# “The role of technological enablers and government support in e-commerce adoption among SMEs in Jordan”


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| **AUTHORS** | Abdallah Ali Mohammad Alrifae |



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| **ARTICLE INFO** | Abdallah Ali Mohammad Alrifae (2025). The role of technological enablers and government support in e-commerce adoption among SMEs in Jordan. *Problems and Perspectives in Management*, *23*(2), 775-784. doi:10.21511/ppm.23(2).2025.56 |
| **DOI** | http://dx.doi.org/10.21511/ppm.23(2).2025.56 |
| **RELEASED ON** | Friday, 20 June 2025 |
| **RECEIVED ON** | Monday, 10 February 2025 |
| **ACCEPTED ON** | Wednesday, 11 June 2025 |



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|---|---|
| **JOURNAL** | "Problems and Perspectives in Management" |
| **ISSN PRINT** | 1727-7051 |
| **ISSN ONLINE** | 1810-5467 |
| **PUBLISHER** | LLC “Consulting Publishing Company “Business Perspectives” |
| **FOUNDER** | LLC “Consulting Publishing Company “Business Perspectives” |

| NUMBER OF REFERENCES | NUMBER OF FIGURES | NUMBER OF TABLES |
|---|---|---|
| 38 | 0 | 5 |



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BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

**Abdallah Ali Mohammad Alrifae** (Jordan)

# THE ROLE OF TECHNOLOGICAL ENABLERS AND GOVERNMENT SUPPORT IN E-COMMERCE ADOPTION AMONG SMES IN JORDAN

## Abstract

Using the technology-organization-environment framework, this paper investigates elements that affect the adoption of e-commerce technology by Jordanian small- and medium-sized enterprises (SMEs). Cloud computing, logistics digitalization, and AI-driven customer engagement serve as elements for technological readiness assessment. In contrast, regulatory compliance readiness and supportive government measures are other significant factors for the study. Survey questionnaires for 425 respondents, including SME owners and managers alongside employees from different Jordanian industries, were distributed between March and July 2024 through stratified random sampling. SEM served as the model for evaluating and testing the hypotheses. The examination shows cloud computing readiness ($\beta = 0.34$, $p < 0.01$) combined with AI-driven customer engagement ($\beta = 0.42$, $p < 0.001$) along with logistics digitalization ($\beta = 0.38$, $p < 0.001$) to be the vital drivers that boost e-commerce adoption among SMEs. The findings show that readiness for regulatory compliance failed to impact enterprises' adoption rates of e-commerce substantially. The government support strengthened the positive impact of technological enablers on e-commerce adoption. The research results present crucial knowledge that shows policymakers and SME managers why they should invest in specific digital infrastructure, improved financial support systems, and less complex regulatory frameworks to support successful digital transformation among Jordanian SMEs.

**Keywords** e-commerce adoption, technology-organization-environment (TOE) framework, government support, cloud computing, SMEs, Jordan

**JEL Classification** L81, O33, M15, L26

**Received on:** 10th of February, 2025
**Accepted on:** 11th of June, 2025
**Published on:** 20th of June, 2025

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Abdallah Ali Mohammad Alrifae, Ph.D., Assistant Professor, Department of Business Administration, Faculty of Business, Middle East University, Jordan.

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**Conflict of interest statement:**
Author(s) reported no conflict of interest

## INTRODUCTION

The current market landscape and new technologies push businesses worldwide to modernize their operations to compete effectively (Alon et al., 2020). Changes brought by digital e-commerce technologies have revolutionized standard business procedures by providing both novel possibilities and difficulties to small and medium-sized enterprises (SMEs) (Zaki, 2019). Advanced technological system adoption faces numerous obstacles for Jordanian and other developing country SMEs because of inadequate infrastructure support and restricted digital competencies along with complicated regulatory demands (Lutfi et al., 2022; Alharasis & Alkhwaldi, 2024).

