

## **Logistics and Customs Digitalization Practices Assessment Using a Technology Acceptance Model**

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### ***Abstract***

*The importance of effective logistics services and customs operations is now recognized globally as a fundamental catalyst for development and is critical for national competitiveness. With the rapid advancement of digitalization, international trade actors around the world are increasingly adopting digital solutions to enable a digitally interconnected ecosystem and to exploit the potential of digitalization. This study applied quantitative approaches to evaluate and understand the status quo of digitalization practices of logistics services and customs operations using basic determinants from the technology acceptance model. A total of 622 responses were collected using subjective questionnaires from customs employees and logistics service providers. The main contribution is that although the determinants of the technology acceptance model are widely used tools, there is no coherent approach to use them to learn the digitalization practices of logistics services and customs operations. Therefore, this study seeks to better understand the trends in logistics and customs digitalization by analyzing the determinants of the technology acceptance model in terms of the simplicity of the technology to use, the importance of the usage, and the perception of user satisfaction. The study comprehensively analyzed and discussed factors of the acceptance model of technology and relevance. The result demonstrates that customs employees' technology usage practices are more positive than portfolios of logistics service providers perception. It serves to identify digitalization practices, enabling actors to determine and implement technologies that promote increased acceptance.*

**Keywords:** *Logistics digitalization, technology acceptance model, digitalization, customs digitalization, perceived usefulness, perceived ease of use.*

## **Introduction**

Globally, in an international ecosystem, the ability to provide efficient logistics service and customs operations is recognized as a key driver of economic development and a prerequisite condition for national competitiveness. Although the responsibilities of logistics operators and customs authorities vary, both domain actors play a key role in facilitating trade. Tadesse et al., (2021) describe integrating digitalization and digital technology plays a pivotal role in exploiting the value within logistics services and customs operations in expediting seamless regional, continental, and international integration to facilitate unrestricted movement of goods and people. Logistics and customs digitalization initiatives can include the adoption of various types of digital technologies and automation that can include enhanced electronic tracking systems, digitalized information flows (Kuteyi & Winkler, 2022) automation, business intelligence, big data analytics, machine learning, and the Internet of Things that are capable of leapfrogging international trade facilitation.

The implementation of digital technologies and automation for successful digital transformation is a complex process accompanied by numerous barriers that could limit its success (Cichosz et al., 2020) and requires careful planning and execution. Among the principal challenges that need to be addressed are understanding current trends and developing a comprehensive digital transformation roadmap. To enhance logistics and customs digitalization for improved logistics service performance (Taufani et al., 2022) and customs competitive standing, it needs to actively revamp the international trade ecosystem by assessing and adopting appropriate technologies and automation to overcome the unclear digitalization transition process (Taufani et al., 2022). This includes the formulation of a comprehensive appropriate framework to evaluate the practice of logistics and customs digitalization in the journey to modernize logistics services and customs operations. To formulate and understand the digitalization setup, many determinants of models are used since 1980s; however, most of the determinants that are used as subjective determinants of models are not validated and their relationship to the usage of technology is unknown (Davis et al., 1989). That being the case, it is necessary to explore and use proper influencing subjective models such as Technology Acceptance Model's (TAM) (Worthington, 2021) determinants, which can be incorporated for evaluating logistics and customs digitalization set-up. This helps to better understand the proper attributes to be considered or deprecated to adopt digital technologies with the intuition to get increased usage with logistics and customs systems.

The technology acceptance model has a solid historical foundation to be used as a fundamental framework to predict the perception of individual adoption and use of new technologies (Worthington, 2021). In 1980s (Davis et al., 1989) developed and validated perceived usefulness (PU) and perceived ease of use (PEU) determinants as fundamental factors of user acceptance of computers with strong relationship revealing that PU has a greater correlation with computer system usage than PEU and suggesting a potential convergence between these two factors. In addition to TAM factors, other factors, such as user satisfaction with technology (UST), that have been shown to influence the understanding of new technologies and automation, must be considered according to the sector's domain. TAM is a generic model (Davis et al., 1989) that can

be tailored and applied to a variety of industries with a goal of understanding and predicting how people accept and use new technologies. For this study, however, it is important to consider the specific context of international trade set-up that includes logistics services and customs operations which are the main services in the ecosystem. By understanding the factors that influence logistics and customs digitalization, stakeholders in international trade can take informed decisions that make users more likely to adopt and easily operate new technologies.

