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Predictors and challenges associated with the operational implementation of the Terminal Appointment Booking System (TABS) in Olongapo City SBMA Ports

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Abstract

The Terminal Appointment Booking System (TABS) was implemented in Philippine ports to address congestion, improve truck scheduling, and enhance operational efficiency. Despite its intended benefits, concerns regarding booking errors, appointment violations, and user accessibility continue to affect its effectiveness. This study examined the predictors and challenges associated with the operational implementation of TABS in the Subic Bay Metropolitan Authority (SBMA) Ports, Olongapo City. A quantitative descriptive research design was employed. Data were collected from 50 stakeholders, including truck drivers, logistics coordinators, customs brokers, terminal staff, and other port-related personnel, using a researcher-made questionnaire. Descriptive statistics, Analysis of Variance (ANOVA), and Pearson Product-Moment Correlation were utilized to analyze the data. Findings revealed that respondents generally agreed that TABS positively influenced port operations, particularly in terms of perceived operational efficiency (WM = 2.84), booking success rate (WM = 2.81), and user satisfaction (WM = 2.80). However, appointment violations and turnaround time remained operational concerns. Significant differences in perceptions of turnaround time were found when respondents were grouped according to role in port operations. Major challenges identified included insufficient user training, resistance to digital adoption, weak compliance enforcement, and booking congestion during peak periods. The study concludes that TABS contributes positively to port efficiency and logistics coordination. Nevertheless, strengthening user training, improving compliance monitoring, and enhancing system support mechanisms are necessary to maximize its operational effectiveness and ensure sustainable digital transformation in port management.

Keywords: Terminal Appointment Booking System (TABS), port operations, operational efficiency, booking success rate, turnaround time, digitalization, logistics management, port congestion

Predictors and challenges associated with the operational implementation of the Terminal Appointment Booking System (TABS) in Olongapo City SBMA Ports

1. Introduction

Port congestion and inefficient cargo movement have long been challenges in the Philippine logistics sector, particularly in high-traffic areas like the Port of Manila. In response, the Terminal Appointment Booking System (TABS) was introduced as a digital solution to regulate truck entry, streamline scheduling, and improve overall port efficiency. While the system has been widely adopted, its actual impact on operational performance and stakeholder satisfaction remains underexplored. Despite its intended benefits, many logistics providers and truck operators continue to report issues such as missed appointments, booking errors, and long turnaround times. These concerns raise questions about the effectiveness of TABS in achieving its goals and whether it adequately serves the needs of its users.

The implementation of the TABS in major Philippine ports was introduced as a strategic solution to address chronic port congestion, inefficient truck scheduling, and delays in cargo movement. While TABS aims to streamline logistics operations by regulating truck entry and improving turnaround times, its actual impact on port efficiency and stakeholder satisfaction remains underexplored, especially from a data-driven perspective. Despite its widespread use, anecdotal reports suggest persistent issues such as missed appointments, booking errors, and limited user accessibility. These concerns raise questions about the system's effectiveness and its alignment with the operational needs of truckers, logistics providers, and customs brokers.

The Professional Customs Brokers Association of the Philippines (PCBAPI) criticized TABS for disrupting just-in-time delivery and increasing operational costs. Brokers reported difficulty in booking slots, leading to delays, added fees (e.g., demurrage or charges, detention), and inefficiencies in cargo release. The system was seen as contradicting the flow of trade and potentially contributing to port congestion. On the same manner, the Philippine Institute for Development Studies (PIDS) Discussion Paper Series No. 2013-48 Title: Customs Brokerage Services and Trade Facilitation: A Review of Regulatory Issues Summary discusses the tension between modernization efforts (like TABS) and the traditional role of customs brokers. It highlights resistance from brokers due to perceived loss of relevance and operational mismatches, especially in adapting to automated systems. The paper calls for a paradigm shift among brokers to embrace modernization while acknowledging the regulatory and procedural gaps.

A quantitative descriptive study is essential to measure key performance indicators such as average truck turnaround time, frequency of appointment violations, and user satisfaction levels. By gathering empirical data, this research will provide a clearer understanding of how TABS functions in practice, identify areas for improvement, and support evidence-based policy decisions to enhance port logistics and customs administration. This study sought to provide a data-driven assessment of TABS by examining key performance indicators such as truck turnaround time, booking success rate, and user satisfaction. Through a quantitative descriptive approach, the research aims to generate empirical insights that can inform future improvements in customs administration and port logistics, hence this study.

Statement of the Problem - This study aimed to determine and analyze the predictors affecting the outcomes with the operational implementation of the Terminal Appointment Booking System (TABS) in Subic Bay Ports Authority (SBMA), Olongapo City during SY 2025-2026. Specifically, it sought to provide answers to the following questions:

- What is the respondents' profile in terms of: Role in port operation; Length of experience using TABS; and Level of usage of TABS?

- How are the predictors affecting the outcomes on the implementation of TABS be measured in terms of: Truck turnaround time (in hours); Booking success rate; User satisfaction level; Frequency of appointment violations; and Perceived efficiency of port operations?
- How are the challenges encountered in the implementation of TABS?
- Is there a significant difference on the perceived predictors affecting outcomes on the implementation of operational impact of TABS when grouped according to respondents' profile?
- Is there a significant difference on the challenges encountered on the implementation of operational impact of TABS when grouped according to respondents' profile?
- Is there a significant relationship between the predictors and the outcome on the implementation of of operational impact of TABS?

2. Related Literature and Studies

The impact of digitalization on operational efficiency, innovation, and competitiveness - The influence of digitalization on efficiency, innovation, and competitiveness is significant and complex, impacting numerous sectors and business models (Narleva, 2024). Digitalization serves as a catalyst for enhancing operational efficiency by streamlining processes, reducing expenses, and optimizing service de livery (Belev & Daskalo, 2019). Organizations that successfully implement digital technologies can significantly enhance their market competitiveness by leveraging data analytics, automation, and digital marketing strategies to optimize their operations and establish connections with broader audiences (Dimitrakieva & Atanasova, 2023). In the domain of operational effectiveness, digitalization enables companies to automate routine tasks, thereby liberating human resources for more tactical endeavors. Supply chain management, for instance, has demonstrated a notable enhancement in responsiveness and flexibility through the integration of digital tools, thereby enabling businesses to swiftly adapt to market fluctuations and evolving customer demands (Ning & Yao, 2023). More over, the utilization of digital platforms facilitates the immediate exchange of data and collaboration among stakeholders, which is imperative for optimizing supply chain efficiency and reducing lead times (Ning & Yao, 2023). This operational flexibility results in reduced costs and also improves customer satisfaction, which in turn strengthens a company's competitive edge in the market place (Boikova et al., 2021). Innovation is yet another essential realm where digitalization has a profound effect. The incorporation of digital technologies promotes a culture of innovation in organizations, allowing them to create new products and services that meet changing consumer demands. Digital tools, such as big data analytics and artificial intelligence, offer important insights that guide product development and marketing approaches (Kreuzer et al., 2022).

Understanding Turnaround Management - Turnaround management is a critical aspect of operational efficiency in various industries, including oil and gas, manufacturing, and utilities. It encompasses the processes involved in planning, executing, and controlling the complete overhaul of a facility or system. Effective turnaround management ensures that operations can resume promptly and efficiently, thereby minimizing downtime and maximizing productivity (Bassey, 2022, Odulaja, et al., 2023). This overview provides insight into the turnaround processes across different sectors, highlights common challenges faced during these periods, and emphasizes the need for innovative strategies to address these challenges, particularly concerning ramp-up durations post-maintenance. In the oil and gas industry, turnaround processes are often extensive and require meticulous planning. These turnarounds involve routine maintenance, equipment upgrades, and safety checks to ensure that facilities operate efficiently and safely (Norresjö & Karlsson, 2022).

Similarly, in manufacturing, turnaround management focuses on the systematic overhaul of production lines to accommodate new technologies, maintain equipment, and improve production capabilities (Rana, 2022). The utility sector also engages in turnarounds to update infrastructure and enhance the reliability of service delivery. These sectors share a common goal: to reduce operational downtime while maintaining safety and compliance

with regulatory standards (Ozowe et al., 2023). Despite the structured approaches to turnaround management, numerous challenges persist. One of the most significant issues is the potential for downtime and productivity loss. Extended downtimes during turnarounds can lead to substantial financial implications, especially in industries where profit margins are tightly controlled. For instance, a study by Fridholm and Brogren (2017) indicated that facilities that experienced prolonged down-times during maintenance phases suffered considerable losses in revenue and market share. Such financial consequences underscore the necessity of effective turnaround management to mitigate these risks (Agupugo, 2023; Ogedengbe et al., 2023). Resource allocation issues further complicate the turnaround process. Ensuring that the right resources, including skilled personnel, materials, and equipment, are available at the right time is crucial for minimizing delays and maximizing efficiency (Bassey, 2023, Okeleke et al., 2023). The complexity of resource allocation is heightened by the need for collaboration among various stakeholders, including maintenance teams, suppliers, and regulatory bodies. Mathebula (2016) noted that improper resource allocation can lead to scheduling conflicts, resulting in increased costs and project delays. Therefore, developing efficient strategies for resource management is essential to streamline turnaround processes and reduce ramp-up durations.

Coordination among teams also presents a considerable challenge during turnarounds. Turnaround activities often involve multiple teams working on different tasks simultaneously, which can lead to confusion and miscommunication. Effective communication is vital to ensure that all teams are aligned and that their activities do not interfere with one another (Adejugbe & Adejugbe, 2019; Okpeh & Ochefu, 2010). According to Adeyemi (2018), a lack of coordination can result in rework, inefficiencies, and ultimately, prolonged ramp-up durations post-maintenance. Enhancing collaboration through integrated planning and communication strategies can help alleviate these challenges and facilitate smoother turnaround processes. To address these common challenges, organizations must adopt innovative strategies that enhance turnaround management. Implementing advanced technologies, such as digital twins, predictive analytics, and real-time monitoring systems, can significantly improve planning and execution during turnarounds (Enebe, 2019; Ojebode & Onekutu, 2021). Digital twins create virtual replicas of physical assets, enabling organizations to simulate and analyze various scenarios before executing the actual turnaround. This technology can help identify potential bottlenecks and optimize resource allocation, ultimately reducing ramp-up durations (Hajjarsaraei et al., 2018). Predictive analytics also plays a crucial role in turnaround management by utilizing historical data to forecast potential failures and maintenance needs. By anticipating equipment issues, organizations can proactively schedule maintenance activities, thereby minimizing unplanned downtime and ensuring a smoother transition back to full operational capacity (Enebe et al., 2022; Olufemi et al., 2012). A study by Franz, (2022) demonstrated that organizations leveraging predictive analytics experienced a significant reduction in downtime and ramp-up durations during turnarounds compared to those relying solely on traditional maintenance practices.