Small businesses use e-commerce technology adoption outcomes based on their ability to implement cloud computing, artificial intelligence (AI) customer engagement system, and supply chain and logistics digitalization programs. Cloud computing allows SMEs to efficiently deploy scalable e-commerce solutions at reduced operational costs while securing their data (Shetty & Panda, 2021). AI-powered

customer engagement methods enhance customer conversational processes and conversion statistics, thereby improving business operational excellence (Raji et al., 2024). Operational efficiencies at SMEs increase through supply chain digitalization because it automates inventory controls and delivery precision while making international transactions seamless (Wang et al., 2020).

The ability of Jordanian SMEs to adopt e-commerce is obstructed by regulatory ambiguities and deficient technological platforms featuring low cloud adoption alongside inadequate artificial intelligence competency and ineffective supply chain networks (Alharasis & Alkhwaldi, 2024). The government's assistance has emerged as a crucial factor that either stimulates or hinders digital transformation among SMEs through joint control of technological frameworks, financial aid schemes, and regulatory systems (Leckel et al., 2020; Mettler et al., 2024).

The investigation into technological enablers and regulatory preparedness, particularly for Jordan, lacks thorough analysis, although researchers have thoroughly studied financial limitations and digital skill gaps. Existing studies also lack a comprehensive examination of government support as a modifying factor that impacts established relationships.

## 1. LITERATURE REVIEW AND HYPOTHESES

Small and medium enterprises (SMEs) must implement e-commerce technologies as a critical business driver in developing economies such as Jordan. Before they can successfully undergo digital transformation, SMEs must overcome three main barriers: resource limitations, technology barriers, and regulatory difficulties. As the literature demonstrates, the adoption of e-commerce by SMEs is successful because of technological enablers and government assistance.

The research foundation adopts the technology-organization-environment (TOE) framework from Tornatzky and Fleischer (1990), which provides extensive insight into technology adoption processes. The TOE framework groups important factors into three dimensions: technology, organization, and environment, which combine internal capabilities with external conditions affecting technology acceptance. The model provides suitable insights for understanding how SMEs adopt e-commerce.

Digital transformation depends heavily on having ready access to cloud computing technologies, which serve as crucial technological elements. The system delivers adjustable, cost-effective, protected data management services that address the fundamental needs of organizations operating with minimal resources. Despite their obvious benefits, the implementation of cloud computing remains limited among SMEs due to major barriers involving infrastructure and cybersecurity, according to Shetty and Panda (2021), Sehgal (2024), and Yaseen et al. (2023).

Artificial intelligence (AI) technology deployment for customer engagement provides substantial technological advantages that enhance customer exchanges and lead to superior operational performance. Implementing predictive analytics and automated customer support systems driven by AI tools provides SMEs with operational benefits and market competition. Electronic technologies encounter practical complications in Jordan and other developing markets because their SMEs lack the technological competencies, training prospects, and impoverished infrastructure systems (Raji et al., 2024; Rane, 2023; Abaddi, 2025).

Different factors contribute to higher organizational productivity levels and better customer satisfaction ratings through supply chain digitalization by optimizing inventory management techniques and delivery systems automation. Digital logistics methods help address various operational problems within the SME sector. Developing regions find it challenging to adopt digital logistics because they lack proper infrastructure and enough financial resources, especially for small to medium enterprises (Handfield et al., 2019; Zennaro et al., 2022).


http://dx.doi.org/10.21511/ppm.23(2).2025.56

Small- to medium-sized businesses establish their e-commerce technology utilization based on existing regulatory systems governing their operational environment. Business execution depends on new privacy data standards and digital payment guidelines, alongside cybersecurity rules, as these regulations secure vital business interests while building customer trust. SMEs choose not to join digital commerce platforms because regulatory frameworks become complex, and multiple changes to compliance regulations make it challenging for them. SMEs' adoption of e-commerce platforms will increase when bureaucratic guidelines become simple and standardized (Adriko & Nurse, 2024; Costa & Castro, 2021).