This research aims to investigate the effectiveness of the determinants of the technology acceptance model (Davis et al., 1989) in the assessment of the digitalization gap to be used as a potential model to explore and understand the trends in digitalization. This is achieved by collecting and evaluating data from logistics service providers and customs employees through structured survey questions. Intimate TAMs determinants subjective survey questions collected addressing issues such as low-end user satisfaction, low performance, incomplete exploitation of IT based customs declaration processing systems, inadequate ICT support, inability to effectively use the digital technologies (Pereira et al., 2022) encountered by both LSPs and customs in the international trade ecosystem. Furthermore, it evaluates the applicability and relevance of the determinants of Technology Acceptance Model within the context of logistics services and customs operations with technology acceptance.

## **Review of the literature**

This section introduces the theoretical fundamentals and technical definition of the study aligned with logistics and customs digitalization.

### **Digitalization**

According to Pereira et al., (2022) digitalization within a business context is a concept of more automatic and digital operations. Digitalization is applicable into various sectors with significant benefits and positive influence on organization performance, improved customer satisfaction (Salume et al., 2022), and innovation. It fosters collaboration with stakeholders and facilitates improved data sharing that leads to informed decision making. Successfully implemented digitalization initiatives lead to digital transformation (Logistics Digitalization, 2022) that can be used as an institution road map for enhanced user experience with streamlined operations and redesigned and optimized business model. Despite the potential opportunities of digitalization, organizations face considerable challenges (Feliciano-Cestero et al., 2023), such as gaps in digital skills, cybersecurity threats, digital leadership, privacy concerns, and a lack of a well-organized institutional digitalization road map. Furthermore, businesses may be reluctant to initiate digitalization or face resistance from end users to operate digital technologies, even though it can make them more efficient and competitive (Logistics Digitalization, 2022). This reluctance may be due to a lack of awareness of the benefits of digitalization or lack of the skills needed to operate from the end user's side.

The future of digitalization is very impactful (Brynjolfsson & McAfee, 2017), and brings disruptive moments that comprise the adoption of industry emerging technologies such as cloud technologies, cyber-physical systems (Holubk et al., 2021),

artificial intelligence (Brynjolfsson & McAfee, 2017), the Internet of Things (IoT), and big data analytics in which it will create new opportunities and lead to digital transformation. In international trade, the importance of digitizing logistics and customs operations is rapidly increasing, along with the exploration of the potential of emerging technologies such as artificial intelligence and blockchain (Holubk et al., 2021; Logistics Digitalization, 2022).

In general, it is essential for organizations to understand these implications and leverage digitalization (Salume et al., 2022), to remain competitive in the rapidly changing business landscape. It also needs to be alerted to use the advantage of emerging opportunities arises with digitalization. The emergence of industry 4.0 applications (Holubk et al., 2021) in logistics has a transformational impact (Brynjolfsson & McAfee, 2017) and has the potential to increase customer satisfaction by introducing customer-focused solutions to ease the burden on trade that can improve operational performance.

### **Digital Transformation**

Digital transformation has been in use and discussed for many years with unaccounted definitions in various domains that impact business process performance and relationship with different types of actors (Plekhanov et al., 2022). Digital transformation has been defined as the integration of emerging digital technologies (Frank et al., 2019) into all aspects of an organization, creating new or modifying existing business (Loebbecke et al., 2015), resulting in fundamental changes in how businesses operate and deliver services to users (Plekhanov et al., 2022).