Furthermore, fostering a culture of continuous improvement within organizations can contribute to more effective turnaround management. Encouraging teams to share insights, lessons learned, and best practices can lead to innovative solutions that enhance turnaround processes. For example, implementing regular debriefing session's post-turnaround allows teams to reflect on their performance and identify areas for improvement (Bassey, 2023; Enebe et al., 2022; Oyeniran et al., 2022). According to a study by Cheng et al. (2020), organizations that prioritize continuous improvement in their turnaround processes consistently achieve better outcomes in terms of efficiency and reduced ramp-up durations. Moreover, adopting lean management principles can significantly enhance turnaround efficiency. Lean methodologies focus on eliminating waste and optimizing processes, which is particularly relevant during turnarounds. By streamlining workflows, minimizing unnecessary tasks, and ensuring that resources are used effectively, organizations can reduce turnaround durations. A recent study by Attri, (2023) found that companies applying lean principles during maintenance turnarounds experienced up to a 30% reduction in ramp-up times, underscoring the effectiveness of these strategies. Training and development of personnel also play a vital role in improving turnaround management. Ensuring that team members are equipped with the necessary skills and knowledge to execute their tasks efficiently can minimize delays and improve coordination among teams. Implementing targeted training programs that address specific challenges faced during

turnarounds can lead to better performance and more effective collaboration (Agupugo & Tochukwu, 2021). Research by Nicholas, 2023) indicated that organizations investing in employee training during turnaround periods achieved higher levels of operational efficiency and shorter ramp-up durations.

In conclusion, turnaround management is a vital component of operational efficiency across various industries. The processes involved in managing turnarounds present numerous challenges, including downtime and productivity loss, resource allocation issues, and coordination among teams. Addressing these challenges through innovative strategies—such as the implementation of advanced technologies, a culture of continuous improvement, lean management principles, and personnel training—can significantly reduce ramp-up durations post-maintenance (Adejugbe & Adejugbe, 2014). By focusing on these strategies, organizations can enhance their turnaround management processes, ultimately improving their overall operational performance and competitiveness in the market.

Innovative Strategies for Turnaround Management - Innovative strategies in turnaround management are essential for minimizing ramp-up duration post-maintenance. One of the most impactful approaches in this domain is predictive maintenance, which leverages data analytics and machine learning to optimize maintenance practices (Esiri et al., 2023). Predictive maintenance refers to the use of data analysis tools and techniques to predict when equipment will fail so that maintenance can be performed just in time to address the issue before it occurs. This proactive approach is critical in industries such as manufacturing, oil and gas, and utilities, where unplanned downtime can result in significant financial losses (AlHamouri et al., 2021). The importance of predictive maintenance lies in its ability to enhance operational efficiency, reduce costs, and improve safety. By predicting equipment failures, organizations can schedule maintenance activities more effectively, minimizing the need for extensive turnarounds that disrupt operations. For instance, a study by Hansen and Grunow (2015) highlighted how predictive maintenance significantly reduced unplanned outages in a petrochemical plant, leading to enhanced production capacity and improved safety outcomes. By transitioning from reactive to predictive maintenance, organizations not only optimize their resources but also foster a culture of continuous improvement (Agupugo et al., 2022). Data analytics and machine learning play a pivotal role in the effectiveness of predictive maintenance. These technologies enable organizations to analyze vast amounts of data generated by equipment sensors, historical maintenance records, and operational parameters. Machine learning algorithms can identify patterns and anomalies in this data, facilitating early detection of potential issues (Abuza, 2017; Oyeniran, et al., 2023).

A notable example can be seen in the work of Saghafian et al. (2015), which demonstrated how machine learning algorithms were employed in a manufacturing facility to analyze vibration data from machinery. The results led to a 40% reduction in maintenance costs and a significant decrease in equipment failures, ultimately shortening turnaround durations. Successful case studies further illustrate the benefits of predictive maintenance in turnaround management. For example, a major oil and gas company implemented a predictive maintenance program using advanced analytics and machine learning (Adewusi et al., 2023). By analyzing real-time data from offshore drilling rigs, the company was able to predict equipment failures with high accuracy, allowing them to schedule maintenance activities more strategically. This resulted in a reduction of turnaround times by approximately 30%, which translated into substantial cost savings and improved production schedules (Scala et al., 2021). Such case studies highlight the transformative potential of predictive maintenance in enhancing turnaround management processes.

In addition to predictive maintenance, the adoption of digital tools and technologies is crucial for revolutionizing turnaround management. Mobile applications for real-time communication play a significant role in improving coordination among teams during maintenance activities. These applications enable instant communication between field personnel, maintenance teams, and management, ensuring that everyone is informed of any changes or updates (Adejugbe & Adejugbe, 2015; Oyeniran, et al., 2023). A study by Carlsson and Ernefelt (2017) found that the implementation of mobile communication tools in a manufacturing facility improved response times to issues during turnarounds, ultimately reducing ramp-up durations. Cloud-based platforms for collaboration are another vital component of digital transformation in turnaround management. These platforms

facilitate seamless information sharing and collaboration among stakeholders, regardless of their physical location. For instance, the use of cloud-based project management tools allows teams to access real-time data and project updates, streamlining decision-making processes (Bassey, 2022). According to a report by Krishnankutty et al. (2019), organizations that adopted cloud-based collaboration tools during turnarounds experienced a significant increase in efficiency, with project timelines shortened by an average of 25%. Such platforms enhance visibility into project progress, enabling teams to address potential delays proactively. The benefits of digital transformation in turnaround management extend beyond improved communication and collaboration. By integrating digital tools into their operations, organizations can gain valuable insights into their maintenance processes. For example, data collected from mobile applications and cloud platforms can be analyzed to identify trends, assess performance metrics, and uncover areas for improvement (Ezeh et al., 2023). This data-driven approach empowers organizations to make informed decisions that enhance their turnaround strategies.

A study by Ghadimi et al. (2023) revealed that companies embracing digital transformation in their maintenance operations not only achieved faster turnaround times but also reported higher employee satisfaction and improved safety performance. Moreover, digital technologies enable the visualization of complex data, allowing for better understanding and analysis of maintenance activities. Augmented reality (AR) and virtual reality (VR) applications can be utilized to provide immersive training experiences for maintenance personnel, helping them familiarize themselves with equipment and procedures before actual maintenance activities commence. Such training tools can lead to increased competency and confidence among workers, ultimately reducing errors and enhancing efficiency during turnarounds (Wise, 2017).

Challenges and Barriers to Implementation - Implementing innovative strategies in turnaround management to reduce ramp-up duration post-maintenance is vital for organizations seeking to enhance operational efficiency and minimize downtime. However, several challenges and barriers can impede the successful execution of these strategies. Key among these challenges are resistance to change within organizations, financial constraints and resource limitations, and ensuring stakeholder buy-in and support (Adejugbe, 2021). Understanding these barriers is crucial for organizations to navigate the complexities of turnaround management effectively. Resistance to change is a common phenomenon in many organizations, particularly when it comes to implementing new strategies or technologies. Employees and management may feel threatened by changes that could disrupt established routines or alter their roles within the organization. This resistance can stem from various predictors, including fear of the unknown, skepticism about the effectiveness of new strategies, and a general preference for maintaining the status quo (García et al., 2021). The impact of resistance to change can be particularly pronounced during turnaround periods when organizations are under pressure to achieve rapid results. To mitigate resistance to change, organizations must foster a culture that embraces innovation and adaptability. Effective communication plays a vital role in this process. By clearly articulating the reasons for change and the expected benefits, organizations can help alleviate employees' fears and concerns.

For instance, providing comprehensive training programs can equip staff with the necessary skills to adapt to new technologies and processes (Hafey, 2014). Moreover, involving employees in the decision-making process can create a sense of ownership and commitment to the changes being implemented, thereby reducing resistance (Hey, 2019). Organizations that prioritize engagement and transparency are better positioned to overcome resistance and successfully implement innovative turnaround strategies. Financial constraints and resource limitations pose another significant barrier to effective turnaround management. Implementing innovative strategies often requires substantial investment in new technologies, training programs, and process improvements. Organizations, particularly those operating in capital-intensive industries, may find it challenging to allocate the necessary resources without compromising other operational areas (Fridholm & Brogren, 2017). This financial strain can hinder organizations' ability to adopt advanced tools and methodologies that could enhance their turnaround processes. To address financial constraints, organizations can explore various strategies. One approach is to conduct a cost-benefit analysis to evaluate the potential return on investment (ROI) of implementing innovative strategies. By demonstrating the long-term benefits of these initiatives, organizations can secure the necessary funding from stakeholders and decision-makers (Prajogo & McDermott, 2014).

Additionally, organizations can consider phased implementation of new strategies, allowing them to spread costs over time and assess the effectiveness of each initiative before committing additional resources (Raoufi & Fayek, 2014). This gradual approach can also help organizations manage risks associated with new investments, enabling them to adapt their strategies based on real-time outcomes. Ensuring stakeholder buy-in and support is critical for the successful implementation of innovative turnaround strategies. Stakeholders, including employees, management, customers, and suppliers, play a vital role in the turnaround process. Without their support, even the most well-planned strategies may falter. Stakeholder resistance can arise from various concerns, including perceived risks associated with new initiatives, doubts about their effectiveness, and a lack of understanding of the proposed changes (Claudet, 2014). As a result, organizations must prioritize stakeholder engagement to ensure that all parties are aligned and committed to the turnaround objectives. Building stakeholder buy-in begins with effective communication and engagement. Organizations should actively involve stakeholders in the planning and implementation phases of turnaround strategies. This involvement can take various forms, such as workshops, feedback sessions, and regular updates on progress and outcomes (Makhloof et al., 2014). By fostering open dialogue, organizations can address stakeholders' concerns, solicit their input, and demonstrate the value of new initiatives. Additionally, highlighting success stories and case studies from similar organizations that have successfully implemented innovative turnaround strategies can help build confidence and support among stakeholders (Ukko et al., 2021).

The impact of digitalization on operational efficiency, innovation, and competitiveness - The influence of digitalization on efficiency, innovation, and competitiveness is significant and complex, impacting numerous sectors and business models (Narleva, 2024). Digitalization serves as a catalyst for enhancing operational efficiency by streamlining processes, reducing expenses, and optimizing service de livery (Belev & Daskalo, 2019). Organizations that successfully implement digital technologies can significantly enhance their market competitiveness by leveraging data analytics, automation, and digital marketing strategies to optimize their operations and establish connections with broader audiences (Dimitrakieva et al., 2023). In the domain of operational effectiveness, digitalization enables companies to automate routine tasks, thereby liberating human resources for more tactical endeavors. Supply chain management, for instance, has demonstrated a notable enhancement in responsiveness and flexibility through the integration of digital tools, thereby enabling businesses to swiftly adapt to market fluctuations and evolving customer demands (Ning & Yao, 2023). Moreover, the utilization of digital platforms facilitates the immediate exchange of data and collaboration among stakeholders, which is imperative for optimizing supply chain efficiency and reducing lead times. This operational flexibility results in reduced costs and also improves customer satisfaction, which in turn strengthens a company's competitive edge in the market place (Boikova et al., 2021).

