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Research Paper

Digitalizing Goods Declaration: Performance Analysis of the Bureau of Customs Portal in Key Philippine Ports

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Abstract

This study assesses the performance of the Bureau of Customs (BOC) portal at major Philippine ports under the "zero contact" policy mandated by Customs Memorandum Order 8-2020, focusing on efficiency, accuracy, and regulatory compliance in Goods Declaration (GD) processing. A quantitative-descriptive design was employed using surveys and secondary time-series data from BOC records. Respondents included licensed customs brokers and declarants at the Port of Manila and the Manila International Container Port, for a total of 363 participants. Guided by the Technology Acceptance Model (TAM), descriptive statistics and paired-sample t-tests were used to compare pre- and post-implementation performance. Findings reveal significant reductions in GD processing time (3.80 to 3.04 days), documentation verification (13.91 to 4.76 hours), and clearance and release (3.74 to 2.91 days). However, system downtime averaging 7.04 hours per month delays approximately 240 GDs per incident and reduces processing efficiency by 0.99%. The GD error rate stands at 4.33%, with corrections averaging 132.43 days; audit trail features are effective but only moderately enhance dispute resolution. Common user errors include typographical mistakes and incorrect attachments, while technical support remains a major bottleneck (average resolution time: 138.65 hours; resolution rate: 0.79%). The study recommends strengthening technical support and ticketing systems, upgrading infrastructure, streamlining error correction, and enhancing audit trails and feedback mechanisms to align the BOC portal with international customs digitalization standards.

Keywords: *Digitalization, Customs Operations, Goods Declarations, Efficiency, Bureau of Customs (BOC) Portal*

INTRODUCTION

Global digitalization has reshaped customs operations by improving efficiency, transparency, and security. International bodies such as the World Customs Organization and United Nations ESCAP highlight the role of digital systems in reducing trade costs, preventing delays, and strengthening risk management, especially in developing economies where border inefficiencies significantly affect competitiveness (Arvis et al., 2018; World Bank, 2020).

In the Philippines, the Bureau of Customs (BOC) introduced Customs Memorandum Order No. 08-2020, which institutionalized the BOC portal for the electronic submission of Goods Declarations and implemented a zero-contact policy (Bureau of Customs, 2020b). This shift, accelerated by the COVID-19 pandemic, aimed to mitigate vulnerabilities of paper-based transactions and align customs processes with global digital standards (Chapa, 2020). Early Time Release Studies reported improved clearance times, though port level bottlenecks and operational disparities persist (Bureau of Customs, 2022).

The Port of Manila and the Manila International Container Port handle a major share of the country's containerized trade, making system efficiency critical to national logistics performance. While digital platforms such as electronic data interchange have been shown to improve information quality and streamline procedures, empirical evidence remains limited regarding their actual operational impact at the port level. Existing work is often descriptive and underexamines

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challenges such as user readiness, system reliability, and support capacity (Matsudaira & Koh, 2022; Jaleta & Tulu, 2023).

Gap and Research Purpose

Three gaps remain in current scholarship: limited empirical pre- and post-evaluation of customs portals, inadequate analysis of adoption issues and organizational fit, and underdeveloped integration of TAM, DOI, and information systems success theory in customs contexts. Addressing these gaps, this study evaluates the BOC portal's performance at POM and MICP and examines how user perceptions and system characteristics shape efficiency, compliance, and operational outcomes.

Research Objectives

1. To assess the efficiency of the Bureau of Customs (BOC) portal in expediting the processing of Goods Declaration.
2. To evaluate the effectiveness of the portal in ensuring accuracy and compliance with customs regulations.
3. To identify challenges and bottlenecks in the current Goods Declaration processing system.

Contributions

The study advances theory by integrating TAM, DOI, and IS success constructs to explain outcomes in a developing country customs setting. In practice, it provides actionable recommendations on system reliability, training, validation logic, and support mechanisms that align with modernization priorities.

Study Significance

This study offers timely insights into digital customs modernization in the Philippines. For the Bureau of Customs (BOC), the findings identify operational inefficiencies, including processing delays, user-generated errors, and gaps in technical support. These insights can inform policy improvements and guide resource allocation for infrastructure upgrades.

For importers, exporters, and customs brokers, the results clarify how portal performance influences clearance predictability, transaction costs, and operational accuracy. Improving validation rules, training, and system responsiveness directly supports compliance and business competitiveness.

For policymakers, the study demonstrates how digital reforms contribute to economic efficiency and risk management goals, while for academic scholars, it offers a rare port-level empirical case that integrates TAM, DOI, and IS success frameworks in a developing-country context.

LITERATURE REVIEW

This study interprets its findings using three complementary models that frame adoption and performance in digital customs. The Technology Acceptance Model (TAM) explains how perceived usefulness and perceived ease of use relate to shorter processing time, fewer errors, and smoother transaction flows. The Diffusion of Innovations theory accounts for variation in uptake across stakeholder groups and ports through relative advantage, compatibility, observability, trialability, and complexity. The DeLone and McLean Information Systems Success Model links system quality, information quality, and service quality to use, satisfaction, and net benefits. In this research, these models serve only as interpretive lenses; they are not directly measured in the survey instrument.

Digital Customs and Efficiency Outcomes

International research consistently demonstrates that digital customs systems such as electronic data interchange, single windows, and online declaration portals improve operational efficiency by reducing clearance times, lowering transaction costs, and minimizing physical interactions (UNCTAD, 2024; World Bank, 2020). These platforms streamline documentation flow, automate verification steps, and enhance transparency in border procedures. Although most studies report reductions in dwell time and improved predictability (Hollensen, 2020; Vorona et al., 2022), efficiency outcomes vary with the quality of digital infrastructure, staff readiness, and interagency coordination. Time Release Studies around the world show gains in submission and verification stages but also identify recurring bottlenecks due to fragmented processes and incompatibility between legacy and new systems (Bureau of Customs, 2022).

These findings align with the Technology Acceptance Model (TAM), where perceived usefulness reflects users' recognition of time savings and reduced workload. Differences across ports reflect Diffusion of Innovations constructs such as relative advantage and compatibility, as ports with better technical infrastructure and operational capacity adopt digital tools more effectively. System quality in the DeLone and McLean model further explains variations in efficiency, as system stability and responsiveness influence the actual realization of operational benefits.

Accuracy, Compliance, and Information Quality

Accuracy in customs declarations is central to revenue protection, enforcement of trade regulations, and risk management. Digital systems improve information quality through validation logic, mandatory data fields, and automated consistency checks (DeLone & McLean, 2003). However, user errors persist due to interface complexity, evolving regulatory requirements, and insufficient training (Jaleta & Tulu, 2023; Matsudaira & Koh, 2022). The persistence of typographical errors, incorrect attachments, and incomplete inputs suggests that the existence of digital tools alone does not guarantee accuracy.