Successful implementation of digital transformation requires a holistic approach that involves not only technology, but also changes in business processes, transformative leadership, and skill or management in behavior (Nadkarni & Prügl, 2021). It is important to understand how to adopt digitalization initiatives that accompany it with collaborative platforms, as well as trace the impact of digital transformation (Yang and Lin, 2023) on different types of businesses such as individual, small and medium-sized enterprises, and multinational enterprises (Nadkarni & Prügl, 2021). This enables us to understand the challenges and opportunities associated with digital transformation. Taufani and Widjaja, (2022) analyzed adaptability, resource mobilization, and innovation capacity to understand digital transformation in logistics firms and learned moderately positive performance.

There are considerable basic stakes for digital transformation, such as strategy, organizational culture, (Henriette et al., 2016) technological complexity, skill and knowledge management, and stakeholder engagement to accelerate the realization of digital transformation that require digital leadership and commitment of top management. Subramaniam, (2020) argues that successful digital transformation requires organizations to harness the power of digital platforms and ecosystems to collaborate and innovate. There are also notable studies that exploit the capacity of emerging technologies of industry 4.0 (Holubk et al., 2021) to optimize decision making in logistics. According to the World Economic Forum, the frameworks for digital transformation initiatives consist of digital strategies, business models, enablers, and orchestration and interaction (WEF, 2018). The steps involved in digital

transformation are developing a comprehensive institutional digital strategy that addresses themes, challenges, and opportunities, creating a conceptual framework, and executing an action plan (Logistics Digitalization, 2022).

Successful logistics and customs digital transformation requires collaboration (Cichosz et al., 2020) between various actors, including LSPs, customs authorities, traders, regulatory agencies, and technology providers in the international trade ecosystem. From the logistics service providers' aspect, overcoming the logistics service providers digital solutions barrier and successful maritime digital transformation road map can improve logistics capabilities by providing real-time data, automation, and increasing the perceived usefulness of logistics services. The implementation of digital transformation has both opportunities and challenges (Cichosz et al., 2020). Nadkarni & Prügl, (2021) discussed the opportunities and challenges of digital transformation for businesses at different levels of scale, as well as developing and developed countries. With considerable challenges (Henriette et al., 2016), the adoption of digital transformation is essential for businesses that want to remain competitive in the digital age. By understanding the opportunity of adopting appropriate technologies (Frank et al., 2019) and the impact they create (Subramaniam, 2020), businesses can be better prepared to take advantage of the opportunities that digital transformation offers.

### **Logistics and Customs Digitalization**

According to Little, (2021) effective logistics services building blocks are real-time synchronization and logistics information flow, digital platforms, and physical transportation. Adopting digitalization can lead logistics service providers to operate at lower costs and higher margins, as well as offer efficient quality services. The efficient and digitalized logistics service plays an important role in affecting the development of the economy and industries. To harness the potential of digitalization, it is important to understand the perception of users on the importance and easy use of digital technologies. Hence, a logistics and customs digitalization gap assessment can be applied to assess the level of digital readiness and identify gaps in logistics operators and customs authorities' digitalization efforts using different models.

The World Customs Organization (WCO) digital maturity model provides a guide for customs authorities to assess their digitalization practices and identify areas for improvement (Clark, 2022) in accordance with WCO standards. Digitalization evaluations guide LSPs and customs authorities in benchmarking their digitalization efforts against best practices and international standards. It can support exploiting opportunities for advancement, adopting innovative solutions, and plan to enhance their operations effectively (Pereira et al., 2022). This improves the collaboration of LSPs and customs authorities with each other and international trade stakeholders for common goals, to tackle challenges, and to develop shared solutions that benefit all parties. The overall well-organized digitalized economy and logistics operation positively affects the proximity of the national logistics performance index.