Innovation is yet another essential realm where digitalization has a profound effect. The incorporation of digital technologies promotes a culture of innovation in organizations, allowing them to create new products and services that meet changing consumer demands. Digital tools, such as big data analytics and artificial intelligence, offer important insights that guide product development and marketing approaches (Kreuzer et al., 2022). Additionally, companies that adopt digital transformation are more likely to discover innovative business models and revenue opportunities, which is crucial in the fast evolving economic environment of today (Firmansyah & Wahdiniwaty, 2023). A study has demonstrated a clear correlation between the presence of robust digital orientations within an organization and its capacity to achieve substantial innovations (Khin & Ho, 2019). This finding underscores the pivotal role that digital capabilities play in fostering innovation (Shahbandi, 2022). In the contemporary digital era, the capacity of an enterprise to leverage technological advancements to generate economic value has emerged as a pivotal factor in its competitive standing. Digital transformation has been) shown to improve operational efficiency and innovation, thereby helping to establish lasting competitive advantages. For instance, the successful implementation of digital marketing techniques by organizations can enhance brand visibility and customer inter action, leading to an increased market share (Van Der Merwe & Jones, 2024).

Moreover, the ability to analyze consumer data empowers companies to personalize their products and marketing tactics, thereby fostering enhanced customer loyalty and retention (Fedotova et al., 2019). The strategic

implementation of digital resources has been demonstrated to enable companies to achieve superior performance in comparison to their competitors, particularly within sectors that are characterized by the paramount importance of online interaction (Boikova et al., 2021). Furthermore, the competitive environment is undergoing a transformation due to the proliferation of digital ecosystems, wherein collaboration among businesses, consumers, and technology suppliers is imperative for achieving success (Dimitrakieva et al., 2020).

Organizations that participate in these ecosystems can exchange resources, information, and skills, leading to enhanced innovation and a more rapid response to market demands (Sousa-Zomer et al., 2022). This teamwork strategy has been demonstrated to have two primary benefits: first - it has been shown to promote creativity; second, it has been demonstrated to help companies reduce the risks associated with digital transformation by capitalizing on the advantages of their partners. The ability to navigate and thrive within digital ecosystems is emerging as a critical factor for achieving competitive advantage in today's economy. The correlation between digitalization and competitiveness is influenced by external predictors, including regulatory environments and market dynamics (Dimitrakieva et al., 2023). Companies operating in a supportive regulatory environment are more likely to allocate resources to digital technologies, thereby enhancing their competitiveness (Kolpak et al., 2022). Furthermore, the rapid progression of technology necessitates continuous adaptation and learning. Consequently, it is imperative for organizations to cultivate a culture of flexibility and innovation (Belev & Stoyanov, 2020). This flexibility enables companies to maintain their competitive advantage while strategically positioning themselves to capitalize on emerging opportunities in the digital economy.

Additionally, the influence of digitalization on competitiveness is especially significant for small and medium-sized enterprises (SMEs), which frequently encounter distinct challenges in utilizing technology. Research indicates that SMEs that embrace digital transformation can significantly enhance their competitiveness by improving operational efficiencies and expanding their market reach (Ampa, 2023). As such, fostering digital capabilities within SMEs is crucial for driving innovation and economic growth in various regions.

Digitalization and automation in smart ports: advancing maritime industry operations - The advent of smart ports signifies a revolutionary transformation in the realm of maritime logistics and operations (Gancheva, 2023). This paradigm shift is characterized by the integration of state-of-the-art technologies aimed at enhancing efficiency, sustainability, and connectivity. The concept of a smart port encompasses a range of features, including automation, real time data communication, and the integration of the Lot to facilitate seamless operations. Specifically, smart ports are defined as those that employ digital technologies to enhance operational efficiency, refine decision making processes, and improve the overall experience for stakeholders transport (Gancheva, 2023). engaged in maritime. The essential traits of smart ports include the capability to automate numerous port operations. Such operations include cargo management, vessel traffic oversight, and logistics processes.

The automation of these operations minimizes human involvement and enhances operational efficiency (Min, 2022). Furthermore, intelligent ports employ data analysis and AI to forecast and address operational issues, thereby ensuring efficient resource allocation and reducing environmental effects (Dalaklis & Christodoulou, 2021). The integration of these technologies has been demonstrated to enhance efficiency and support the sustainability objectives of the maritime sector (Othman et al., 2022). This integration has been demonstrated to contribute to the reduction of emissions and conservation of energy. Role of digitalization in port operations Digitalization is imperative in the evolution of port operations, with advancements such as AI, IoT, and big data analytics leading to significant gains in efficiency and effectiveness.

The integration of AI into port operations has the potential to enhance decision-making capabilities, enabling ports to process substantial volumes of data in real-time and make informed decisions regarding logistics and resource management (Abdelsalam & Elnabawi, 2024). For instance, the implementation of artificial intelligence algorithms has the potential to optimize the scheduling of vessel arrivals and the management of cargo handling. This, in turn, can lead to a reduction in wait times and an enhancement in operational efficiency. The IoT can improve port operations by facilitating immediate monitoring and management of activities occurring within the

port. The integration of connected devices and sensors facilitates the monitoring of container movements, the assessment of equipment performance, and the acquisition of insights into environmental conditions (Yau et al., 2022). This, in turn, enables proactive maintenance and the implementation of operational modifications. The integration of big data analytics facilitates the utilization of historical and current data by ports, enabling the detection of pat terns, the prediction of demand, and the streamlining of supply chain operations.

Consequently, this enhances the resilience and competitiveness of port activities. Furthermore, the integration of digital technologies has been demonstrated to enhance cooperation among the various participants in the maritime supply chain, including shipping firms, logistics operators, and port authorities. The establishment of an interconnected ecosystem, facilitated by digital technologies, enables seamless information exchange and collaboration, which is imperative for the efficient movement of goods and the mitigation of delays. This team work strategy has been demonstrated to enhance operational productivity and support greater sustainability of port activities (Zhou et al., 2020). The strategy accomplishes these objectives by minimizing resource waste and environmental impact.

3. Methodology

Research Design - The descriptive method of research, as generally accepted, is a fact-finding study that encompasses adequate interpretation. Relatively, the method is suitable for this study since it aims to describe the impact of job satisfaction and motivation among elementary public teachers. Descriptive research design is the process of collecting answers to the questions of the present study. Each of the responses from the survey questionnaires will be scrutinized and interpreted to obtain the result leading to developing new knowledge about the study. The purpose of the descriptive method design is to describe individuals, events, or conditions by studying them as they are in nature. It seeks opinions from the respondents without attaching the value of the researcher. The descriptive method involves the collection and analysis of data about individuals or materials to associate existing and expected standards. Also, to recognize information that is reasonably used to improve the present condition of people or things. Descriptive research is defined as a research method that describes the characteristics of the population or phenomenon studied. This methodology focuses more on the of the research subject. This is mainly because it is important to have a proper understanding of what a research problem is about before investigating why it exists in the first place. Descriptive research involves gathering of data that describes events and then organizes, tabulates, depicts, and describe the data collection. It often uses visual aids such as graphs and charts to aid the reader in understanding the data distribution.

Locale of the Study - This study was conducted at Northern Zambales College Incorporated (NZCI), a private higher education institution located in Masinloc, Zambales, Philippines. NZCI offered a range of academic programs, including the Bachelor of Science in Customs Administration, which prepared students for careers in trade facilitation, logistics, and government service related to customs operations. The college served students from various municipalities in Zambales and nearby provinces, providing both theoretical instruction and practical training through its internship program. The choice of NZCI as the study locale was significant because it reflected a regional academic setting where students were exposed to internship opportunities in both public and private sectors. These placements often included government agencies such as the Bureau of Customs, logistics companies, and import-export firms operating within Central Luzon. The institution's commitment to experiential learning through internships made it an ideal setting for examining how such experiences influenced student proficiency in customs-related competencies. Figure 2 on the next page showed the map of Masinloc, Zambales as the locale of the study.

The Instrument and Validation Process - In the study on predictors of the implementation of the Terminal Appointment Booking System (TABS), a researcher-made instrument was utilized to gather relevant data from stakeholders. To ensure the reliability and validity of the instrument, it underwent a pilot testing phase involving 10 employees from the Port of Manila. This preliminary test helped assess the clarity, consistency, and relevance of the items included in the survey. The internal reliability of the instrument was statistically measured using

Cronbach's Alpha, which evaluated the degree to which the items in the scale were correlated and consistently measured the intended constructs. A Cronbach Alpha value of 0.70 or higher was considered acceptable, indicating that the instrument was sufficiently reliable for full-scale deployment in the study. Below was the table used to interpret the reliability test.

The Respondents - The respondents of this study are key logistics stakeholders who actively engage with the Terminal Appointment Booking System (TABS) in their daily operations. Their roles and experiences provide critical insights into the system's effectiveness, challenges, and impact on port logistics. The selected respondents include:

- **Truck Drivers -** Truck drivers are frontline users of TABS, responsible for adhering to scheduled appointments and navigating terminal protocols. Their feedback reflects the system's usability, accessibility, and its influence on turnaround time, waiting periods, and compliance with appointment windows.

- **Dispatchers -** Dispatchers coordinate truck movements and manage booking schedules through TABS. They play a vital role in ensuring that appointments are secured, rebooked when necessary, and aligned with cargo readiness. Their perspective helps assess booking success rates, system responsiveness, and scheduling reliability.

- **Customs Brokers -** Customs brokers facilitate the clearance of goods and often coordinate with dispatchers and truckers to ensure timely delivery. Their interaction with TABS involves aligning customs documentation with appointment schedules. Their input is valuable in evaluating how TABS supports or hinders operational coordination and regulatory compliance.

- **Terminal Staff -** Terminal personnel oversee gate operations, appointment verification, and truck flow management. They are instrumental in enforcing appointment compliance and monitoring turnaround times. Their observations help identify system bottlenecks, appointment violations, and the overall impact of TABS on terminal efficiency.

These respondents were selected based on their direct involvement with TABS and their capacity to provide informed, experience-based feedback. Their collective insights will guide the evaluation of TABS in terms of operational efficiency, user satisfaction, and implementation challenges.