Audit trails enhance transparency and support post-clearance audit, though their effectiveness depends on the completeness and reliability of underlying data (UNCTAD, 2024). From a theoretical lens, information quality influences user satisfaction and system success per the DeLone and McLean model. Likewise, error frequency reflects perceived ease of use in TAM, while the DOI attribute of complexity explains difficulties in adopting and consistently using the system. These insights justify evaluating how information quality indicators such as error rate and correction duration shape compliance outcomes in the BOC portal.

System Quality, Service Quality, Downtime, and Support

System and service quality are critical elements of digital government systems, especially in mission-critical environments such as customs administration. Empirical evidence shows that even minor system interruptions cause processing delays, additional storage costs, and missed shipping schedules (Matsudaira & Koh, 2022). When technical support systems are slow or understaffed, users revert to manual workarounds, diminishing the intended benefits of digitalization (Jaleta & Tulu, 2023).

These findings align with the DeLone and McLean model, in which system quality (availability, reliability, response time) and service quality (responsiveness, issue resolution) jointly influence actual use and overall effectiveness. In TAM, system instability weakens perceived ease of use and behavioral intention. In DOI, complexity and poor trialability inhibit adoption, particularly among users who rely heavily on timely system performance.

User Adoption in Electronic Government Systems

The Technology Acceptance Model (TAM) provides strong explanatory power in electronic government contexts, where perceived usefulness and ease of use predict intention and actual system use (Davis, 1989; Venkatesh & Davis, 2000). Public sector studies highlight that facilitating conditions such as training, infrastructure, and organizational support shape the adoption of digital systems (Venkatesh et al., 2003). In customs settings, perceived usefulness is linked to faster processing and fewer physical touchpoints, while perceived ease of use is influenced by interface clarity, error prevention, and support services (Matsudaira & Koh, 2022).

The Diffusion of Innovations theory complements TAM by explaining variations in adoption across stakeholder groups. Relative advantage and compatibility shape perceptions of system value, while complexity reduces adoption and increases user errors. Observability and trialability explain variations in realized benefits across ports. The DeLone and McLean model connects these perceptions of adoption with measurable operational performance. Together, the three models provide a comprehensive foundation for evaluating how system design, user perceptions, and support structures influence the performance of customs digitalization initiatives.

Synthesis and Gap to the Current Study

Existing literature shows that digital customs systems can enhance efficiency, accuracy, and transparency, yet their effectiveness varies widely due to system readiness, user capability, and contextual constraints (UNCTAD, 2024). In the Philippines, modernization reports document improvements, but few studies conduct port-level empirical evaluations using operational performance indicators and integrated theoretical frameworks. Studies often remain descriptive and fail to connect user adoption constructs and system quality measures to measurable outputs such as processing time, error rate, and downtime impact.

This study addresses these gaps by applying TAM, DOI, and the DeLone and McLean IS success model to evaluate pre- and post-performance of the BOC portal at the Port of Manila and the Manila International Container Port. This integrated approach enables a more complete understanding of how user perceptions, adoption dynamics, and system attributes influence operational outcomes in customs administration.

RESEARCH METHOD

Research Design and Type

This study used a quantitative explanatory and evaluative design with a comparative pre- and post-analysis to assess the Bureau of Customs (BOC) portal under the zero-contact policy implemented through Customs Memorandum Order No. 08-2020 (Bureau of Customs, 2020b). The framework integrates constructs from the Technology Acceptance Model (TAM), Diffusion of Innovations theory, and the DeLone and McLean Information Systems Success Model to examine how system characteristics and user perceptions influence efficiency, accuracy, and operational performance.

Setting and Population

The study was conducted at the Port of Manila and the Manila International Container Port. The target population consisted of licensed customs brokers and declarants who regularly interact with the portal and are directly affected by its performance.

Sampling Strategy, Sample Size, and Observations

Active portal users listed in port-level operational rosters formed the sampling frame. Stratified random sampling ensured representation across stakeholder roles and ports. A total of

363 valid survey responses were obtained, exceeding the minimum requirements for paired-sample testing and regression analysis based on standard power thresholds.

Data Sources

Two primary data sources were used. Secondary operational records from the Bureau of Customs (BOC) provided indicators of efficiency (processing, documentation verification, and clearance time), system quality (downtime frequency and declarations affected), information quality (error rates and correction time), and service quality (support resolution metrics). These variables were cross-checked with definitions used in Time Release Studies.

A structured survey collected operational experience and perception data on efficiency, accuracy, and compliance experience, downtime exposure, audit trail utility, user errors, technical issues, and capacity constraints. Survey items were derived from operational practice and Time Release Study stage concepts and were not designed to measure psychometric constructs from the Technology Acceptance Model (TAM), Diffusion of Innovations, or the DeLone and McLean model. Those models are used to interpret the observed patterns in performance and system experience.

Measurement and Instruments

Survey items were developed to capture pre- and post-performance, experience with accuracy and compliance, and operational bottlenecks. Item wording and performance definitions were adapted from international customs practice and Time Release Study stage concepts (Bureau of Customs, 2019, 2020a, 2021, 2022; UNCTAD, 2024; World Bank, 2020), while system and information quality constructs were conceptually guided by the DeLone and McLean model and public sector digital adoption literature (DeLone & McLean, 2003). Most variables are single-indicator measures of experience or frequency that align with the operational definitions used in customs performance monitoring.

Objective and construct	Example items	Response scale	Data source	Adopted or adapted from
Efficiency: processing time (pre and post)	Days to process a Goods Declaration before and after portal use	Ordinal categories	Survey: aligned with TRS stage timing	TRS stage definitions; UNCTAD guidance
Efficiency: documentation verification time (pre and post)	Wait time for documentation verification before and after portal use	Ordinal categories	Survey: TRS alignment	TRS; UNCTAD
Efficiency: clearance and release time (pre and post)	Clearance time using traditional processing versus the portal	Ordinal categories	Survey: TRS alignment	TRS
Downtime impact and volume affected	Frequency and duration of downtime; percent of workday affected; declarations delayed per incident	Ordinal and percentage bands	Survey: operations concepts	System quality concept; operations practice
Accuracy and errors	Errors per 100 declarations; percent	Counts, percentages,	Survey: operations	Information quality

	corrected; time to correction	duration	concepts	concept; error monitoring practice
Compliance alerts and non-compliance	Monthly compliance alerts; instances of non-compliance detected; perceived effectiveness	Counts; effectiveness rating	Survey	Compliance monitoring practice; UNCTAD
Audit trail effectiveness	Effectiveness in tracking changes; frequency of use for disputes; transparency	1 to 4 or 1 to 10 scales; frequency	Survey	Records management and audit trail literature
Technical limitations and support	Frequency of limitations; issues per period; percent resolved within 24 hours; time to resolve; workflow impact	Ordinal; 1 to 10	Survey	Service quality concept
Data throughput and capacity	Peak simultaneous users without degradation; frequency of capacity reached; wait time at peak; adequacy	Counts; minutes; 1 to 10 adequacy	Survey	Capacity planning literature

Data Analysis Techniques, Validity, and Reliability

Data analysis

Descriptive statistics summarized all survey and secondary record variables. For pre- and post-contrasts of time-based outcomes, paired sample t tests were used because observations represent two related conditions. Normality was assessed using Shapiro-Wilk tests and visual inspection of Q-Q plots and histograms. When normality was not met, the Wilcoxon signed-rank tests were applied as robustness checks. Effect sizes were reported using Cohen's d for t-tests and r for non-parametric tests. Categorical and frequency-based items were analyzed using proportions and cross-tabulations.