Another study Peters, (2022) examined the impact of the digital economy and the use of the digital economy partnership in Southeast Asia. The author discussed that digitalization has the potential to improve economy and reduce costs, with online spending projected to reach \$363 billion by 2025 (Peters, 2022), it is explored that

digitalization is becoming a key driver of economic growth and development in Southeast Asia to expand their presence in the international economy. Another study Rahayu and Kusdianto, (2023) investigated the necessity of a digital transformation policy in Indonesia for the tax authority to achieve successful tax administration that impacts costs and improving administration. The authors argued that digitalization by tax authorities can lead to increased efficiency and reduced costs in customs declaration and clearance processes. The study also identifies challenges to implementation, such as the need for interoperability between the digital systems of different tax authorities (Rahayu and Kusdianto, 2023). On the other hand, the WEF, (2022) report shows that the current system of customs border and procedures in Africa is inefficient and fragmented due to the lack of seamless information flow along with logistics. Import and export goods are experiencing prolonged transit delays, leading to high costs in international trade. It is also reported on World Economic Forum that the pragmatic perspective of digital transformation can improve customs efficiencies in customs processes and can yield trade gains on the Africa continent of \$20 billion annually (WEF, 2022).

Logistics digitalization uses digital technologies to fundamentally change the way LSPs and customs communicate and operate business. It has the ability to have a positive impact on the businesses of LSPs and the customs operation, where those who have adopted digitalization can see improvements in their performance, such as increased productivity, cost reduction, and innovation. However, there are also challenges associated with digitalization, such as the need for investment in new technologies, investment in infrastructure, investment in human skill and the need to change organizational culture. End-to-end digitalization of customs procedures and system-to-system interaction could help to address these challenges. Thus, acceptable digitalization has to base the interest of end users, which can be explored through tested models to assess the digitalization trends.

### **Technology Acceptance Model**

Logistics operators and customs authorities around the world have been attempting to digitize their operations through the adoption of pertinent digital technologies. Therefore, the acceptance and effective use of these digital technologies by customs employees and logistics service providers is crucial to achieve the desired results and requires continuous improvement evaluation. The research on the search for suitable models and theories of technology adoption came into the attention of scholars since the 1980s (Davis et al., 1989) empirically evaluated the ability of theory of reasoned action (TRA) basically researched by (Ajzen and Fishbein, 1980). TAM was deliberated to predict and explain future user behavior in computer-based technologies. TRA is a social psychology model concerned with the determinants of consciously intended behaviors, and it is applicable in various domains; TAM is an adaptation (Davis et al., 1989) of TRA for information system domain and used as a theoretical basis. It is a comprehensive model, which means that it is simple and easy to understand, as well as a widely used framework to analyze the adoption and acceptance of digital technologies (Mondego and Gide, 2022).

Many studies have built upon TAM by adding additional factors that are considered reasonable with a specific context. Mondego and Gide, (2022) developed a TAM to

evaluate electronic customs systems by modeling structural equations (SEM) to analyze the data. Gefen et al., (2003) extended the TAM to include additional variables such as trust and social influence to enhance its explanatory capability. Extensively, many studies used the unified theory of acceptance and use of technology (UTAUT) model (Naveed et al., 2020), due to its capacity to incorporate extensive factors such as social, contextual, performance, and other facilitating factors (Venkatesh et al., 2003) and UTAUT widens the lens of perceptions.

On another hand, Mondego and Gide, (2022) used TAM to analyze the cloud-based payment systems of countries such as China, India, Indonesia, Spain and Malaysia to learn the effect of determinants of TAM on the cloud-based payment system. Hence, TAM advocates that perceived usefulness and perceived ease of use of a technology are key determinants of users' intention to use it. Cognizant to the above, the intuition of this is study is to learn the perceptions of LSPs and customs employees toward technology adoption and usage using determinants of technology acceptance model.