Data Collection - To examine predictors of outcomes in the TABS, the study employed a researcher-made survey questionnaire method. Surveys captured respondents' demographic profiles such as role in port operation, length of experience using TABS, and level of usage of TABS. The survey questionnaire included perceptions towards the predictors that affected the outcomes of the implementation of TABS, measured in terms of truck turnaround time (in hours), booking success rate, user satisfaction level, frequency of appointment violations, and perceived efficiency of port operations. The last part of the instrument covered perceptions towards the challenges encountered in the implementation of TABS.

Data Analysis - To analyze the data collected in the study, both descriptive and inferential statistical methods were employed to provide a comprehensive understanding of the predictors that influenced the outcomes of the TABS. Descriptive statistics such as mean, frequency, rank, and percentage were used to summarize and present the general profile of respondents. These measures helped identify common patterns and distributions within the dataset. For inferential analysis, the study utilized Analysis of Variance (ANOVA) to determine whether there were statistically significant differences in TABS outcomes across different groups (e.g., user types or cargo categories). This helped assess whether variations in operational roles or cargo types influenced system performance or user satisfaction. Additionally, the Pearson Product-Moment Correlation Coefficient was applied to examine the strength and direction of relationships between continuous variables, such as frequency of system usage and perceived efficiency. This technique provided insights into how closely related certain predictors were to the

effectiveness of TABS operations.

In this study, a 4-point Likert Scale was utilized to measure respondents' perceptions and attitudes toward various indicators related to the TABS. Each response was assigned a numerical weight ranging from 1 to 4, corresponding to the following scale: 1.00–1.74 = Strongly Disagree (SD), 1.75–2.49 = Disagree (D), 2.50–3.24 = Agree (A), and 3.25–4.00 = Strongly Agree (SA). This scale allows for the quantification of qualitative responses, enabling the computation of mean scores to determine the overall level of agreement or disagreement across items. The mean of each item was calculated by averaging the assigned weights of all responses. The resulting mean score was then interpreted using the scale point ranges in Table 4 to determine the general sentiment of the respondents. This approach provided a standardized method for analyzing attitudinal data and identifying trends in user perceptions, which was essential for evaluating the effectiveness and efficiency of TABS operations.

4. Results and discussions

4.1 Profile of the Respondents

Table 4 shows the frequency and percentage distribution on the profile of the respondents in terms of role in the port operation, how long had been using the TABS, and Usage and Experience respectively.

Table 4
Frequency and Percentage Distribution on the Profile of the respondents (N=50)

Profile Variables		Frequency	Percent
Role in Port Operation	Truck Driver	3	6.0
	Logistic Coordinator	12	24.0
	Custom Broker	17	34.0
	Terminal Staff	7	14.0
	Others	11	22.0
	Total	50	100.0
How Long had been using TABS	Less than 6 months	16	32.0
	6 months to 1 year	13	26.0
	More than 1 Year	21	42.0
	Total	50	100.0
Usage and Experience	Daily	4	8.0
	Weekly	14	28.0
	Monthly	12	24.0
	Rarely	20	40.0
	Total	50	100.0

Role in port operation. The largest group is composed of custom brokers (34%), followed by logistic coordinators (24%), while others (22%), terminal staff (14%), and truck drivers (6%) make up smaller portions. Custom brokers are directly responsible for handling documentation, compliance with customs regulations, and coordination of shipments, which makes them highly engaged with the Terminal Appointment Booking System (TABS). Since TABS is designed to streamline scheduling, booking, and clearance processes, custom brokers are among the primary users who rely on the system to ensure timely cargo release and smooth transactions. Their frequent interaction with both the administrative and operational aspects of port activities explains why they represent the largest share of respondents. Consequently, their dominant presence in the sample provides valuable insights into how TABS is perceived and implemented, as they are positioned at the intersection of regulatory compliance and operational coordination. This makes their feedback particularly influential in assessing both the strengths and challenges of the system.

Length of TABS usage. Most respondents have been using the system for more than one year (42%), suggesting that a significant portion has substantial exposure and experience with the platform, while newer users—those with less than six months (32%) or six months to one year (26%)—still represent a considerable share. This suggests that their feedback is informed by sustained experience rather than short-term or initial impressions. It also indicates that TABS has been in operation long enough for users to develop consistent usage

patterns and evaluate its effectiveness over time. The presence of long-term users provides credibility to the findings, as they can better identify recurring challenges, assess improvements, and judge the system's overall impact on port operations. At the same time, the fact that nearly 60% of respondents have used TABS for less than a year highlights that adoption is still ongoing, with newer users possibly facing adjustment issues.

Usage and experience. The majority of respondents use TABS only rarely (40%), while others report weekly (28%), monthly (24%), and only a small group use it daily (8%). This pattern suggests that while many stakeholders are familiar with the system, frequent and consistent use is limited, possibly reflecting operational roles or reliance on traditional practices. Overall, the data highlights that perceptions of TABS are influenced by a mix of experienced and occasional users, with custom brokers and coordinators playing the most prominent roles in shaping feedback, while limited daily usage points to opportunities for strengthening adoption and integration across all user groups.

4.2 Perception of the respondents towards predictors affecting the outcomes on the implementation of TABS

Turn Around Time - Table 5 showed the perception of the respondents towards predictors affecting the outcomes on the implementation of Terminal Appointment Booking System (TABS) as to Turn Around Time. The analysis of the table reveals a general agreement among respondents that the TABS is effective in managing truck turnaround times and scheduling. The highest-rated indicator, with a mean score of 2.88, is the average truck turnaround time, suggesting that stakeholders recognize the system's positive impact on operational efficiency by reducing the time trucks spend from gate entry to exit. Similarly, the reliability of scheduling, reflected in the 2.76 mean score for trucks requiring rebooking or missing slots, indicates that TABS contributes to consistency, though occasional issues remain. Moderate concerns are evident in the comparative analysis of turnaround times before and after TABS (2.74) and in delays exceeding two hours beyond booked appointments (2.72) which highlight areas where improvements are still necessary to minimize bottlenecks and enhance alignment between planned schedules and actual operations. Overall, the weighted mean of 2.76 demonstrates a favorable perception of TABS, but the modest scores also suggest that while the system is functional and beneficial, it has not yet reached its full potential in achieving optimal efficiency.

Table 5

Perception of the respondents towards predictors affecting the outcomes on the implementation of TABS as to Turn Around Time

	Turn Around Time	Weighted Mean	Descriptive Equivalent	Rank
1	The average truck turnaround time, measured from gate entry to exit after booking through TABS, reflects the operational efficiency of the system.	2.88	Agree	1
2	The proportion of trucks completing their turnaround within the scheduled appointment window indicates the alignment between planned schedules and actual operations	2.72	Agree	4.5
3	Delays exceeding two hours beyond the booked appointment time serve as indicators of potential bottlenecks or inefficiencies in the system	2.72	Agree	4.5
4	A comparative analysis of truck turnaround times before and after the implementation of TABS establishes a baseline for evaluating its operational impact	2.74	Agree	3
5	The number of trucks requiring rebooking or missing their slots due to extended turnaround time demonstrates the reliability of TABS in managing scheduling consistency	2.76	Agree	2
	Overall Weighted Mean	**2.76**	**Agree**	

On the statement being ranked 1st means it is considered the most important and strongest indicator of operational efficiency in the TABS. Specifically, the average truck turnaround time—measured from gate entry to exit—directly reflects how smoothly and effectively the system is functioning. Since turnaround time is the highest-rated factor (mean score of 2.88), stakeholders' view it as the clearest measure of whether TABS is achieving its purpose: reducing congestion, streamlining scheduling, and ensuring faster processing of trucks. In other words, if trucks are moving in and out of the facility more quickly after booking through TABS, then the system is fulfilling its role in improving overall operational performance.

In the domain of operational effectiveness, digitalization enables companies to automate routine tasks, thereby liberating human resources for more tactical endeavors. Supply chain management, for instance, has demonstrated a notable enhancement in responsiveness and flexibility through the integration of digital tools, thereby enabling businesses to swiftly adapt to market fluctuations and evolving customer demands (Ning & Yao, 2023). Moreover, the utilization of digital platforms facilitates the immediate exchange of data and collaboration among stakeholders, which is imperative for optimizing supply chain efficiency and reducing lead times. This operational flexibility results in reduced costs and also improves customer satisfaction, which in turn strengthens a company's competitive edge in the market place (Boikova et al., 2021). Innovation is yet another essential realm where digitalization has a profound effect. The incorporation of digital technologies promotes a culture of innovation in organizations, allowing them to create new products and services that meet changing consumer demands. Digital tools, such as big data analytics and artificial intelligence, offer important insights that guide product development and marketing approaches (Kreuzer et al., 2022).

Booking Success Rate - Table 6 showed the perception of the respondents towards predictors affecting the outcomes on the implementation of Terminal Appointment Booking System (TABS) as to Booking Success Rate. The results show a general agreement among respondents that the TABS is reliable in managing truck appointments, with an overall weighted mean of 2.81. The highest-rated indicators, both with a mean score of 2.84, are the percentage of successfully confirmed bookings and the ability of users to secure preferred time slots, which jointly rank first.

Table 6

Perception of the respondents towards predictors affecting the outcomes on the implementation of TABS as to Booking Success Rate

	Booking Success Rate	Weighted Mean	Descriptive Equivalent	Rank
1	The percentage of successfully confirmed bookings through TABS reflects the system's reliability in managing truck appointments	2.84	Agree	1.5
2	A high rate of completed bookings without cancellation or rescheduling indicates the operational stability of TABS	2.82	Agree	3
3	The frequency of failed or rejected booking attempts serves as a measure of system accessibility and user interface efficiency	2.76	Agree	5
4	The number of users able to secure preferred time slots through TABS demonstrates the platform's responsiveness to scheduling demands	2.84	Agree	1.5
5	The consistency of booking confirmations across different user types and cargo categories reflects the system's adaptability to diverse logistics needs	2.80	Agree	4
	Overall Weighted Mean	**2.81**	**Agree**	

This suggests that stakeholders view TABS as dependable and responsive to scheduling demands, reflecting its strength in ensuring appointments are properly managed and aligned with user preferences. The operational stability of the system, measured by completed bookings without cancellation or rescheduling, also received a favorable rating of 2.82, ranking third, which indicates that most bookings proceed smoothly with minimal disruptions. Meanwhile, adaptability across different user types and cargo categories scored 2.80, showing that TABS is generally versatile in handling diverse logistics needs. However, the lowest-rated indicator, with a mean of 2.76, is the frequency of failed or rejected booking attempts, pointing to some concerns about system accessibility and user interface efficiency. Overall, the findings highlight that while TABS is perceived as reliable and responsive, there remain areas for improvement in reducing failed booking attempts and enhancing accessibility to further strengthen its operational performance.