Validity

Content validity was established conceptually by ensuring that survey items reflected operational definitions used in Time Release Studies, documentation procedures, and system performance indicators in customs operations. Items were adapted from internationally recognized customs metrics and the existing literature on digital customs systems, thereby supporting the validity of construct alignment. Because items were based on real operational events rather than latent psychometric scales, additional forms of construct validation, such as factor analysis, were not required.

Reliability

The instrument primarily consists of single indicator operational measures (for example, time to process, number of errors, downtime duration), which do not require internal consistency

tests such as Cronbach's alpha. Multi-item constructs, such as audit trail effectiveness, may be evaluated for internal consistency if Cronbach's alpha results are available. In the absence of such values, descriptive statistics were used to interpret user assessments of audit trail performance.

Timeline

The study proceeded in four phases: (1) design and approvals, (2) data extraction and survey administration, (3) data cleaning, validity checks, and statistical analysis, and (4) integration of findings and report preparation. Each phase spanned approximately four to eight weeks.

FINDINGS AND DISCUSSION

Instrument checks

Content validity was supported through alignment with Time Release Study stage definitions and international customs guidance. The survey items were based on established operational concepts used in customs performance monitoring, which ensured relevance to the study objectives. Since the instrument focused on factual operational indicators rather than latent constructs, internal consistency coefficients were generally not applicable. For the multi-item block on audit trail effectiveness, internal consistency was reported when computed; otherwise, descriptive results were used.

Objective 1: Assess the Efficiency of the Bureau of Customs (BOC) Portal in Expediting the Processing of Goods Declarations

Measure the Average Processing Time for Goods Declarations Before and After the Implementation of the BOC Portal

The study aimed to assess the efficiency of the Bureau of Customs (BOC) portal by comparing the average processing times for Goods Declarations (GD) before and after its implementation. The results, illustrated in Figure 1, show a notable improvement in processing times. Before the BOC portal was implemented, the average processing time was 3.80 days. After implementation, this average decreased to 3.04 days.

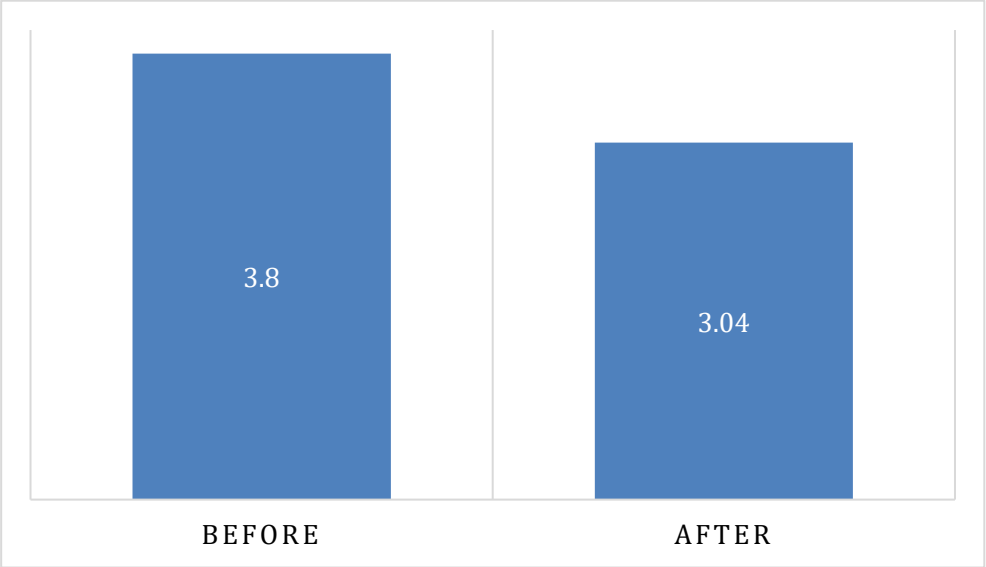

Figure 1. Average Processing Time for Goods Declarations Before and After the Implementation of the BOC Portal

To ensure that this observed improvement was statistically significant and not due to random variation, a Paired-Samples T-Test was conducted. The results, presented in Table 1, indicate a significant difference in the mean processing times before and after the portal's implementation. The t-value of 4.231 and a p-value of less than 0.001, with a 95% confidence interval ranging from 0.412 to 1.127, confirm this significance. The mean score increased by 0.769, with the pre-implementation mean at 0.769 and a standard deviation of 3.445.

Table 1. Paired Samples T-test Results for the Average Processing Time for Goods Declarations Before and After the Implementation of the BOC Portal

Mean	Standard Deviation	Std. Error Mean	Lower	Upper	t	Sig. (2-tailed)
0.76922	3.44478	0.18181	0.41167	1.12677	4.231	0.000

The study aimed to evaluate the efficiency of the Bureau of Customs (BOC) portal by comparing the average processing times for Goods Declarations (GD) before and after its implementation. Results indicated a significant improvement, with the average processing time decreasing from 3.80 days before the portal's implementation to 3.04 days after its implementation. To confirm the statistical significance of this improvement, a Paired Sample T-test was conducted, yielding a t-value of 4.231 and a p-value of less than 0.001. The 95% confidence interval ranged from 0.412 to 1.127, confirming that the observed reduction in processing time is not due to random variation.

Interpreting these results through the Technology Acceptance Model (TAM) provides valuable insights. TAM posits that perceived ease of use and perceived usefulness are critical factors influencing the acceptance and usage of new technology. The significant reduction in processing time suggests that users find the BOC portal both easy to use and beneficial, leading to greater acceptance and more efficient operations. Improved processing times positively affect the portal's perceived ease of use by streamlining the customs declaration process, making it quicker and less cumbersome for users. Furthermore, the portal's perceived usefulness is evident in its ability to expedite GD processing, thereby enhancing operational efficiency and user satisfaction.