Government backing is critical in determining how much SMEs will use new technology methods. SMEs adopt technology at higher rates by receiving financial incentives from government programs, improved infrastructure development, and regulatory simplification and education programs. SMEs encounter significant obstacles to digital transformation success because the government's framework stability does not match the inadequate physical infrastructure development. Changes to the technology adoption patterns of SMEs must have consistent government backing, according to Karim (2019) and Leckel et al. (2020), as well as Skare et al. (2023) and Glyptis et al. (2020).

Studies examining e-commerce adoption factors, government support, and regulatory readiness across various technological features have very little presence in research about developing nations like Jordan. Academic investigations mainly study independent technology elements and regulations alongside infrastructural barriers yet omit the entire collective effect of these variables. This study addresses a gap in research knowledge by analyzing technological readiness mechanisms with regulatory structures and governmental backing for e-commerce technology adoption among Jordanian SMEs.

This study examines the factors that influence e-commerce adoption among Jordanian SMEs, including cloud computing preparation, AI-based consumer interactions, supply chain and logistics digitization, and regulatory compliance readiness. The study evaluates government support as a modifier that influences the relations between these factors. The following hypotheses are proposed based on the literature review:

*H1: Cloud computing readiness positively influences e-commerce adoption among Jordanian SMEs.*

*H2: AI-driven customer engagement positively impacts e-commerce adoption among Jordanian SMEs.*

*H3: Logistics and supply chain digitalization positively affects e-commerce adoption among Jordanian SMEs.*

*H4: Regulatory and compliance readiness positively influences e-commerce adoption among Jordanian SMEs.*

*H5: Government support moderates the relationship between cloud computing readiness and e-commerce adoption among Jordanian SMEs.*

*H6: Government support moderates the relationship between AI-driven customer engagement and e-commerce adoption among Jordanian SMEs.*

*H7: Government support moderates the relationship between logistics and supply chain digitalization and e-commerce adoption among Jordanian SMEs.*

*H8: Government support moderates the relationship between regulatory and compliance readiness and e-commerce adoption among Jordanian SMEs.*

## 2. METHODOLOGY

The analysis uses quantitative measurement methods because these methods generate numerical data assessment through statistical processes. The reliability and validity of detecting patterns, testing hypotheses, and the interpretation of variable associations originate directly from quantitative research methods. A representative sample and bias reduction were achieved through stratified random sampling. The research approach em-

**Table 1.** Measurement instruments

| Construct | Measurement Items | Source |
|---|---|---|
| Cloud Computing Readiness (CCR) | 4 | Buyya et al. (2018) |
| AI-Driven Customer Engagement (AI) | 4 | Buyya et al. (2018) |
| Logistics and Supply Chain Digitalization (LSD) | 5 | Buyya et al. (2018) |
| Regulatory and Compliance Readiness (RCR) | 4 | Buyya et al. (2018) |
| Government Support (GS) | 4 | Buyya et al. (2018) |
| Adoption of E-Commerce Technologies (DV) | 4 | Alobaydi et al. (2025) |

ploys stratified random sampling, which involves segmenting the entire population into strata to obtain representative participants from each portion (Ahmed, 2024). This sampling methodology helps the study minimize collection bias, producing stronger and more reliable results for conclusion drawing.

This paper evaluates how Jordanian SMEs embrace e-commerce technology by examining cloud computing preparedness, AI customer support, supply chain digitization, and regulatory readiness backed by government support. The research data originated from owner representatives along with staff and management members of Jordanian SMEs to evaluate their implemented practices and management attitudes. The study utilized stratified random sampling to acquire multiple business-type representations that comprehensively analyze the subject area.

Through methods with error-reduction capabilities, the structured questionnaire attempted to measure information systematically. Previous research scales in the literature served as the foundation for adapting the research instrument to enhance validity and reliability. The cloud computing readiness survey drew items from Pacheco et al. (2024), while Jayawardena et al. (2022) provided their survey items for AI-driven customer engagement assessment. The study adapted both regulatory and compliance readiness items from Wong et al. (2020) for their digitalization measures concerning logistics and supply chains, according to Ivanov et al. (2021). The evaluation points in the questionnaire spanned from one (strongly disagree) to five (strongly agree) to allow accurate and measurable feedback from survey participants.