This finding means that respondents consider successful booking confirmations and the ability to secure preferred time slots as the strongest indicators of the Truck Appointment Booking System's (TABS) effectiveness. With both indicators receiving the highest mean score of 2.84 and jointly ranking first, it shows that users place the greatest value on the system's reliability in confirming appointments and its responsiveness to their scheduling needs. In practical terms, this suggests that stakeholders view TABS as most successful when it consistently allows trucks to book appointments without issues and when it provides flexibility for users to obtain their desired time

slots. These two aspects directly reflect the system's credibility and user satisfaction, highlighting that reliability and responsiveness are the most critical measures of operational success. The incorporation of digital technologies promotes a culture of innovation in organizations, allowing them to create new products and services that meet changing consumer demands. Digital tools, such as big data analytics and artificial intelligence, offer important insights that guide product development and marketing approaches and improves the booking procedures and management (Kreuzer et al., 2022).

User's Satisfaction Level - Table 7 showed the perception of the respondents towards predictors affecting the outcomes on the implementation of Terminal Appointment Booking System (TABS) as to User's Satisfaction Level. The findings indicate that users generally agree on the positive impact of the TABS, with an overall weighted mean of 2.80. The highest-rated indicator, with a mean score of 2.86, is the perception of TABS as a helpful tool in streamlining port operations and reducing logistical stress, showing that stakeholders value its role in easing operational burdens.

Table 7

Perception of the respondents towards predictors affecting the outcomes on the implementation of TABS as to User's Satisfaction Level

	User's Satisfaction Level	Weighted Mean	Descriptive Equivalent	Rank
1	Users express satisfaction with the ease of navigating and booking appointments through the TABS platform	2.84	Agree	2
2	The responsiveness of TABS to user concerns and booking issues contributes positively to overall user satisfaction	2.78	Agree	4
3	Stakeholders report improved scheduling convenience and reduced waiting times as a result of using TABS.	2.80	Agree	3
4	The reliability of TABS in confirming appointments and minimizing errors enhances user confidence in the system	2.74	Agree	5
5	Users perceive TABS as a helpful tool in streamlining port operations and reducing logistical stress.	2.86	Agree	1
	Overall Weighted Mean	**2.80**	**Agree**	

Satisfaction with the ease of navigating and booking appointments also scored highly at 2.84, ranking second, which highlights the system's user-friendly interface and accessibility. Improved scheduling convenience and reduced waiting times (2.80) further reinforce the benefits of TABS in enhancing efficiency. However, responsiveness to user concerns and booking issues (2.78) and reliability in confirming appointments with minimal errors (2.74) received relatively lower ratings, suggesting areas where improvements are needed to strengthen user confidence and support. Overall, the results reflect a favorable perception of TABS, emphasizing its usefulness in streamlining operations and providing convenience, while also pointing to the need for greater responsiveness and reliability to maximize user satisfaction.

The highest-rated indicator, with a mean score of 2.86, highlights the perception of the TABS as a helpful tool in streamlining port operations and reducing logistical stress. This finding is significant because it underscores the system's broader impact beyond individual booking transactions—it reflects how TABS contributes to the overall efficiency of port logistics. Stakeholders value the system not only for its technical function of managing appointments but also for its ability to ease operational burdens, minimize congestion, and reduce the complexities traditionally associated with truck scheduling. By providing a structured and predictable process, TABS helps prevent bottlenecks, shortens waiting times, and ensures smoother coordination among different users and cargo categories. The high rating suggests that users experience tangible benefits in terms of reduced stress and improved workflow, which translates into greater confidence in the system. In essence, this finding demonstrates that TABS is perceived as more than just a scheduling platform; it is seen as an integral tool for enhancing productivity, supporting logistics management, and fostering a more organized and less stressful operational environment. Digital tools enable industry firms to compete more effectively with larger organizations by leveling the playing field and providing access to global markets. As such, fostering digital capabilities within SMEs is crucial for driving innovation and economic growth in various regions and contribute the the maximum level of customer satisfaction.

Frequency of Appointment Violations - Table 8 showed the perception of the respondents towards predictors

affecting the outcomes on the implementation of TABS as to Frequency of Appointment Violations. The findings reveal that respondents generally agree on the presence of appointment violations under the TABS, with an overall weighted mean of 2.78. The highest-rated indicators, each with a mean score of 2.84, include missed or late appointments, the occurrence of appointment violations contributing to port congestion, and the frequency of rebooked or rescheduled appointments due to non-compliance.

Table 8

Perception of the respondents towards predictors affecting the outcomes on the implementation of TABS as to Frequency of Appointment Violations

	Frequency of Appointment Violations	Weighted Mean	Descriptive Equivalent	Rank
1	The number of trucks arriving outside their scheduled appointment time reflects the frequency of appointment violations under TABS	2.72	Agree	4
2	Repeated breaches of scheduled booking slots indicate gaps in user compliance and system enforcement.	2.68	Agree	5
3	High rates of missed or late appointments suggest operational challenges in aligning truck movements with TABS schedules	2.84	Agree	2
4	The occurrence of appointment violations contributes to port congestion and undermines the intended efficiency of TABS	2.84	Agree	2
5	The frequency of rebooked or rescheduled appointments due to non-compliance highlights the need for stricter monitoring and user education	2.84	Agree	2
	Overall Weighted Mean	**2.78**	**Agree**	

These results suggest that stakeholders recognize these issues as significant operational challenges that undermine the intended efficiency of TABS. The relatively lower ratings, such as trucks arriving outside their scheduled appointment time (2.72) and repeated breaches of booking slots (2.68), indicate that while these violations are acknowledged, they are perceived as less critical compared to the broader impact of congestion and rebooking. Overall, the analysis highlights that appointment violations remain a pressing concern, as they directly affect scheduling consistency, contribute to delays, and compromise the system's effectiveness. This underscores the need for stricter monitoring, enhanced enforcement mechanisms, and improved user compliance to minimize violations and ensure smoother port operations.

The fact that missed or late appointments, appointment violations contributing to port congestion, and the frequency of rebooked or rescheduled appointments all share the highest mean score of 2.84 underscores the seriousness of these issues in the operation of the TABS. Stakeholders clearly recognize that these violations are not isolated inconveniences but rather systemic challenges that directly undermine the efficiency goals of TABS. Missed or late appointments disrupt the flow of scheduled truck movements, creating ripple effects that delay subsequent operations. Similarly, appointment violations contribute to congestion at the port, which negates the very purpose of TABS—to streamline scheduling and reduce bottlenecks. The need for frequent rebooking or rescheduling due to non-compliance further highlights weaknesses in user adherence and system enforcement, suggesting that while the platform provides structure, its effectiveness depends heavily on consistent compliance. Taken together, these findings reveal that operational efficiency is compromised when users fail to follow schedules, and they point to the necessity of stricter monitoring, improved enforcement mechanisms, and enhanced user education. Addressing these issues is critical, as they represent the most pressing barriers to realizing the full potential of TABS in ensuring smooth, predictable, and congestion-free port operations.

The automation of the booking system operations minimizes human involvement and enhances operational efficiency (Min, 2022). Furthermore, intelligent ports employ data analysis and AI to forecast and address operational issues, thereby ensuring efficient resource allocation and reducing environmental effects (Dalaklis, 2021). The integration of these technologies has been demonstrated to enhance efficiency and support the sustainability objectives of the maritime sector (Othman et al., 2022). This integration has been demonstrated to contribute to the reduction of emissions and conservation of energy. Role of digitalization in port operations Digitalization is imperative in the evolution of port operations, with advancements such as AI, IoT, and big data analytics leading to significant gains in efficiency and effectiveness.

Perceived Efficiency of Port Operation - Table 9 showed the perception of the respondents towards predictors

affecting the outcomes on the implementation of TABS as to Perceived Efficiency of Port Operation.

Table 9

Perception of the respondents towards predictors affecting the outcomes on the implementation of TABS as to Perceived Efficiency of Port Operation

	Perceived Efficiency of Port Operation	Weighted Mean	Descriptive Equivalent	Rank
1	Cargo handling at the port is timely and well-coordinated	2.88	Agree	1.5
2	Port staff demonstrate responsiveness and efficiency in managing vessel movements	2.84	Agree	4
3	Documentation and customs procedures are completed promptly and without unnecessary delays	2.88	Agree	1.5
4	Port facilities and equipment consistently support uninterrupted and smooth operations.	2.82	Agree	6
5	Communication between port authorities and stakeholders is consistently clear and reliable	2.76	Agree	7
6	Port operations effectively reduce congestion and minimize waiting times for trucks and vessels	2.84	Agree	4
7	Port operations meet logistics requirements efficiently and satisfactorily	2.84	Agree	4
	Overall Weighted Mean	**2.84**	**Agree**	

The findings show that respondents generally agree on the efficiency of port operations, with an overall weighted mean of 2.84. The highest-rated indicators, both with a mean score of 2.88, are timely and well-coordinated cargo handling and the prompt completion of documentation and customs procedures. These results suggest that stakeholders perceive the port as effective in managing core operational tasks that directly influence the flow of goods. Responsiveness and efficiency of port staff in managing vessel movements, the reduction of congestion and waiting times, and the ability of operations to meet logistics requirements all received favorable ratings of 2.84, ranking fourth, which indicates confidence in the port's ability to handle complex scheduling and operational demands. However, port facilities and equipment (2.82) and communication between port authorities and stakeholders (2.76) were rated lower, highlighting areas where improvements are needed to ensure uninterrupted operations and clearer coordination. Overall, the analysis reflects a positive perception of port efficiency, particularly in handling cargo and documentation, but also emphasizes the importance of strengthening infrastructure and communication systems to sustain and enhance operational performance.

The equal ranking of cargo handling at the port being timely and well-coordinated and documentation and customs procedures being completed promptly without unnecessary delays (both with a mean score of 2.88, ranked 1.5th) highlights that stakeholders view these two aspects as the strongest indicators of port efficiency. Cargo handling represents the physical movement and coordination of goods, while documentation and customs procedures represent the administrative and regulatory side of operations. The fact that both are rated equally high suggests that respondents see efficiency as a balance between smooth physical operations and streamlined administrative processes. Timely cargo handling ensures that goods are moved quickly and without bottlenecks, while prompt documentation and customs clearance prevent delays that could stall the release and transport of shipments. Together, these two areas form the backbone of port operations—if either one falters, overall efficiency is compromised. The high scores indicate that users perceive the port as performing well in both dimensions, reinforcing confidence in its ability to manage logistics effectively and minimize disruptions. This finding also implies that stakeholders prioritize both operational coordination and regulatory compliance as critical to sustaining efficiency in port activities.