The findings underscore the importance of user-centric design and functionality in digital solutions. By addressing key user needs and improving the overall experience, the BOC portal has effectively increased its adoption among customs officials and stakeholders. This aligns with TAM's assertion that technology adoption is driven by the perceived advantages it offers to users. The implications of these results are significant, suggesting that continued focus on enhancing the BOC portal's ease of use and usefulness can lead to sustained improvements in customs operations. Overall, the study confirms that the BOC portal has successfully enhanced the efficiency of GD processing, validating the principles of TAM in the context of customs administration.

Analyze the Reduction in Waiting Time for Documentation Verification through the Portal

The study further aimed to analyze the reduction in waiting time for documentation verification facilitated by the Bureau of Customs (BOC) portal. The results, illustrated in Figure 2, show a substantial decrease in average waiting times. Before the BOC portal's implementation, the average waiting time for documentation verification was 13.91 hours. After the portal's implementation, the time was significantly reduced to 4.76 hours.

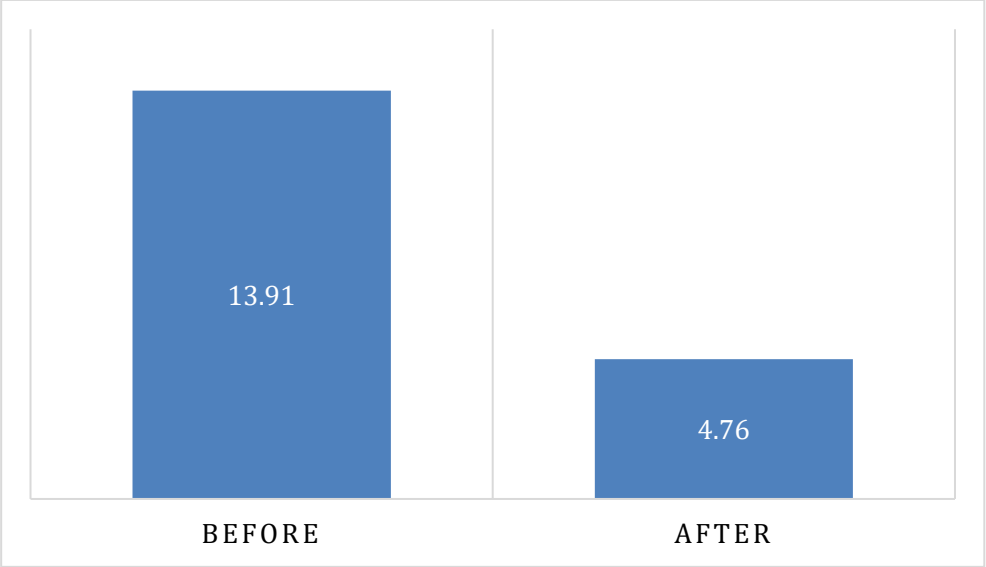

Figure 2. Average Waiting Time for the Documentation Verification Before and After the Implementation of the BOC Portal

To confirm the statistical significance of this reduction, a Paired-Samples T-Test was conducted. The results indicated a significant difference in the average waiting times before and after the portal's implementation, with a t-value of 8.321 and a p-value of less than 0.008. The mean difference in scores was 9.087, with a standard deviation of 20.663, and a confidence interval ranging from 6.939 to 11.235. This significant reduction highlights the portal's effectiveness in expediting the documentation verification process.

The drastic reduction in waiting time suggests that users perceive the BOC portal as both easy to use and highly beneficial. The streamlined process for documentation verification likely enhances the perceived ease of use, as users can complete their tasks more efficiently and with fewer complications. Additionally, the significant reduction in waiting time underscores the portal's perceived usefulness, as it delivers tangible benefits by saving time and reducing delays.

This improvement in waiting times can be attributed to the portal's ability to automate and streamline previously manual processes, reducing bottlenecks and enhancing overall efficiency. The findings align with TAM's assertion that when users perceive a system as useful and easy to navigate, they are more likely to adopt and utilize it effectively. The implications of these results are far-reaching, suggesting that continued focus on improving the BOC portal's user interface and functionality can lead to sustained enhancements in customs operations.

Moreover, the significant reduction in waiting times can lead to increased user satisfaction and compliance, as stakeholders experience quicker and more reliable service. This positive user experience can foster greater trust and reliance on the portal, further driving its adoption and integration into daily operations. In conclusion, the study confirms that the BOC portal has significantly reduced waiting times for documentation verification, thereby validating the principles of TAM and demonstrating its substantial impact on customs processes.

Table 2. Paired Samples T-test Results for the Average Waiting Time for the Documentation Verification Before and After the Implementation of the BOC Portal

Mean	Standard Deviation	Std. Error Mean	Lower	Upper	t	Sig. (2-tailed)
-1.32295	9.31171	0.49561	-2.29768	-0.34821	-2.669	0.008

Interpreting these results through the Technology Acceptance Model (TAM) provides valuable insights into the portal's impact. TAM posits that perceived ease of use and perceived usefulness are critical factors influencing technology acceptance. The significant reduction in waiting time suggests that users find the BOC portal both easy to use and highly beneficial. The streamlined process for documentation verification likely enhances the perceived ease of use, as users can complete their tasks more efficiently and with fewer complications. Additionally, the significant reduction in waiting time underscores the portal's perceived usefulness, as it delivers tangible benefits by saving time and reducing delays.

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The statistical significance of the Paired Samples T-test, with a mean difference of -1.32295 and a confidence interval ranging from -2.29768 to -0.34821, highlights the robustness of these findings. The negative mean difference indicates a clear reduction in waiting times post-implementation, reinforcing the portal's effectiveness. The t-value of -2.669 and the p-value of 0.008 further substantiate the claim that the observed improvements are not due to random chance but are a direct result of the portal's implementation. This statistical validation strengthens the argument for the BOC portal's contribution to the efficiency of customs operations, aligning with TAM's emphasis on the critical importance of perceived ease of use and usefulness in technology adoption.

Compare the Clearance and Release Times of Goods Using Traditional Processing Versus the Portal

The study also aimed to compare the clearance and release times for goods processed through traditional methods versus those processed via the Bureau of Customs (BOC) portal. The results, illustrated in Figure 3, show a notable improvement in processing times after the implementation of the BOC portal. Prior to the portal's implementation, the average clearance and release time for goods was 3.74 days. This significantly improved to 2.91 days after the portal's implementation.

