that freedom-from-crash indicators (ESQ3 = 4.068) remain the lowest-rated aspect, exposing a condition of 'pseudo-satisfaction' where high subjective user ratings mask underlying technical vulnerabilities. To eliminate these technical bottlenecks, customs authorities must execute scheduled database performance audits, deploy automated input validation tooltips on entry forms to block crash-triggering non-standard characters, allocate dedicated Quality of Service (QoS) intranet bandwidth for port data traffic, and enforce strict Service Level Agreements (SLAs) for server uptime. Systematically strengthening infrastructure reliability ensures that high system usability is grounded in objective technical stability rather than continuous human intervention.

Despite the aggregate rejection of moderating hypothesis H2, Digital Transformational Leadership (DTL) must be aggressively emphasized and cultivated through structured leadership training as a vital operational mitigation strategy. Because unexpected server overloads, network latency, and software glitches can still randomly occur even under the most rigorous routine maintenance schedules, transformational leadership provides the essential human-capital safety net needed during crisis moments. Comprehensive DTL training programs should focus on building digital leadership agility, establishing clear emergency workaround protocols, and fostering peer coaching for senior staff. By equipping supervisors with transformational capabilities, the organization ensures a proactive mitigation framework that buffers temporary technical disruptions, maintains uninterrupted public service delivery, and prevents employee burnout when system errors inevitably arise.

FUTURE RESEARCH

This study presents methodological limitations that offer opportunities for future inquiry. First, cross-sectional design limits long-term technology adoption tracking; future studies should adopt longitudinal designs. Second, focusing on a single vertical unit (KPPBC TMP A Marunda) restricts external validity; multi-site replications across national customs offices are strongly encouraged.

Third, to eliminate internal self-reporting Common Method Bias (CMB), future researchers should adopt a 360-degree usability view involving external business stakeholders. Fourth, to explain the remaining 59.60% variance, future models should integrate constructs such as Individual Digital Literacy, Task-Technology Fit (TTF), or Technology Readiness Index (TRI).

ACKNOWLEDGEMENTS

The authors express their highest appreciation to the Rector of Telkom University, the Dean of the Faculty of Economics and Business, and the Management of the Distance Learning Master of Management Program. Special thanks are extended to Dr. Helni Mutiarsih Jumhur, S.H., M.Hum. as Thesis Advisor for profound intellectual guidance, and Dr. Maria Apsari Sugiat, S.E.Ak., M.M. as Academic Advisor. Deep appreciation is also expressed to Dr. Chusnul Rofiah, S.E., M.M. and Dr. Adhi Prasetyo, S.T., M.M. for rigorous evaluation during defense. Finally, heartfelt gratitude is conveyed to the Head and officers of KPPBC TMP A Marunda for research permission, operational data, and active survey participation.

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