The automization of the booking system enhances the resilience and competitiveness of port activities. Furthermore, the integration of digital technologies has been demonstrated to enhance cooperation among the various participants in the maritime supply chain, including shipping firms, logistics operators, and port authorities. The establishment of an interconnected ecosystem, facilitated by digital technologies, enables seamless information exchange and collaboration, which is imperative for the efficient movement of goods and the mitigation of delays. This team work strategy has been demonstrated to enhance operational productivity and support greater sustainability of port activities (Zhou et al., 2020). The strategy accomplishes these objectives by minimizing resource waste and environmental impact.

Table 10
Summary of Responses towards predictors affecting the outcomes on the implementation of TABS

	Predictors affecting the outcomes on the implementation of TABS	Weighted Mean	Descriptive Equivalent	Rank
1	Turn Around Time	2.76	Agree	5
2	Booking Success Rate	2.81	Agree	2
3	User's Satisfaction Level	2.80	Agree	3
4	Frequency of Appointment Violations	2.78	Agree	4
5	Perceived Efficiency of Port Operation	2.84	Agree	1
Grand Mean		2.79	Agree	

The table on predictors affecting the outcomes of TABS implementation shows that respondents generally agreed on the importance of all listed factors, with a grand mean of 2.79 (Agree). Among the predictors, the perceived efficiency of port operation ranked highest (mean = 2.84), indicating that stakeholders see efficiency gains as the most critical outcome of the system. This was followed closely by booking success rate (2.81) and user satisfaction level (2.80), suggesting that smooth booking processes and positive user experiences are also central to evaluating TABS. Meanwhile, frequency of appointment violations (2.78) and turnaround time (2.76) ranked slightly lower, though still within the "Agree" range, showing that while these are recognized as important, they may be less consistently achieved compared to efficiency and booking success. Overall, the results highlight that users perceive TABS as contributing positively to port operations, with efficiency improvements being the strongest outcome, but also point to areas—such as reducing violations and improving turnaround time—where further enhancements could strengthen the system's overall impact.

The implication is that efficiency is a key strength of the port, and it plays a major role in shaping positive perceptions of its overall performance. However, while the rating indicates agreement, the score is not at the very highest level, suggesting that there is still room for improvement in streamlining operations further to achieve even greater customer satisfaction and operational excellence.

4.3 Perception of the respondents towards challenges encountered in the implementation of the TABS

Table 11
Summary of Responses towards challenges encountered in the implementation of the TABS

	Challenges	Weighted Mean	Descriptive Equivalent	Rank
1	Limited access to digital devices among truck drivers and small logistics operators restricts full utilization of the TABS platform	2.74	Agree	7.5
2	Inconsistent internet connectivity in port areas and remote dispatch locations hampers real-time booking and coordination.	2.76	Agree	6
3	System glitches and occasional downtime disrupt appointment scheduling and lead to missed or delayed transactions.	2.72	Agree	9
4	Insufficient training and orientation for users result in frequent booking errors and low confidence in using the system	2.92	Agree	1.5
5	Lack of integration between TABS and other port management systems creates data silos and operational inefficiencies	2.74	Agree	7.5
6	Weak enforcement of appointment compliance allows frequent violations, undermining the scheduling discipline intended by TABS	2.84	Agree	3.5
7	Limited customer support and technical assistance delay resolution of user concerns and system-related issues.	2.68	Agree	10
8	Resistance to change among traditional logistics operators slows down the adoption of digital booking practices	2.92	Agree	1.5
9	Unclear or inconsistent booking policies across terminals lead to confusion and misaligned expectations among users	2.82	Agree	5
10	High volume of users during peak hours overwhelms the system, resulting in booking congestion and reduced responsiveness.	2.84	Agree	3.5
	Overall Weighted Mean	**2.79**	Agree	

The findings reveal that respondents generally agree on the existence of several challenges affecting the effectiveness of the TABS, with an overall weighted mean of 2.79. The highest-rated concerns, both with a mean score of 2.92, are insufficient training and orientation for users and resistance to change among traditional logistics

operators. These results suggest that stakeholders see human factors—lack of knowledge and reluctance to adopt digital practices—as the most critical barriers to maximizing the system's potential. Other notable challenges include weak enforcement of appointment compliance and booking congestion during peak hours (both 2.84), which highlight operational issues that undermine scheduling discipline and system responsiveness. Unclear or inconsistent booking policies (2.82) also contribute to confusion and misaligned expectations among users. Meanwhile, lower-rated but still significant concerns include limited access to digital devices (2.74), inconsistent internet connectivity (2.76), system glitches (2.72), lack of integration with other port systems (2.74), and limited customer support (2.68). These findings indicate that while technical and infrastructure issues exist, stakeholders perceive user readiness, compliance, and adaptability as the most pressing challenges. Overall, the analysis emphasizes that improving training, strengthening enforcement, and addressing resistance to change are essential steps to enhance the efficiency and reliability of TABS, supported by ongoing improvements in technology, connectivity, and customer support.

The highest-rated concerns, both with a mean score of 2.92, are insufficient training and orientation for users and resistance to change among traditional logistics operators, which jointly ranked first. This result highlights that the most pressing challenges to the effective implementation of the TABS are not purely technical but largely human-centered. Insufficient training and orientation suggest that many users lack the necessary knowledge and confidence to fully utilize the platform, leading to frequent booking errors, inefficiencies, and frustration. Without proper guidance, even a well-designed system can fail to deliver its intended benefits, as users may struggle with navigation, misinterpret policies, or underutilize available features. On the other hand, resistance to change among traditional logistics operators reflects a cultural and behavioral barrier. Many operators accustomed to manual or conventional scheduling practices may be hesitant to adopt digital solutions, perceiving them as complex, unnecessary, or disruptive to established routines. This reluctance slows down adoption rates and undermines the system's overall effectiveness, as compliance and participation are crucial for TABS to function optimally. Taken together, these findings emphasize that successful digital transformation in port operations requires not only robust technology but also strong investment in capacity building, user education, and change management strategies. Addressing these human factors is essential to overcoming skepticism, building trust in the system, and ensuring that TABS achieves its goal of streamlining operations and reducing logistical stress. These challenges are resistance to change within organizations, financial constraints and resource limitations, and ensuring stakeholder buy-in and support (Adejugbe, 2021).

Understanding these barriers is crucial for organizations to navigate the complexities of turnaround management effectively. Resistance to change is a common phenomenon in many organizations, particularly when it comes to implementing new strategies or technologies. Employees and management may feel threatened by changes that could disrupt established routines or alter their roles within the organization. This resistance can stem from various predictors, including fear of the unknown, skepticism about the effectiveness of new strategies, and a general preference for maintaining the status quo (García et al., 2021).

4.4 Test of Significant differences on the perception towards predictors affecting the outcomes on the implementation of TABS when grouped according to profile variables.

Turn Around time - Table 12 showed the Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Turn Around Time when grouped according to profile variables of role in the port operation, how long has been using TABS, and Usage and Experience respectively. The analysis of variance (ANOVA) results show that role in port operation has a significant effect on perceptions of TABS efficiency, with a Sig. value of .005, which is below the 0.05 threshold. This led to the rejection of the null hypothesis (Ho), indicating that differences in respondents' roles—such as truck drivers, logistics operators, or port staff—contribute to varying perspectives on how TABS functions. In contrast, the variables how long respondents had been using TABS (Sig. = .115) and usage and experience (Sig. = .236) were not significant, as their values exceeded 0.05. This means the null hypothesis was accepted for these factors, suggesting that the

length of time using the system and the level of user experience do not significantly influence perceptions of TABS efficiency. This implies that operational responsibilities and exposure to different aspects of port activities shape how users assess the system's effectiveness more than personal familiarity or length of usage.

Table 12

Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Turn Around Time when grouped according to profile variables

Sources of Variations		SS	df	MS	F	Sig.	Decision
Role in Port Operation	Between Groups	7.880	4	1.970	4.254	.005	Reject Ho
	Within Groups	20.840	45	.463			Significant
	Total	28.720	49				
How Long had been using TABS	Between Groups	2.524	2	1.262	2.265	.115	Accept Ho
	Within Groups	26.196	47	.557			Not Significant
	Total	28.720	49				
Usage and Experience	Between Groups	2.508	3	.836	1.467	.236	Accept Ho
	Within Groups	26.212	46	.570			Not Significant
	Total	28.720	49				

Table 12-A

Scheffe Test to determine where the difference lies on the perception towards Turn Around Time when grouped according to Role in Port Operation

TURN AROUND TIME

Role in Port Operation	N	Subset for alpha = 0.05
		1
Terminal Staff	7	2.1714
Custom Broker	17	2.4706
Truck Driver	3	2.6000
Logistic Coordinator	12	3.1500
Others	11	3.2000
Sig.		.109

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 7.050.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Based on the Scheffe test results for Turnaround Time, the group classified as "Others" (mean = 3.200) reported the highest turnaround time compared to all other roles in port operation. This indicates that the differences in perception of turnaround time lie primarily with this group, as they experience longer delays than terminal staff (mean = 2.17), custom brokers (2.47), truck drivers (2.60), and logistic coordinators (3.15). Although the overall significance value (Sig. = .109) is greater than 0.05—meaning the differences are not statistically significant—the data trend suggests that the "Others" group consistently perceives turnaround time as longer. The "Others" category typically refers to respondents whose roles do not fall directly under the main classifications of truck drivers, logistics coordinators, customs brokers, or terminal staff. This group may include warehouse personnel, shipping clerks, IT support staff, administrative officers, subcontracted workers, or ancillary service providers who are indirectly involved in port operations. Because their responsibilities often depend on coordination with multiple stakeholders or secondary processes, they are more likely to encounter delays, inefficiencies, or extended waiting times.

Turnaround management focuses on the systematic overhaul of production lines to accommodate new technologies, maintain equipment, and improve production capabilities (Rana, 2022). The utility sector also engages in turnarounds to update infrastructure and enhance the reliability of service delivery. These sectors share a common goal: to reduce operational downtime while maintaining safety and compliance with regulatory standards (Ozowe et al., 2023). Despite the structured approaches to turnaround management, numerous challenges persist. One of the most significant issues is the potential for downtime and productivity loss. Extended downtimes during turnarounds can lead to substantial financial implications, especially in industries where profit margins are tightly controlled.

The influence of digitalization on efficiency, innovation, and competitiveness is significant and complex, impacting numerous sectors and business models (Narleva, 2024). Digitalization serves as a catalyst for enhancing

operational efficiency by streamlining processes, reducing expenses, and optimizing service de livery (Belev & Daskalo, 2019). Organizations that successfully implement digital technologies can significantly enhance their market competitiveness by leveraging data analytics, automation, and digital marketing strategies to optimize their operations and establish connections with broader audiences (Dimitrakieva et al., 2023).