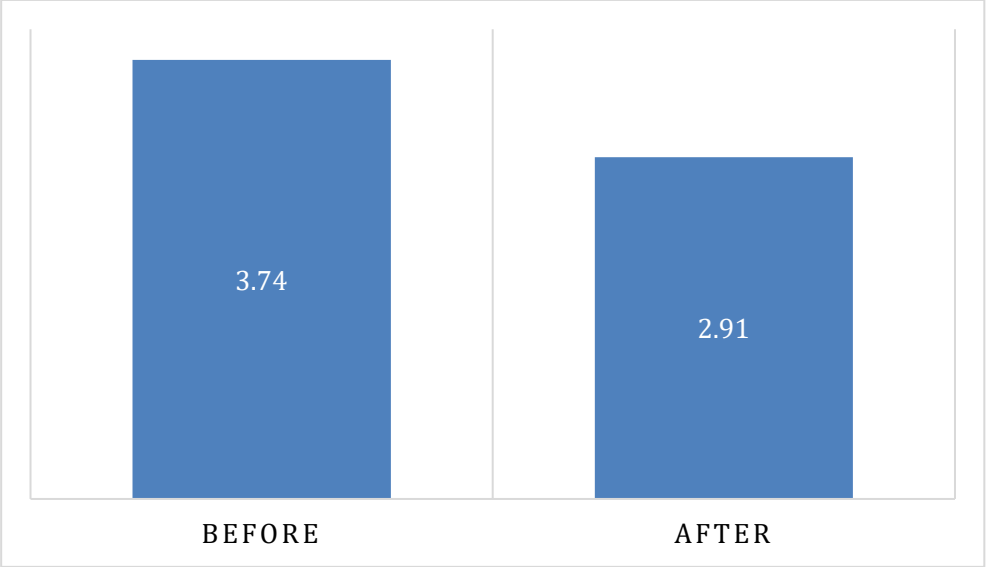

Figure 3. Comparison of the Clearance and Release Times of Goods Using Traditional Processing Versus the Portal

To validate the statistical significance of this improvement, a Paired Samples T-test was conducted. The results, presented in Table 3, indicated a significant difference in the clearance and release times before and after the portal's implementation. The test yielded a t-value of 5.182 and a p-value of less than 0.000, confirming the statistical significance of the observed reduction. The mean difference in scores was 0.80682, with a standard deviation of 2.92102, and a standard error mean of 0.15569. The confidence interval ranged from 0.50061 to 1.11302, further supporting the significance of the reduction in processing times.

Table 3. Paired Samples T-test Results for the Comparison of the Clearance and Release Times of Goods Using Traditional Processing Versus the Portal

Mean	Standard Deviation	Std. Error Mean	Lower	Upper	t	Sig. (2-tailed)
0.80682	2.92102	0.15569	0.50061	1.11302	5.182	0.000

Interpreting these findings through the Technology Acceptance Model (TAM) provides crucial insights into the portal's impact. TAM posits that perceived ease of use and perceived usefulness are key factors influencing technology acceptance. The significant reduction in clearance and release times suggests that users find the BOC portal both easy to use and highly beneficial. The streamlined clearance and release process likely enhances the perceived ease of use, as users can complete their tasks more efficiently and with fewer complications. Additionally, the significant reduction in processing times underscores the portal's perceived usefulness, as it delivers tangible benefits by saving time and reducing delays.

This improvement in clearance and release times can be attributed to the portal's ability to automate and streamline previously manual processes, reducing bottlenecks and enhancing overall efficiency. The findings align with TAM's assertion that when users perceive a system as useful and easy to navigate, they are more likely to adopt and utilize it effectively. The implications of these results are far-reaching, suggesting that continued focus on improving the BOC portal's user interface and functionality can lead to sustained enhancements in customs operations.

Moreover, the significant reduction in clearance and release times can increase user satisfaction and compliance, as stakeholders experience quicker, more reliable service. This positive

user experience can foster greater trust and reliance on the portal, further driving its adoption and integration into daily operations. In conclusion, the study confirms that the BOC portal has significantly reduced clearance and release times for goods, validating the principles of TAM and demonstrating its substantial impact on customs processes.

The statistical significance of the Paired Samples T-test, with a mean difference of 0.80682 and a confidence interval ranging from 0.50061 to 1.11302, highlights the robustness of these findings. The positive mean difference indicates a clear reduction in processing times post-implementation, reinforcing the portal's effectiveness. The t-value of 5.182 and the p-value of less than 0.000 further substantiate the claim that the observed improvements are not due to random chance but are a direct result of the portal's implementation. This statistical validation strengthens the argument for the BOC portal's contribution to the efficiency of customs operations, aligning with TAM's emphasis on the critical importance of perceived ease of use and usefulness in technology adoption.

Investigate the Frequency and Impact of System Downtimes on Processing Efficiency

The study also aimed to investigate the frequency and impact of system downtimes on processing efficiency. The findings, illustrated in Figure 4, provide key insights into the extent and consequences of these downtimes. Specifically, the data revealed that the system experiences considerable downtime, averaging 7.04 hours per month. Each downtime incident typically lasts around 3.84 hours.

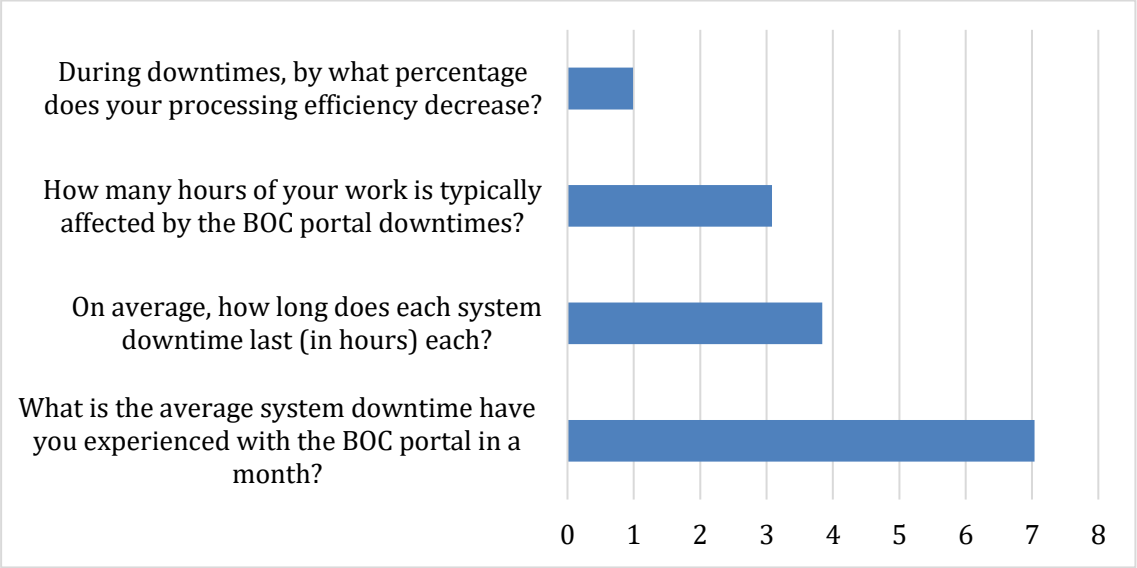

Figure 4. Assessment on the Frequency and Impact of System Downtimes on Processing Efficiency

In terms of impact, these downtimes affect an average of 3.08 work hours and result in the delay of approximately 240 Goods Declarations per incident. Despite these disruptions, the overall reduction in processing efficiency was only 0.99%. This suggests that the work processes exhibit a certain degree of robustness, maintaining efficiency despite system downtime.