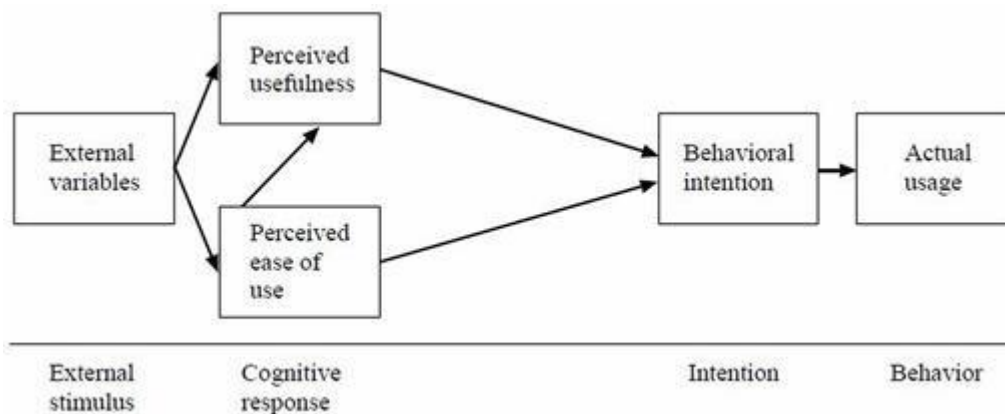


Figure 1. Technology Acceptance Model (Davis 1989 cited in Koul et al., 2018).

Venkatesh et al., (2003) suggest that perceived usefulness and perceived ease of use are the main unifying determinants of technology users' behavioral intention to use digital technologies. In particular, in logistics and customs digitalization, TAM helps LSPs and customs authorities to understand the factors that affect technology adoption that influence them to make informed decisions. In general, studies using TAM typically find practical ways to assess and improve the acceptability and perceived importance of technologies to users.

### **Perceived usefulness and Perceived ease of use**

With a principal goal to understand the factors behind users' acceptance of technology to use or rejection not to use (Davis et al., 1989; Mondego & Gide, 2022; Aboelmaged, 2010), and despite diverse factors of TAM, scholars have verified the effectiveness of perceived usefulness and perceived ease of use. The technology acceptance model primarily uses these two determinants (Davis et al., 1989; Mondego and Gide, 2022; He, 2018) aimed to predict user perception of the digital technology in place, easy to use (perceived ease of use), and exhibit greater confidence and proficiency in adopting digital technology (perceived usefulness) (He, 2018). The first factor tends to show the degree to which a user believes that using certain technology will be free of effort, while

the second factor is the degree to which a user believes that using certain technology will improve the effort performance (Davis et al., 1989). The reason why studies are exerting effort on the determinant of TAMs is in the information system, a digital solution that is not exploited by its users will never be a success (He, 2018), implying that the importance and simplicity are at the forefront.

Preliminary supportive literature is available for the delineation of the aforementioned factors of TAM. For instance, Aboelmaged, (2010) investigated the adoption of e-procurement system in a developing country using TAM and theory of planned behavior. Aboelmaged, (2010) finding suggests that the extended TAM is capable of explaining a relatively high proportion of variation of intention to use e-procurement. Similarly, Ramayah et al., (2007) explored the factors affecting employees' acceptance of automation in northern Malaysia. The results of Ramayah et al., (2007) showed that perceived usefulness and perceived ease of use were the main determinants of employees' intention to use digital solutions (Ramayah et al., 2007; Koul et al., 2018) as end users of various digital platforms.

Another study conducted in the United States on driverless car technology Koul et al., (2018) examined the relationship between perceived usefulness and perceived ease of use. Koul et al., (2018) concluded that perceived usefulness and perceived ease of use were positively correlated with the intention to use driverless cars. This implies that users who believe that driverless cars will be useful and easy to use are more likely to say that they intend to use them. Consequently, the two factors of TAM are being employed and evaluated to understand the process by which users adopt and utilize new technologies, and also to potentially explore the correlation between these two factors and user satisfaction with technology usage.

## **Methodology**

In this study, primarily the two key determinants of TAM were highlighted and assessed for their validity in a survey conducted across two international trade domain actors involving LSPs and employees of the Ethiopian Customs Commission (ECC). For the purpose of building a sample frame, a complete list of ECC employees at the head office and the population size of logistics service providers was collected, and the sample size was decided judgmentally. The target group was chosen objectively, based on those who have experience in the interaction with logistics and digital technologies of customs.

The sample size required to conduct this study is set to 251 customs employees and 384 LSPs, totaling 635 samples. However, to increase the probability of the response rate, a total of 849 and 959 questionnaires were distributed to employees of ECC and LSPs respectively. Through all methods, a total of 315 from customs employees and 455 from LSPs responses were collected. Due to missing values in some questionnaires, the usable and complete responses amounted to 622 valid questionnaires. Therefore, a total of 622 respondents from international trade environment service providers who were utilizing various software applications and digital technologies were considered.