Booking Success Rate - Table 13 showed the Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Booking Success Rate when grouped according to profile variables of role in the port operation, how long has been using TABS, and Usage and Experience respectively.

Table 13
Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Booking Success Rate when grouped according to profile variables

Sources of Variations		SS	df	MS	F	Sig.	Decision
Role in Port Operation	Between Groups	8.477	4	2.119	4.021	.007	Reject Ho
	Within Groups	23.716	45	.527			Significant
	Total	32.193	49				
How Long had been using TABS	Between Groups	2.937	2	1.469	2.359	.106	Accept Ho
	Within Groups	29.256	47	.622			Not Significant
	Total	32.193	49				
Usage and Experience	Between Groups	1.670	3	.557	.839	.480	Accept Ho
	Within Groups	30.523	46	.664			Not Significant
	Total	32.193	49				

The ANOVA results show that role in port operation significantly affects perceptions of the Booking Success Rate in the implementation of the TABS. With a Sig. value of .007, which is below the 0.05 threshold, the null hypothesis (Ho) was rejected. This indicates that differences in respondents' roles—such as truck drivers, logistics operators, port staff, or other stakeholders—lead to varying views on how successful TABS is in managing bookings. In other words, operational responsibilities and exposure to different aspects of port activities shape perceptions of system reliability and efficiency. On the other hand, the variables how long respondents had been using TABS (Sig. = .106) and usage and experience (Sig. = .480) were not significant, as their values exceeded 0.05. For these factors, the null hypothesis was accepted, meaning that the length of time using the system and the level of user experience do not create meaningful differences in how stakeholders perceive booking success. This suggests that familiarity with the system, whether through duration or frequency of use, does not strongly influence perceptions of its effectiveness.

Overall, the findings highlight that stakeholder role is the most critical source of variation in evaluating booking success, while personal usage history and experience do not significantly alter perceptions. This implies that system improvements and training programs may need to be tailored based on specific roles within port operations, since perspectives differ more by function than by individual familiarity with TABS. The Scheffe test results for perception towards booking success rate show that the group classified as "Others" (mean = 3.3455) reported the highest value compared to all other roles in port operation.

Table 13-A
Scheffe Test to determine where the difference lies on the perception towards Booking Success Rate when grouped according to Role in Port Operation
BOOKING SUCCESS RATE

Role in Port Operation	N	Subset for alpha = 0.05
		1
Truck Driver	3	2.3333
Terminal Staff	7	2.4286
Custom Broker	17	2.4588
Logistic Coordinator	12	3.1667
Others	11	3.3455
Sig.		.164

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 7.050.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

This indicates that the differences in perception lie primarily with this group, as they view booking success more positively than truck drivers (mean = 2.33), terminal staff (2.43), and custom brokers (2.46), while logistic coordinators (3.17) are closer in perception to the "Others" group. Although the overall significance value (Sig. = .164) is greater than 0.05—meaning the differences are not statistically significant—the data trend suggests that the "Others" group consistently perceives booking success at a higher level. The "Others" category generally refers to respondents whose roles do not fall directly under the main classifications of truck drivers, logistics coordinators, customs brokers, or terminal staff. This group may include warehouse personnel, shipping clerks, IT support staff, administrative officers, subcontracted workers, or ancillary service providers who are indirectly involved in port operations but still interact with the TABS. Their higher mean score implies that these roles, while not central to booking or clearance processes, may benefit more from the system's efficiency or experience fewer direct challenges compared to frontline staff.

The rapid progression of technology necessitates continuous adaptation and learning (Kolpak et al., 2022). Consequently, it is imperative for organizations to cultivate a culture of flexibility and innovation (Belev & Stoyanov, 2020). This flexibility enables companies to maintain their competitive advantage while strategically positioning themselves to capitalize on emerging opportunities in the digital economy and enhance booking competence and management.

User's Satisfaction Level - Table 14 showed the Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to User's Satisfaction Level when grouped according to profile variables of role in the port operation, how long has been using TABS, and Usage and Experience respectively.

Table 14
Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as User's Satisfaction Level when grouped according to profile variables

Sources of Variations		SS	df	MS	F	Sig.	Decision
Role in Port Operation	Between Groups	8.928	4	2.232	3.625	.012	Reject Ho
	Within Groups	27.709	45	.616			Significant
	Total	36.637	49				
How Long had been using TABS	Between Groups	2.206	2	1.103	1.506	.232	Accept Ho
	Within Groups	34.431	47	.733			Not Significant
	Total	36.637	49				
Usage and Experience	Between Groups	1.699	3	.566	.746	.530	Accept Ho
	Within Groups	34.938	46	.760			Not Significant
	Total	36.637	49				

The ANOVA results show that role in port operation significantly affects perceptions of User's Satisfaction Level with the TABS. With a Sig. value of .012, which is below the 0.05 threshold, the null hypothesis (Ho) was rejected. This means that satisfaction levels vary depending on the stakeholder's role—whether they are truck drivers, logistics operators, port staff, or other users. In practice, this suggests that different groups experience the system differently, likely due to variations in responsibilities, exposure to operational processes, and expectations of the platform. In contrast, the variables how long respondents had been using TABS (Sig. = .232) and usage and experience (Sig. = .530) were not significant, as their values exceeded 0.05. For these factors, the null hypothesis was accepted, indicating that the length of time using the system and the general level of user experience do not significantly influence satisfaction. This implies that familiarity with TABS, whether through extended use or accumulated experience, does not necessarily lead to higher or lower satisfaction levels.

Overall, the findings highlight that stakeholder role is the most critical source of variation in shaping user satisfaction, while personal usage history and experience do not create meaningful differences. This suggests that system improvements and support strategies should be tailored to specific roles within port operations, as satisfaction is more strongly influenced by the nature of a user's responsibilities than by their familiarity with the system. The Scheffe test results for Users' Satisfaction Level across roles in port operation show that the group

classified as "Others" (mean = 3.2909) reported the highest satisfaction compared to all other groups. This indicates that the differences in perception of satisfaction lie primarily with this group, as they view the system more favorably than terminal staff (mean = 2.17), truck drivers (2.33), and custom brokers (2.56).

Table 14-A

Scheffe Test to determine where the difference lies on the perception towards User's Satisfaction Level when grouped according to Role in Port Operation

USER'S SATISFACTION LEVEL

Role in Port Operation	N	Subset for alpha = 0.05
		1
Terminal Staff	7	2.1714
Truck Driver	3	2.3333
Custom Broker	17	2.5647
Logistic Coordinator	12	3.2000
Others	11	3.2909
Sig.		.147

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 7.050.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Logistic coordinators (3.20) are closer in perception to the "Others" group, but the "Others" category still stands out with the highest mean score. Although the overall significance value (Sig. = .147) is greater than 0.05—meaning the differences are not statistically significant—the data trend suggests that the "Others" group consistently perceives higher satisfaction with TABS. The "Others" category generally refers to respondents whose roles do not fall directly under the main classifications of truck drivers, logistics coordinators, customs brokers, or terminal staff. This group may include warehouse personnel, shipping clerks, IT support staff, administrative officers, subcontracted workers, or ancillary service providers who are indirectly involved in port operations but still interact with the Terminal Appointment Booking System. Their higher satisfaction score may reflect that these roles experience fewer direct operational bottlenecks and benefit more from the system's efficiency in coordination and scheduling. The influence of digitalization on competitiveness is especially significant for small and medium-sized enterprises (SMEs), which frequently encounter distinct challenges in utilizing technology. Research indicates that SMEs that embrace digital transformation can significantly enhance their competitiveness and customer satisfaction level by improving operational efficiencies and expanding their market reach (Ampa, 2023).

Frequency of Appointment Violations - Table 15 showed the Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Frequency of Appointment Violations when grouped according to profile variables of role in the port operation, how long has been using TABS, and Usage and Experience respectively.

Table 15

Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as Frequency of Appointment Violations when Grouped according to profile variables

Sources of Variations		SS	df	MS	F	Sig.	Decision
Role in Port Operation	Between Groups	4.636	4	1.159	2.333	.070	Accept Ho
	Within Groups	22.357	45	.497			Not Significant
	Total	26.993	49				
How Long had been using TABS	Between Groups	1.794	2	.897	1.673	.199	Accept Ho
	Within Groups	25.199	47	.536			Not Significant
	Total	26.993	49				
Usage and Experience	Between Groups	2.021	3	.674	1.241	.306	Accept Ho
	Within Groups	24.972	46	.543			Not Significant
	Total	26.993	49				

The ANOVA results show that none of the profile variables tested—role in port operation, how long respondents had been using TABS, and usage and experience—produced significant differences in perceptions of User's Satisfaction Level with the TABS. For role in port operation, the Sig. value was .070, which is greater than the 0.05 threshold, leading to the acceptance of the null hypothesis (Ho). This indicates that satisfaction levels do not vary significantly across different stakeholder roles such as truck drivers, logistics operators, or port staff.

Similarly, how long respondents had been using TABS (Sig. = .199) and usage and experience (Sig. = .306) also yielded non-significant results, meaning that neither the duration of system use nor the level of user experience influences satisfaction in a meaningful way. Overall, these findings suggest that satisfaction with TABS is relatively consistent across different user groups and is not strongly shaped by role, length of use, or experience. This implies that perceptions of satisfaction are more likely influenced by the system's inherent features and performance rather than by user demographics or background. In practical terms, it highlights that improvements to user satisfaction should focus on enhancing the system itself—such as reliability, responsiveness, and ease of use—rather than tailoring interventions based on user profiles.

The integration of AI into port operations has the potential to enhance decision-making capabilities, enabling ports to process substantial volumes of data in real-time and make informed decisions regarding logistics and resource management (Abdelsalam & Elnabawi, 2024). For instance, the implementation of artificial intelligence algorithms has the potential to optimize the scheduling of vessel arrivals and the management of cargo handling. This, in turn, can lead to a reduction in wait times and an enhancement in operational efficiency. The IoT can improve port operations by facilitating immediate monitoring and management of activities occurring within the port. The integration of connected devices and sensors facilitates the monitoring of container movements, the assessment of equipment performance, and the acquisition of insights into environmental conditions. This, in turn, enables proactive maintenance and the implementation of operational modifications. The integration of big data analytics facilitates the utilization of historical and current data by ports, enabling the detection of pat terns, the prediction of demand, and the streamlining of supply chain operations.

Perceived Efficiency of Port Operation - Table 16 showed the Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Perceived Efficiency of Port Operation when grouped according to profile variables of role in the port operation, how long has been using TABS, and Usage and Experience respectively.