Information was collected through various Jordanian SMEs with e-commerce technology systems and organizations planning their implementation. A diverse sample of SMEs across various operational business areas participated in this survey to gather information about adaptive behaviors. Five hundred questionnaires were distributed to SMEs via social media, email marketing platforms, and their engagement with business forums. Four hundred twenty-five usable questionnaires passed screening for illogical and incomplete responses, which exceeded the necessary sample size for SEM analysis (Hair & Alamer, 2022; Alnajdawi et al., 2024).

Data analysis using descriptive statistics enabled the discovery of the mean and standard deviation, which indicated user attitudes toward e-commerce adoption for each variable. CFA served as part of the measurement model to analyze validity and reliability by conducting convergent and discriminant validity tests (Ibrahim & Alzubi, 2024). The study performed the analysis using version 24 of AMOS due to its trustworthy performance capabilities. The SEM analysis included evaluating direct effects and variable moderation effects in testing study hypotheses. The proposed model's fit integrity assessment relied on measuring indices comprising RMSEA, CFI, TLI, and Chi-Square/df.

The study undertakes a comprehensive method that produces essential knowledge about Jordanian SME e-commerce technology adoption, supports academic research, and provides operational recommendations to practitioners and policy developers. The developed questionnaire contained no redundancies between its structural measurements while entirely giving information about the desired elements (Table 1).

## 3. RESULTS

The statistics gathered in Table 2 demonstrate key factors regarding the adoption behavior of e-commerce technology among Jordanian SMEs. 40% of


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respondents in the sample identify as female; the other 60% identify as male. Middle-aged professionals between 25 and 44 comprise 57% of the respondents, participants between 45 years and higher represent 28%, and those between 18 and 24 years comprise 15%. The population using e-commerce technology within Jordanian SMEs comprises individuals with advanced educational credentials because university students comprise 55% of the group, postgraduate students account for 32%, and those who graduated from high school account for 13%. The data evidence demonstrates that Jordanian businesses with highly educated professionals adopt e-commerce solutions in large numbers.

The study indicates that 62% of respondents who conduct business online adopt e-commerce weekly, but only 10% operate through e-commerce less than monthly. The analysis indicates that educated technology-proficient professionals make up the core group of users for e-commerce technology adoption in Jordan. Additional strategies to overcome obstacles related to user awareness and concerns about risks would optimize the number of older and periodic e-commerce users.

**Table 2.** Demographic profile of respondents

| Demographic Variable | Category | Percentage (%) |
|---|---|---|
| Gender | Male | 60 |
| | Female | 40 |
| Age | 18–24 | 15 |
| | 25–44 | 57 |
| | 45+ | 28 |
| Education Level | High School | 13 |
| | University Degree | 55 |
| | Postgraduate | 32 |
| E-commerce Usage | Less than once a month | 10 |
| | 1–3 times per month | 28 |
| | Once a week or more | 62 |

The research methodology relied on data analysis through SPSS-AMOS version 24, which performed confirmatory factor analysis (CFA) and structural equation modeling (SEM) assessments. The research methods were established to achieve the study goals while producing solid results. The analysis relies on Bee et al. (2023), who state that AMOS V.24 produces strong results through its CFA and SEM analysis when applied to multi-construct models. Various statistical techniques and constraints were maintained to ensure study reliability, according to Sepasgozar et al. (2019).

The data preparation process involved SPSS software for data coding, identifying non-active responses, and handling outliers and missing values. After the completion of data preparation tasks, the CFA and SEM analysis with AMOS V.24 began. The research model obtained confirmation for validity and reliability through the application of three fundamental statistical assessments, including convergent validity, construct validity, and discriminant validity, as suggested by Baistaman et al. (2020).