The study questionnaires focused assessing the effective situations from the perspective of simplicity and importance to target users on implemented logistics and customs

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digital platform under TAM factors perceived usefulness, perceived ease of use, and users' satisfaction to learn end users' behavioral intention of direct system usage. The questionnaire items used to measure respondents' perspectives regarding the perceived usefulness, perceived ease of use, and satisfaction with the digital technologies utilized in their daily business operations.

Hence, the theoretical minimum sample size for the perception survey using the Likert scale through Monte Carlo imulation found that the minimum sample size according to the survey scales is  $n = 31.61 + 2.33$  (Louangraph, 2017). Furthermore, Sudman, (1976) suggested that a minimum of 100 elements is needed for each major group or subgroup in the sample, and for each minor subgroup, a sample of 20 to 50 elements is necessary. Similarly, Kish, (1965) says that 30 to 200 elements are sufficient when the attribute is present 20 to 80 percent of the time.

### **Data Collection**

The survey questionnaire developed to measure the technology acceptance model scheme perceived usefulness and perceived ease of use in digital technologies were examined to evaluate perceived gaps. The survey instrument was formulated to assess the determinants of the technology acceptance model, focusing on perceived usefulness and perceived ease of use in digital technologies. The questionnaires were focused on capturing the effective picture on digital platforms implemented under the TAM specification.

### **Method of Analysis**

Theoretically, three independent determinants of TAM are identified as the most contributing factors and tested empirically. Descriptive analysis is used by summarizing and describing the collected data using relevant measures to provide and get relevant insights from the responses. Extensively, correlation analysis is applied to evaluate the strength and direction of relationships between variables. It helps to explore significant correlations between the determinants of TAM and the actual adoption of digital technologies.

### **Analysis and Results**

Questionnaires with more than 50% missing data were eliminated (Hair, 2010), and the collected data were analyzed for potential outliers that exceeded the -3 and +3 thresholds in the residual plot. Consequently, an analysis was performed on the valid data of 238 customs employees. To improve stakeholder response rates, a total of 959 questionnaires were distributed, leading to the collection of usable logistics stakeholder data 384 and finally totaled ( $n=622$ ) samples used for analysis.

### **Descriptive analysis of technology acceptance data**

In addition to the two main factors of TAM, perceived ease of use (PEU) and perceived usefulness (PU), another additional attribute is used to gain insight into user satisfaction with technology (UST). Therefore, the preparation of subjective survey questionnaires aligned with these three determinants was considered. In this construct, the variables

are measured in a 7-point scale. Hence, the mean value of the current outcomes is evaluated in the adjusted interval, i.e., 1 to 3 represents low perception, 3 to 5 represents medium perception, and 5 to 7 represents high perception. The descriptive statistical analysis of the LSP and the survey respondents of the customs employees is presented in Table 1 and Table 2 respectively.

Table 1. LSPs descriptive statistics and correlation matrix on TAM LSPs

Variables	Mean	SD	1	2	3	4
1. TAM	3.2697	1.34194	1			
2. PU	3.2511	1.11943	.633	1		
3. PEU	3.1380	1.11694	.709	.799	1	
4. UST	3.0585	1.06923	.602	.707	.698	1

A close look at the responses regarding the correlation Table 1 shows that the data highlights strong positive links between TAM and PU (0.633), TAM and PEU (0.709), and PU and PEU (0.799). In addition, TAM moderately correlates with UST (0.602), indicating a positive relationship. PEU also moderately correlates with UST (0.698), suggesting a connection between ease of use and user satisfaction. The overall LSPs response analysis implies positive relationships among perceived usefulness, ease of use, the technology model, and user satisfaction.