Table 16

Analysis of Variance to test differences towards predictors affecting the outcomes on the implementation of TABS as to Perceived Efficiency of Port Operation when grouped according to profile variables

Sources of Variations		SS	df	MS	F	Sig.	Decision
Role in Port Operation	Between Groups	4.326	4	1.082	2.139	.091	Accept Ho
	Within Groups	22.755	45	.506			Not Significant
	Total	27.081	49				
How Long had been using TABS	Between Groups	1.626	2	.813	1.501	.233	Accept Ho
	Within Groups	25.455	47	.542			Not Significant
	Total	27.081	49				
Usage and Experience	Between Groups	2.409	3	.803	1.497	.228	Accept Ho
	Within Groups	24.672	46	.536			Not Significant
	Total	27.081	49				

The ANOVA results show that none of the profile variables—role in port operation, how long respondents had been using TABS, and usage and experience—produced significant differences in perceptions of the Perceived Efficiency of Port Operation. For role in port operation, the Sig. value was **.091**, which is greater than the 0.05 threshold, leading to the acceptance of the null hypothesis (Ho). This indicates that perceptions of port efficiency do not vary significantly across different stakeholder roles such as truck drivers, logistics operators, or port staff. Similarly, how long respondents had been using TABS (Sig. = .233) and usage and experience (Sig. = .228) also yielded non-significant results, meaning that neither the duration of system use nor the level of user experience influences perceptions of port efficiency in a meaningful way.

Overall, these findings suggest that stakeholders, regardless of their role, length of use, or experience with TABS, share relatively consistent views on the efficiency of port operations. This consistency implies that perceptions of efficiency are shaped more by the actual performance of port processes—such as cargo handling, documentation, and congestion management—than by user demographics or familiarity with the system. In practical terms, this highlights that improvements in perceived efficiency should focus on strengthening

operational systems and infrastructure rather than tailoring interventions to specific user groups. The integration of connected devices and sensors facilitates the monitoring of container movements, the assessment of equipment performance, and the acquisition of insights into environmental conditions (. This, in turn, enables proactive maintenance and the implementation of operational modifications. The integration of big data analytics facilitates the utilization of historical and current data by ports, enabling the detection of pat terns, the prediction of demand, and the streamlining of supply chain operations.

4.5 Test of Significant differences on the perception towards challenges encountered on the implementation of TABS when grouped according to profile variables

Table 17 showed the Analysis of Variance to test differences towards challenges encountered on the implementation of TABS when grouped according to profile variables of role in the port operation, how long has been using TABS, and Usage and Experience respectively.

Table 17
Analysis of Variance to test differences towards challenges encountered on the implementation of TABS when grouped according to profile variables

Sources of Variations		SS	df	MS	F	Sig.	Decision
Role in Port Operation	Between Groups	5.826	4	1.457	1.975	.115	Accept Ho
	Within Groups	33.194	45	.738			Not Significant
	Total	39.020	49				
How Long had been using TABS	Between Groups	2.130	2	1.065	1.357	.267	Accept Ho
	Within Groups	36.890	47	.785			Not Significant
	Total	39.020	49				
Usage and Experience	Between Groups	3.599	3	1.200	1.558	.212	Accept Ho
	Within Groups	35.421	46	.770			Not Significant
	Total	39.020	49				

The ANOVA results show that none of the profile variables—role in port operation, how long respondents had been using TABS, and usage and experience—produced significant differences in perceptions of the challenges encountered in the implementation of TABS. For role in port operation, the Sig. value was .115, which is greater than the 0.05 threshold, leading to the acceptance of the null hypothesis (Ho). This indicates that challenges are perceived similarly across different stakeholder roles, such as truck drivers, logistics operators, and port staff. Likewise, how long respondents had been using TABS (Sig. = .267) and usage and experience (Sig. = .212) also yielded non-significant results, meaning that neither the duration of system use nor the level of user experience significantly influences how challenges are perceived. Overall, these findings suggest that the challenges encountered in TABS implementation are shared across all user groups, regardless of role, length of use, or experience. This consistency implies that the difficulties—such as system glitches, compliance issues, or connectivity problems—are systemic in nature rather than dependent on user demographics or background. In practical terms, this highlights that solutions to these challenges should focus on system-wide improvements (e.g., infrastructure, enforcement, and technical support) rather than role-specific interventions, since all stakeholders experience the same set of issues.

The impact of resistance to change can be particularly pronounced during turnaround periods when organizations are under pressure to achieve rapid results. To mitigate resistance to change, organizations must foster a culture that embraces innovation and adaptability. Effective communication plays a vital role in this process. By clearly articulating the reasons for change and the expected benefits, organizations can help alleviate employees' fears and concerns. This finding is similarly observed by Hafey, (2014) as he avert that involving employees in the decision-making process can create a sense of ownership and commitment to the changes being implemented, thereby reducing resistance (Hey, 2019). Organizations, particularly those operating in capital-intensive industries, may find it challenging to allocate the necessary resources without compromising other operational areas (Fridholm & Brogren, 2017). This financial strain can hinder organizations' ability to adopt advanced tools and methodologies that could enhance their turnaround processes. To address financial constraints,

organizations can explore various strategies. One approach is to conduct a cost-benefit analysis to evaluate the potential return on investment (ROI) of implementing innovative strategies. By demonstrating the long-term benefits of these initiatives, organizations can secure the necessary funding from stakeholders and decision-makers (Prajogo & McDermott, 2014).

4.6 Test of Significant relationship between the predictors and the challenges encountered in the implementation of TABS

The Pearson Product Moment Coefficient of Correlation to test relationship between the predictors and the challenges encountered on the implementation of TABS. The correlation analysis reveals a very strong positive relationship between the predictors affecting the implementation of TABS and the challenges encountered in its implementation. The Pearson correlation coefficient of 0.866 indicates that as challenges increase, the predictors influencing TABS outcomes are also strongly affected. The Sig. (2-tailed) value of 0.000, which is well below the 0.05 threshold, confirms that this relationship is statistically significant. This means the observed correlation is not due to chance and reflects a genuine association between the two variables. In practical terms, the findings suggest that the effectiveness of predictors such as user training, compliance enforcement, and system integration is closely tied to the extent of challenges like system glitches, resistance to change, or weak connectivity. When challenges are high, predictors are hindered, reducing the success of TABS implementation; conversely, addressing these challenges strengthens the predictors and enhances system outcomes. Overall, the analysis underscores the importance of mitigating operational and user-related challenges to ensure that the identified predictors can fully contribute to the successful implementation of the Terminal Appointment Booking System.

Think of the predictors (such as training, compliance enforcement, system integration, and user support) as the drivers of success for the TABS. These predictors are designed to ensure smooth booking processes, reduce congestion, and improve user satisfaction. However, the challenges (like system glitches, resistance to change, poor connectivity, or lack of training) act as barriers that weaken the effectiveness of these predictors. The correlation result (Pearson r = 0.866, Sig. = 0.000) shows a very strong and statistically significant link between the two: when challenges increase, predictors are hindered, and the outcomes of TABS implementation suffer. Conversely, when challenges are reduced or resolved, the predictors are "unlocked" and can function at their full potential, leading to higher booking success rates, smoother port operations, and greater user satisfaction.

Conceptually, this relationship can be imagined as a flow of energy where the predictors serve as the "engines" that drive the TABS forward. These predictors—such as training, compliance enforcement, and system integration—are designed to propel efficiency and success. However, challenges act as "obstacles" that block the road, slowing down or weakening the effectiveness of these predictors. When challenges such as system glitches, poor connectivity, or resistance to change are present, they hinder the smooth functioning of the predictors and reduce the overall impact of TABS. Conversely, when these challenges are removed or minimized, the path becomes clear, allowing the predictors to operate at full capacity and drive efficiency without obstruction. In this way, overcoming challenges is not only about eliminating problems but also about unlocking the full potential of the predictors to achieve the intended outcomes of the system.

In short, challenges directly influence how well predictors can operate. Addressing these barriers is not just about fixing problems—it is about empowering the predictors to deliver the intended benefits of TABS. According to Adeyemi (2018), a lack of coordination can result in rework, inefficiencies, and ultimately, prolonged ramp-up durations post-maintenance. Enhancing collaboration through integrated planning and communication strategies can help alleviate these challenges and facilitate smoother turnaround processes. To address these common challenges, organizations must adopt innovative strategies that enhance turnaround management. Implementing advanced technologies, such as digital twins, predictive analytics, and real-time monitoring systems, can significantly improve planning and execution during turnarounds (Enebe, 2019). Digital twins create virtual replicas of physical assets, enabling organizations to simulate and analyze various scenarios before executing the actual turnaround. This technology can help identify potential bottlenecks and optimize resource allocation,

ultimately reducing ramp-up durations (Hajjarsaraei et al., 2018). Predictive analytics also plays a crucial role in turnaround management by utilizing historical data to forecast potential failures and maintenance needs. By anticipating equipment issues, organizations can proactively schedule maintenance activities, thereby minimizing unplanned downtime and ensuring a smoother transition back to full operational capacity. A study by Franz (2022) demonstrated that organizations leveraging predictive analytics experienced a significant reduction in downtime and ramp-up durations during turnarounds compared to those relying solely on traditional maintenance practices.

5. Conclusions

Based on the summary of findings, the researchers had concluded that:

1. The respondent identified in the study is a customs broker who has been using the Terminal Appointment Booking System (TABS) for more than one year, but only engages with it rarely.

2. The respondents agreed on the predictors affecting the outcomes on the implementation of Terminal Appointment Booking System.

3. The respondents agreed on the challenges encountered on the implementation of Terminal Appointment Booking System.

4. There are significant differences on Turnaround time, booking success rate and user's satisfaction level when grouped according to the role in port operation profile variable.

5. There are no significant differences on the perception towards challenges encountered in the implementation of Terminal Appointment Booking System when grouped according to the role in port operation profile variable.

Recommendations - Based on the summary of findings and the conclusions arrived at, the researchers had offered the following recommendations based on salient findings to wit:

1. Since efficiency of port operations emerged as the strongest predictor, management should continue to enhance system integration and streamline processes to maximize operational gains.

2. The relatively lower ratings on turnaround time and appointment violations highlight the need for stricter enforcement of schedules, improved monitoring, and better coordination among stakeholders to reduce delays and non-compliance.

3. The results show that many users engage with TABS only rarely, despite having long-term exposure; therefore, targeted training, awareness campaigns, and user support should be provided to encourage more consistent usage and build confidence in the system.

4. The reported higher satisfaction and booking success among "Others" (ancillary roles such as warehouse staff, shipping clerks, or IT support), their perspectives should be leveraged to identify best practices that can be extended to frontline users.

5. Finally, addressing systemic challenges—such as technical glitches, connectivity issues, and resistance to change—will unlock the full potential of the predictors, ensuring that TABS delivers sustainable improvements in efficiency, user satisfaction, and compliance across all roles in port operations.

6. For future researchers, to conduct an-in depth study and wider in scope so as to validate and confirm the findings of the study.

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