According to Raza and Awang (2021), a one-pool CFA assessment evaluated all construct items at first to verify factor loading values greater than 0.50 and covariance correlation values not exceeding 0.85. Modification indices allowed one to check whether the necessary values reached their target. Xia and Yang (2019) established the necessary threshold values used to assess the fit of the overall model through various fit indices. Table 3 demonstrates that the model exhibits strong evidence of its suitability based on these results.

**Table 3.** Model fit assessment results

| Fit Index | Obtained Value | Threshold | Decision |
|---|---|---|---|
| RMSEA | 0.047 | RMSEA < 0.08 | Ideal |
| GFI | 0.90 | GFI > 0.90 | Ideal |
| AGFI | 0.87 | AGFI > 0.85 | Contented |
| CFI | 0.948 | CFI > 0.90 | Ideal |
| TLI | 0.93 | TLI > 0.90 | Ideal |
| NFI | 0.91 | NFI > 0.90 | Ideal |
| ChiSq/df | 2.10 | ChiSq/df < 3 | Ideal |

CFA measurements determined the reliability and validity of constructs present in the model. The convergent validity assessment relied on factor loading and average variance extracted (AVE), with requirements that exceeded 0.50, according to Sujati et al. (2020). The measurement for construct reliability included composite reliability (CR) and Cronbach's alpha (α), which needed to exceed 0.70, according to Sürücü and Maslakci (2020). The validation process for convergent validity and construct reliability appears in Table 4.

**Table 4.** Convergent validity and construct reliability outcomes

| Constructs | Number of Items | Loading Factor | Average Variance Extracted (AVE) | Composite Reliability (CR) | Cronbach's Alpha (α) |
|---|---|---|---|---|---|
| Cloud Computing Readiness (CCR) | 4 | 0.68–0.89 | 0.63 | 0.86 | 0.84 |
| AI-Driven Customer Engagement (AI) | 4 | 0.72–0.88 | 0.65 | 0.88 | 0.85 |
| Logistics and Supply Chain Digitalization (LSD) | 5 | 0.69–0.91 | 0.67 | 0.89 | 0.86 |
| Regulatory and Compliance Readiness (RCR) | 4 | 0.70–0.85 | 0.62 | 0.85 | 0.82 |
| Government Support (GS) | 4 | 0.72–0.89 | 0.66 | 0.88 | 0.84 |
| Adoption of E-commerce Technologies (DV) | 4 | 0.73–0.88 | 0.68 | 0.89 | 0.85 |

These results confirm the validity and reliability of the research model, demonstrating the strong foundation of the extended framework used to study e-commerce adoption in this context.

The findings in Table 5 imply that cloud computing readiness (H1), AI-driven customer engagement (H2), and logistics and supply chain digitalisation (H3) each exert significant positive effects on e-commerce adoption among Jordanian SMEs. Each of these hypotheses was validated by statistically significant path coefficients ($p < 0.01$ or $p < 0.001$).

Nevertheless, regulatory and compliance readiness (H4) failed to exhibit a statistically significant effect on e-commerce adoption ($\beta = 0.16$, $p > 0.05$), and consequently the hypothesis was not retained.

Additionally, governmental support was shown to significantly moderate the linkage between technological readiness factors (cloud readiness, AI engagement, logistics digitalisation) and e-commerce adoption (H5, H6, and H7 were accepted). However, the influence of government support on the relationship between regulatory and compliance readiness and e-commerce adoption was not significant, leading to the rejection of H8.

# 4. DISCUSSION

This study evaluates e-commerce adoption factors among Jordanian SMEs through an extension of TOE principles combined with government support analysis. Three main technological readiness elements profoundly influence small and medium enterprises' adoption of e-commerce technology through cloud computing readiness and the application of AI for customer relationships, logistics chains, and supply digitalization. Research findings revealed that readiness for regulatory compliance measures did not establish a significant relationship with e-commerce adoption within Jordanian SMEs. The vital role of government support became evident when it strengthened the relationship between technology factors and e-commerce adoption in digital transitions.