Table 2. Customs employees descriptive statistics and correlation matrix on TAM

Variables	Mean	SD	1	2	3	4
1. TAM	5.48	1.31	1			
2. PU	6.01	1.02	.55**	1		
3. PEU	5.02	1.01	.59**	.66**	1	
4. UST	5.13	1.02	.55**	.61**	.75**	1

Table 2 correlation analysis shows there are consistently strong positive correlations among all pairs of variables. TAM correlates strongly with other determinants and there are strong correlations among determinants themselves. These suggest a highly interdependent relationships indicating that improvements or perceptions in one variable are likely to affect the others positively.

### **Perceived Usefulness (PU)**

The mean value of logistics service providers' perception is 3.25 with 1.11 SD and the employees is 6.01 with 1.12 SD on the usefulness of the technology being in use in operations, which is in the high mean value category. Furthermore, the frequency distribution indicates that more than 93.3% of the respondents' opinion supports the usefulness of the technology used by the customs. In addition, there is a strong and significant positive intercorrelation (0.51,  $p < 0.01$ ) between the perception of employees about the usefulness of technology and their actual acceptance of technology.

### Perceived Ease of Use

Logistics service providers and customs employees were asked to rate whether the technology installed in the ECC is easy to use or not. The mean value of logistics service providers is 3.13 with 1.11 SD and the employee is 5.02 with 1.02 SD perception of the ease of technology, which is also categorized as high mean value, but it is the low margins of high value. Additionally, the correlation analysis indicates that there is a positive significant relationship (0.59,  $p < 0.01$ ) relationship between customs employees' perception of the ease of technology and their actual acceptance of the technology.

### Users' satisfaction with the technology (UST)

Users' satisfaction on the type of technology they used also plays a significant role in increasing the actual usage of the technology. Therefore, the satisfaction of logistics service providers and customs employees with technologies was assessed, and the mean value of the logistics service providers UST is 3.05 with 1.06 SD, and the UST of the customs employees is 5.13 with 1.02 which is also a marginal high value. In addition to the central tendency, there is also a significant positive relationship (0.55,  $p < 0.01$ ) relationship between the satisfaction of logistics service providers with the technology in use and their actual acceptance of the technology.

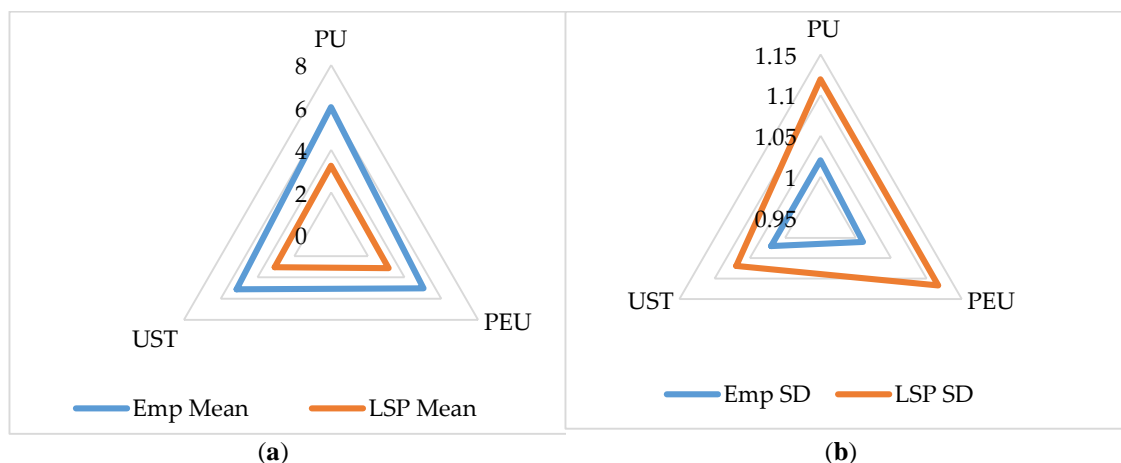


Figure 2. (a) Mean value of TAM; (b) Standard deviation (SD) of TAM.