The resilience of processing efficiency in the face of downtimes can be attributed to several factors. First, it indicates that there are likely effective contingency plans and backup systems in place to mitigate the impact of downtimes. Additionally, the staff may be well-trained to handle such incidents, ensuring that delays are minimized and operations can quickly return to normal once the system is back online.

The minimal reduction in processing efficiency (0.99%) despite frequent downtimes underscores the robustness of the BOC's operational processes. This resilience can be seen as a positive indication of the system's overall reliability and the effectiveness of any implemented downtime mitigation strategies. It also highlights the importance of having robust operational procedures and contingency plans to handle unexpected disruptions.

While the respondents' direct responses provide valuable insights, further detailed analysis could help clarify the specific strategies that contribute to this robustness. For instance, understanding the exact nature of the contingency plans, staff training programs, and backup systems could provide a roadmap for other organizations facing similar challenges.

In conclusion, while system downtime does occur with some frequency and for varying durations, its overall impact on processing efficiency is relatively minor. The ability to maintain high levels of efficiency despite these downtimes indicates a strong and resilient operational framework within the BOC. This finding is crucial for future improvements and can serve as a benchmark for other customs operations aiming to enhance their efficiency and resilience.

Further studies could focus on identifying and analyzing the specific elements that contribute to this robustness, providing deeper insights into effective downtime management strategies. Understanding these elements could help further minimize the impact of downtime and enhance overall processing efficiency.

These results are consistent with evidence that system interruptions in mission-critical public platforms can delay large transaction volumes and weaken user satisfaction, underscoring the central role of system and service quality in information systems performance (Matsudaira & Koh, 2022; Jaleta & Tulu, 2023).

Objective 2: Evaluate the Effectiveness of the Portal in Ensuring Accuracy and Compliance with Customs Regulations

Analysis of Error Rate in Goods Declarations Submitted Through the Portal

The second objective of the study was to evaluate the BOC portal's effectiveness in ensuring accuracy and compliance with customs regulations. This section examines the error rate of Goods Declarations submitted through the portal.

Table 4. Error Rate in Goods Declarations Submitted Through the Portal

Statement	Total
On average, how much additional time (in days) is required to correct an error in a Goods Declaration?	132.43
How many times per month do these common errors occur, on average, based on your experience?	131.42
On average, how many errors do you typically encounter for every 100 Goods Declarations you submit through the portal?	4.33
On average, what percentage of your total submissions through the portal required corrections for errors in a month?	0.28

The analysis of error rates in Goods Declarations submitted through the portal reveals several critical insights. Firstly, the average error rate is 4.33 errors per 100 submissions, which equates to 4.33%. This indicates that although most submissions are accurate, errors are not uncommon and warrant attention.

Secondly, on average, 0.28% of total submissions require corrections each month. Although this percentage may seem small, it still highlights errors that need to be addressed to ensure

compliance and accuracy. Thirdly, the average time required to correct an error is significant, at 132.43 days. This extended correction period highlights inefficiencies and delays in the current process, which could lead to substantial operational disruptions and increased costs. Lastly, with an average of 131.42 errors per month, these errors are not isolated incidents but a recurring issue that requires systematic corrective measures.

The analysis reveals that the BOC portal has an average error rate of 4.33% for Goods Declarations, with an average correction time of 132.43 days. These findings reflect the broader challenges in error management noted in the literature. According to Arvis et al. (2018), efficient customs processing systems should minimize errors and reduce correction times. The significant error rate and extended correction period suggest that further improvements are necessary to align with best practices in customs processing. The observed error rate and prolonged correction cycle mirror reports indicating that interface complexity and evolving regulatory requirements sustain error incidence and lengthen correction cycles unless validation and training are strengthened (Jaleta & Tulu, 2023; UNCTAD, 2024).

Assess the Portal's Capability to Detect and Prevent Regulatory Non-Compliance

To assess the portal's capability to detect and prevent regulatory non-compliance, a Paired Samples t-test was performed. This test compared the average number of compliance-related alerts respondents receive from the portal each month with the average number of instances of regulatory non-compliance detected in their submissions. The results indicated a significant difference between these two events.

The analysis showed that the former (compliance-related alerts) had a mean score of -2.026 with a standard deviation of 7.198. In contrast, the post-event (instances of regulatory non-compliance detected) had a confidence interval ranging from -2.779 to -1.272. The t-test results were t = -5.287 with a p-value < 0.000, indicating a statistically significant difference.

Table 5. Assessment of the Portal's Capability to Detect and Prevent Regulatory Non-Compliance

Mean	Standard Deviation	Std. Error Mean	Lower	Upper	t	Sig. (2-tailed)
-2.02550	7.19785	0.38310	-2.77895	-1.27204	-5.287	0.000

These findings suggest that the portal is effective at generating compliance-related alerts that significantly differ from the actual instances of regulatory non-compliance detected. The negative mean score indicates that the portal tends to generate fewer compliance-related alerts than the actual non-compliance instances detected, suggesting a potential area for improvement in the portal's alert system.

The significant discrepancy between compliance-related alerts and the actual instances of regulatory non-compliance detected by the portal suggests that, while the portal's alert system is effective, it requires further enhancement. Chapa (2020) highlights the importance of continuous innovation in IT solutions for customs processes to improve both detection and prevention of non-compliance.

Analyze the Effectiveness of the Portal's Audit Trail Features in Maintaining Transparent and Trackable Records

The effectiveness of the portal's audit trail features was analyzed in two facets. First, the effectiveness of the audit trail feature itself was examined. A mean rating of 3.019 on a scale from 1 to 4 (where 1 is very ineffective and 4 is very effective) suggests that employees generally find the

audit trail feature effective. This suggests that the audit trail feature is well-regarded for its ability to track changes to Goods Declarations.

Secondly, the impact of the audit trail feature on resolving disputes was assessed. The data showed a monthly average of 1.99 instances, indicating that the audit trail feature helped address and resolve disputes or clarify declarations approximately twice a month. Given that this is discrete data, it can be rounded to 2, reinforcing the utility of the audit trail in practical scenarios.