The readiness of cloud computing solutions boosts e-commerce adoption among SMEs by 34% according to statistical significance at $p < 0.01$, which shows how cloud solutions help businesses reduce costs and increase capabilities for data security. Multiple studies show that cloud technology is a primary factor for both automation adoption and operational improvement procedures (Sehgal, 2024; Yaseen et al., 2023). Industrial organizations

**Table 5.** Hypothesis test

| Hypothesis | Path Relationship | β | p-value | Decision |
|---|---|---|---|---|
| *H1* | Cloud computing readiness → E-commerce adoption | 0.34 | < 0.01 | Accepted |
| *H2* | AI-driven customer engagement → E-commerce adoption | 0.42 | < 0.001 | Accepted |
| *H3* | Logistics and supply chain digitalization → E-commerce adoption | 0.38 | < 0.001 | Accepted |
| *H4* | Regulatory and compliance readiness → E-commerce adoption | 0.16 | > 0.05 | Rejected |
| *H5* | Government support × Cloud readiness → E-commerce adoption | 0.29 | < 0.01 | Accepted |
| *H6* | Government support × AI-driven customer engagement → E-commerce adoption | 0.35 | < 0.01 | Accepted |
| *H7* | Government support × Logistics digitalization → E-commerce adoption | 0.31 | < 0.01 | Accepted |
| *H8* | Government support × Regulatory and compliance readiness → E-commerce adoption | 0.11 | > 0.05 | Rejected |


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starting digitally competitive ventures need cloud readiness fundamentals as their fundamental requirement.

Artificial intelligence had a considerable positive effect on customer engagement in e-commerce adoption, as AI systems delivered better service experiences ($\beta = 0.42$, $p < 0.001$). This study confirms that installing predictive analytics with chatbots leads to enhanced customer relations and business success (Raji et al., 2024; Rane, 2023). Many small businesses face challenges when implementing artificial intelligence systems correctly into their operational procedures. AI adoption in Jordanian SMEs needs user-friendly AI solutions and special training initiatives aimed at this industrial segment to drive widespread AI implementation.

The investigation confirms that digitalization in supply chain operations, coupled with logistics practices, simultaneously enhances e-commerce acceptance ($\beta = 0.38$, $p < 0.001$), as digital logistics improves inventory management capabilities, delivery operations, and operational effectiveness. Handfield et al. (2019) and Zennaro et al. (2022) establish logistics digitalization as a performance-enhancing mechanism that provides better customer satisfaction. Digital logistics system investments by Jordanian SMEs should be treated as essential strategic moves to enhance their service delivery speed and operational adaptability.

The findings indicate that regulatory and compliance readiness failed to demonstrate significant correlations with e-commerce adoption ($\beta = 0.16$, $p > 0.05$). Organizations need regulatory compliance to function but must pursue additional methods when aiming to drive adoption. Regulatory complexity is a limiting factor for SMEs unless they receive adequate regulatory support systems. Union SMEs require regulatory simplification and active policy engagement to eliminate barriers preventing their e-commerce adoption.

Government support strengthened all critical relationships among technological drivers and e-commerce adoption with cloud computing readiness ($\beta = 0.29$, $p < 0.01$) as well as AI-driven customer engagement ($\beta = 0.35$, $p < 0.01$) and logistics digitalization ($\beta = 0.31$, $p < 0.01$). The study demonstrates the essential role that public sector financial support, digital infrastructure creation, and education initiatives play in business success. Government backing provides SMEs with the capacity to address their structural and financial challenges, ultimately leading to the successful implementation of digital transformation strategies.

The structural model explained the e-commerce adoption case with 69% ($R^2 = 0.69$) variance, thus having strong explanatory power and confirming the usefulness of the extended TOE model. Findings indicate that mobilizing technological readiness policies to nurture e-commerce adoption among SMEs in emerging markets is essential.

The research findings offer policymakers and managers of small and medium-sized enterprises valuable lessons. Policymakers and SMEs need to understand that heavy investment in cloud-based infrastructure, AI systems, and digitized logistics systems play a critical role in maintaining their competitive position. At the same time, the government should take an active approach to encouraging SMEs toward digitalization through streamlined policies, funding schemes, and training programs.