Finally, the actual acceptance of current technology of logistics service providers and customs employees was measured using two items on a seven-point likert scale. The survey results indicate that most logistics service providers and customs employees are using the technologies without major difficulties and are well aware of the importance of the digital technologies in use in customs. The analysis result shows that the perceived ease of use and perceived usefulness of TAM factors are correlated with user satisfaction with technology. Figure 2. shows the three factors of TAM and shows that people who believe that the digital technologies are easy to use and useful to them are more likely to be satisfied with it.

On another note, more than 96% of the respondents are using the technology platforms installed by customs, however, different problems that hinder their active involvement

due to power interruption (59.2%), internet interruption (42.7%), ineffectiveness of e-services of customs digital technologies (82,7%), inadequate knowledge and skill to operate digital technologies (46.7%).

## **Discussion**

In this study, the use of technology acceptance model for logistics and customs digitalization practices was analyzed to understand the perception of LSPs and customs users. Furthermore, the prevalence of the technology acceptance model was used for both target groups with its two underpinning determinants. On the basis of the analysis, it could be shown that both perceived ease of use and perceived usefulness are well relevant to understand the organization's digitalization practice.

A review of the literature on the factors of the model provided a comprehensive overview of the key factors that influence the acceptance of technology for implementation. The review consolidates existing research on the subject and highlighted the possible state-of-the-art approaches to evaluate the implementation or adoption of new technology by measuring the users' view from the importance and simplicity of technologies perspectives.

The survey elements were intended to learn the gap in digitalization practices that supports interpretation of remedial action on the importance or ease of use of digital technologies. It is used as a critical element in enhancing the effectiveness, quality, and integrity of end users with respect to operating and using the digital platforms.

Furthermore, the study investigated how digitalization can be achieved by applying the factors of two basic acceptance models of technology and their alignment with user satisfaction with technology. The analysis supports the view that organizations that need to implement sustainable digital technology need to exert an important effort to assess their current digitalization practices by using key TAM determinants to understand overall practices and area of improvement to consider the needs of the target user. It was found that among the factors analyzed, the mean value of the respondents is medium.

## **Conclusions**

The empirical findings of this study demonstrate that TAM can assist organizations in understanding users' perceptions of the digital technology in use, thereby contributing to the improvement of digitalization practices. The study investigated the perceived ease of use and perceived usefulness of the TAM determinants, as well as the perceived satisfaction of the user with technology to capture insights of the digitalization practices that underpin successful digital transformation. The mean value analysis demonstrates that customs employees' technology usage practices are more positive than the portfolios of LSPs technology users.

The contribution of this study lies in its ability to offer consolidated insights into the factors that organizations should take into account within the framework of TAM that guide them to understand and enhance their digitalization practices. It helps organizations understand the importance of TAM factors and provides insights into

how they can use them to achieve their specific digitalization goals. Among the core contributions, the first is the need for gap assessment for digitalization initiatives through TAM frameworks considering the target system users' perceptions. The second contribution comes along with insights aligned with human element evaluation through TAM determinants for new technology adoption or implementation, where we uncovered core factors that facilitate digital transformations.

The study's findings show that perceived usefulness and perceived ease of use are important factors in determining whether users (i.e., LSPs and customs employees) will use digital technology in place. Furthermore, the study found that perceived ease of use and perceived usefulness were positively correlated with user satisfaction. In other words, users who believe that the technologies in use are easy to use and useful are more likely to be satisfied. It supports institutions to rethink and exert their efforts towards digitalization by identifying the prerequisites from the perspective of system importance and simplicity for the intended target users. The results of the analysis imply that logistics service providers and customs authorities should focus on making their digital technologies easy to use, useful, and in line with user expectations when designing and implementing them.

The practical implication of this study is used as evidence to select digitalization assessment models, in terms of understanding digitalization practice from end users perception on usage and importance of digital technologies aimed at increasing the level of perceived ease of use and perceived usefulness.

This study focused on the perspectives of LSPs and internal customs employees of the digital technologies users with limited generalizability; therefore, small- and private organizations could work with the determinants of the framework. On the other hand, it is expected to apply other qualitative approaches to exploit further instances and capture extensive digitalization practices. Future research should consider other qualitative study patterns through informative expert feedback and discussion that could exploit the stereotype to implement effective digitalization.

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