Table 6. Effectiveness of the Portal's Audit Trail Features in Maintaining Transparency and Trackable Records

Statement	Mean	Standard Deviation
How would you rate the effectiveness of the audit trail feature in tracking changes to Goods Declarations on a scale from 1-4 (1 as very ineffective and 4 as very effective)?	3.019	0.904
On a monthly average, how many times have audit trails helped you resolve disputes or clarify declarations?	1.990	2.758

These findings indicate that the audit trail feature is perceived as effective by users and plays a significant role in resolving disputes and clarifying declarations. The mean rating of 3.019 suggests a high level of satisfaction with the audit trail's ability to maintain transparent, trackable records. Moreover, the feature's utility in resolving disputes twice a month underscores its practical importance in operational contexts.

The audit trail feature of the BOC portal received a mean effectiveness rating of 3.019 out of 4, with an average of 1.990 disputes resolved per month. This is consistent with findings from the literature that underscore the importance of digital tools in providing transparency and improving dispute resolution. Systems like ASYCUDA have shown similar benefits globally, improving operational transparency and efficiency (UNCTAD, 2024).

Objective 3: Identify Challenges and Bottlenecks in the Current GD Processing System

Identify Common Errors or Issues Encountered by Users When Submitting Goods Declarations Through the Portal

The analysis of common errors users encounter when submitting Goods Declarations (GD) through the BOC portal reveals several significant issues. The most frequent errors include typographical errors, wrong attachments, and issue summaries. These errors represent the primary challenges and bottlenecks in the current GD processing system.

Table 7. Frequency Table for the Types of Error

Error Type	Frequency	Percentage (%)
Typographical errors	198	28.0%
Wrong attachments	181	25.6%
Issue Summary	107	15.1%
Wrong Goods Declaration Reference Number	76	10.7%
Name of Importer	59	8.3%
Wrong Port Code	54	7.6%
Wrong Declaration Type	45	6.4%
Name of Declarant	10	1.4%

The data show that typographical errors are the most common, with 198 occurrences, accounting for 28.0% of all errors. Wrong attachments follow this (reported 181 times, 25.6%) and issue summaries (noted 107 times, 15.1%). Other notable errors include wrong Goods Declaration Reference Numbers (76 occurrences, 10.7%), incorrect names of importers (59 occurrences, 8.3%), wrong port codes (54 occurrences, 7.6%), wrong declaration types (45 occurrences, 6.4%), and incorrect names of declarants (10 occurrences, 1.4%).

These findings highlight the areas where users frequently encounter difficulties, indicating the need for targeted improvements in the portal's interface and user guidance. Addressing these common errors can significantly enhance the efficiency and accuracy of the GD processing system.

Investigate Any Technical Limitations or Inefficiencies of the Portal That Contribute to Processing Delays

The investigation into the technical limitations and inefficiencies of the BOC portal reveals significant factors contributing to processing delays. The data indicates that the average resolution time for technical issues is about 138.65 hours, suggesting substantial delays in resolving problems. Additionally, the frequency of technical limitations incidents is approximately 3.88 times per employee/respondent, which could be a critical factor in processing delays.

Moreover, the resolution rate for reported issues is alarmingly low at 0.79%, indicating potential inefficiencies or an overwhelmed technical support system. This low resolution rate further exacerbates processing delays and highlights the need for improvements in technical support and issue management.

Table 8. Summary of the Technical Issues and Limitations for the BOC Portal

Statement	Average
On average, how long does it take to resolve a technical issue on the BOC portal (in hours)?	138.65
On average, how often do you encounter technical limitations with the BOC portal that hinder processing?	3.88
On average, how many technical issues have been reported in a month based on your experience?	3.07
What percentage of reported technical issues are resolved in a month based on your experience?	0.79

The data shows that it takes an average of 138.65 hours to resolve a technical issue, which is a significant delay. Employees encounter technical limitations approximately 3.88 times on average, and about 3.07 technical issues are reported monthly. However, only 0.79% of these issues are resolved within a month, underscoring the inefficiency or overload of the technical support system.

These findings suggest that the BOC portal's technical limitations and inefficiencies are major contributors to processing delays. The extended resolution time and low resolution rate indicate a need for better technical support infrastructure and more efficient issue management processes.

The average resolution time for technical issues was 138.65 hours, with a low resolution rate of 0.79%. These inefficiencies reflect broader challenges in technical support and system capacity. The literature suggests that addressing these issues is crucial for improving customs processing systems. Azcárraga et al. (2022) and Yereshko et al. (2024) emphasize the need for robust technical support and infrastructure upgrades to manage data throughput and user demand effectively.

In conclusion, addressing these technical limitations and inefficiencies is crucial to reducing processing delays and improving the BOC portal's overall functionality. Enhancing the technical support system and increasing the resolution rate for reported issues will significantly improve the

efficiency and reliability of the GD processing system.

Survey Stakeholders to Gather Feedback on Difficulties Faced During the GD Process

Given the high average number of technical issues reported, which stands at 3.07 per month, as well as the frequent technical limitations, it is crucial to gather feedback from respondents and stakeholders. Their insights will provide critical perspectives on the BOC portal's performance, user acceptability, and overall user experience. This feedback will be invaluable in identifying specific areas for improvement and understanding the broader impact of technical issues on the GD process.

Analyze Data Throughput and Capacity Issues That May Cause Bottlenecks in Processing

The high average resolution time of 138.65 hours and the low percentage of issues resolved, at a mere 0.79%, suggest significant inefficiencies in data throughput and capacity constraints. These inefficiencies likely contribute to processing bottlenecks, driven by two primary factors: low throughput and capacity constraints.

1. Low Throughput**:**
   The portal may not efficiently handle the volume of data being processed, indicated by slow processing times and increased resolution times for technical issues. This low throughput results in delays and prolonged resolution times, impacting the overall efficiency of the GD processing system.
2. Capacity Constraints**:**
   The BOC portal's infrastructure may not fully support the number of concurrent users, demand, and transactions. This leads to bottlenecks, causing delays in processing and resolution. The inability to manage high user demand and transaction volumes effectively points to capacity issues within the system.

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On average, how many technical issues have been reported in a month based on your experience?	3.07
What percentage of reported technical issues are resolved in a month based on your experience?	0.79

These findings underscore the need for a comprehensive review and upgrade of the BOC portal's infrastructure to improve data throughput and address capacity constraints. Enhancing the portal's ability to handle larger volumes of data and support more concurrent users will be critical in reducing processing delays and improving the overall efficiency of the GD processing system.

The high frequency of reported technical issues and the technical limitations experienced by stakeholders underscore significant challenges in system performance and user experience. This aligns with research on the impact of technology adoption in customs administration, which highlights the need for ongoing adjustments to meet user needs and improve system efficiency (Shpak et al., 2020; Bekkers et al., 2021).