Despite the outlined contributions, the study has some limitations. First, the use of a cross-sectional design limits the assessment of behavioral changes over time. Future work should adopt longitudinal approaches to explore the evolving interrelation of factors, including technology, policy, and organizational behavior. Second, the findings are concerned with Jordan and may be too context-specific, with little adoption in other countries with different cultural or regulatory settings. Cross-national comparisons would enhance the external validity of the framework provided.

This study illustrates how government backing plays a decisive role in strengthening the influence of technological readiness for e-commerce adoption. It offers substantial empirical support along with strategic direction for transforming the digital operations of SMEs in Jordan and other developing nations. These results expand the understanding of SME technology adoption while presenting actionable steps to boost digital competitiveness in emerging markets.

## CONCLUSION

The paper examined how Jordanian SMEs adopt e-commerce technology using an expanded technology-organization-environment (TOE) framework that includes government support as a moderating factor. The study examined four primary technological enablers (cloud computing readiness, AI-driven customer engagement, logistics and supply chain digitization, and regulatory compliance readiness) to assess their impact on e-commerce technology adoption among SMEs.

The study indicates that e-commerce adoption by SMEs experiences significant positive effects from cloud computing readiness alongside AI-driven customer engagement and logistics digitalization. Scalable, automated, data-driven technologies boost operational performance alongside customer service and inventory management to help SMEs remain competitive in a digitalized economy. The direct impact of regulatory compliance readiness on e-commerce adoption proved statistically insignificant, indicating that regulatory preparedness needs additional support mechanisms to be effective.

The impact of technological enablers on e-commerce adoption was found to intensify through government support. The digitalization of SMEs depended heavily on public sector initiatives such as fiscal incentives, digital literacy programs, infrastructure development, and regulatory simplification. The research outcomes demand intricate and specific governmental strategies to eliminate financial and operational obstacles hindering technology adoption.

The findings present important guidance to leaders in business policymakers and technological service providers who want to boost digital adoption within SMEs. Small and medium enterprises should focus their investments on deploying cloud solutions combined with AI tools while implementing logistics digitalization. Government bodies must create specific policies that build digital infrastructure, introduce financial assistance programs, and streamline regulations to help small and medium enterprises expand their presence in digital markets.

The significant findings of this study arise from restrictions that highlight research opportunities for upcoming investigations. The analysis conducted using a cross-sectional design cannot provide insight into how adoption behaviors evolve; thus, future research should move toward longitudinal studies. Generalization of the research findings would improve through analysis in various cultural and regulatory settings. The models should incorporate future examinations of competitive marketplace dynamics alongside consumer digital skills because they would lead to enhanced explanatory power.

This study confirms the essential role of extensive governmental assistance in promoting digital transformation within SMEs. Calculated government initiatives that support funding and infrastructure development, establish regulatory clarity, and enhance digital skills among businesses will skyrocket the adoption of electronic commerce by small and medium enterprises in Jordan and improve their global market competitiveness.

## AUTHOR CONTRIBUTIONS

Conceptualization: Abdallah Ali Mohammad Alrifae.
Data curation: Abdallah Ali Mohammad Alrifae.
Formal analysis: Abdallah Ali Mohammad Alrifae.
Funding acquisition: Abdallah Ali Mohammad Alrifae.
Investigation: Abdallah Ali Mohammad Alrifae.
Methodology: Abdallah Ali Mohammad Alrifae.
Project administration: Abdallah Ali Mohammad Alrifae.
Resources: Abdallah Ali Mohammad Alrifae.


http://dx.doi.org/10.21511/ppm.23(2).2025.56

Software: Abdallah Ali Mohammad Alrifae.
Supervision: Abdallah Ali Mohammad Alrifae.
Validation: Abdallah Ali Mohammad Alrifae.
Visualization: Abdallah Ali Mohammad Alrifae.
Writing – original draft: Abdallah Ali Mohammad Alrifae.
Writing – review & editing: Abdallah Ali Mohammad Alrifae.

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