In conclusion, gathering stakeholder feedback and addressing data throughput and capacity issues are essential steps in identifying and mitigating the challenges and bottlenecks in the current GD processing system. By focusing on these areas, the BOC portal can enhance its performance, increase user satisfaction, and streamline the GD processing workflow.

CONCLUSIONS

This study evaluated the performance of the Bureau of Customs (BOC) portal in processing Goods Declarations at the Port of Manila and the Manila International Container Port under the zero contact policy. The results demonstrate that the portal contributed to notable improvements in operational efficiency. Significant reductions were observed in Goods Declaration processing time, documentation verification time, and clearance and release time, indicating that the digital platform streamlined key stages within the customs process.

The findings also reveal that the portal supported compliance functions, although gaps remained between the number of alerts generated and the number of actual non-compliant submissions detected. Accuracy-related challenges persist, as shown by a Goods Declaration error rate of 4.33 percent and exceptionally long correction durations. System quality concerns were also evident, particularly the frequency and duration of downtime incidents that delayed substantial volumes of declarations despite having a limited effect on overall monthly efficiency rates. Furthermore, the lengthy resolution time for technical issues and the low resolution rate emphasize the critical role of service quality in system performance.

Taken together, the results show that the Bureau of Customs (BOC) portal has made meaningful progress in enhancing efficiency and supporting compliance monitoring, but its performance is constrained by issues relating to information quality, system quality, and technical support capacity. These insights underline the importance of strengthening digital customs infrastructure, improving data quality processes, and ensuring responsive support systems to sustain and expand the benefits of digitalization in customs administration.

IMPLICATIONS

Theoretical Implications

The findings reinforce the relevance of the Technology Acceptance Model (TAM) by showing how perceived usefulness and ease of use translate into improved processing, verification, and clearance times. The persistence of user errors and correction delays highlights the importance of interface design and training in shaping ease of use.

The study contributes to Diffusion of Innovations theory by demonstrating how relative advantage, compatibility, and complexity manifest in the context of digital customs. Efficiency gains reflect relative advantage, while recurring errors and capacity constraints illustrate complexity and uneven adoption.

The results also strengthen the DeLone and McLean Information Systems Success Model. System quality issues, particularly downtime and throughput limitations, were shown to affect operational outcomes, while information quality challenges, such as error rates and long correction times, constrained compliance. Despite these issues, positive user experiences with audit trail features indicate that system use and user satisfaction continue to drive net benefits. Together, the integrated models offer a comprehensive explanation of technology adoption and performance outcomes in customs modernization.

Practical Implications

The findings highlight several practical actions needed to strengthen the performance of the Bureau of Customs (BOC) portal. Although the portal has improved processing, verification, and clearance times, persistent issues such as recurring user errors, lengthy correction periods, limited accuracy of compliance alerts, system downtime, and slow resolution of technical issues continue to limit its full effectiveness.

First, validation rules and data-entry controls should be strengthened to reduce common errors, such as typographical mistakes, incorrect attachments, and incomplete summaries.

Enhanced data validation and automated error detection mechanisms can reduce error rates and correction workloads.

Second, the lengthy correction duration of more than 130 days indicates the need for a dedicated correction workflow module that provides automated notifications, tracking dashboards, and clear guidance for brokers and declarants. This improvement would address significant delays linked to information quality.

Third, the portal's compliance alert system should be recalibrated using rule-based or analytic techniques to better align with actual non-compliant submissions. Strengthening alert accuracy will support more effective regulatory monitoring.

Fourth, system quality must be improved by reducing downtime through infrastructure upgrades, redundancy mechanisms, and improved load distribution. Given that each downtime incident delays large volumes of declarations, enhancing reliability is essential for sustaining operational performance.

Fifth, the extremely low technical support resolution rate underscores the need to reinforce helpdesk capacity. Increasing staffing, improving ticket prioritization, and implementing escalation protocols can significantly enhance service quality and support user satisfaction.

Sixth, interface improvements such as guided workflows, auto-complete fields, and real-time suggestions can reduce user errors and improve perceived ease of use. Regular training sessions should complement these enhancements to build user competence.

Finally, establishing structured stakeholder feedback mechanisms is crucial. Continuous user feedback through consultations or in portal feedback tools will enable iterative refinements, increase user acceptance, and support long-term adoption.

These practical implications provide a coherent set of recommendations to improve system reliability, enhance information quality, strengthen support services, and optimize the user experience, thereby helping the Bureau of Customs (BOC) align the portal with international digital customs standards.

LIMITATION & FURTHER RESEARCH

This study has several limitations that should be considered when interpreting the findings. First, the analysis was limited to two major ports in the Philippines, namely the Port of Manila and the Manila International Container Port. While these ports handle a substantial share of national containerized trade, the results may not fully represent conditions in smaller or less technologically resourced ports. Differences in infrastructure readiness, staff capacity, and transaction volumes across ports may lead to varying performance outcomes of the Bureau of Customs portal.

Second, the study relied primarily on self-reported survey data complemented by secondary operational records. Although survey responses provide valuable insights into user experience, they may be subject to recall bias or respondent perception. Objective, system-generated transaction logs could offer additional precision in measuring processing times, error frequency, and the impact of downtime.

Third, the study focused on descriptive performance comparisons and paired-sample t-tests to evaluate pre- and post-implementation outcomes. The analysis did not examine causal relationships or employ longitudinal modeling techniques. Consequently, while performance improvements are documented, the study does not attribute these changes exclusively to specific system features or organizational interventions.

Fourth, the Technology Acceptance Model, Diffusion of Innovations theory, and the DeLone and McLean Information Systems Success Model were applied as interpretive lenses rather than being directly operationalized as psychometric constructs. As such, user attitudes such as perceived usefulness, perceived ease of use, and satisfaction were inferred from observed performance

outcomes rather than measured explicitly through validated multi-item scales.

Future research may address these limitations in several ways. Subsequent studies could expand the scope to include additional ports and regional customs offices, enabling comparative analysis across different operational contexts. Incorporating system-generated transactional data and log files would improve measurement accuracy and reduce reliance on self-reported indicators. Longitudinal designs and multivariate modeling may also be employed to examine causal mechanisms and identify key drivers of efficiency, accuracy, and compliance performance.

Further research may explicitly measure technology acceptance and information systems success constructs using validated survey instruments to test theoretical relationships more rigorously. Qualitative approaches, such as interviews or focus group discussions with customs officers, brokers, and system developers, could provide deeper insights into the organizational, technical, and behavioral factors that affect portal performance. Finally, comparative studies across countries or across different customs digital platforms may offer broader lessons for customs modernization and digital trade facilitation initiatives.

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