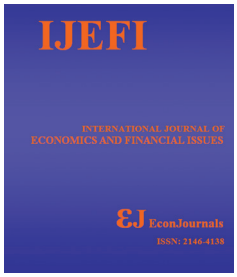

International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2025, 15(6), 83-96.

Determinants of E-commerce Adoption for Saudi MSMEs: Does E-commerce Adoption Impact Financial and Non-Financial Performances?

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Received: 05 May 2025 **Accepted:** 27 August 2025 **DOI:** https://doi.org/10.32479/ijefi.20739

ABSTRACT

Recently, business operations and performance for micro, small, and medium-sized enterprises (MSMEs) around the world have been impacted from the COVID- 19 spread. To sustain their businesses, many strategies have been adopted and implemented from the MSMEs. This study examines and analyzes the correlation between e-commerce adoption (ECA) and the performance of MSMEs in Saudi Arabia and identifying the drivers that influencing ECA over the period of COVID- 19 pandemic. The data in this study were collected from 513 MSMEs across different regions of Saudi Arabia. Statistically, the data were examined utilizing the partial least squares-structural equation modeling (PLS-SEM) method to evaluate the proposed model. The results indicated that technology resources, technical infrastructure, and company size are critical factors influencing e-commerce adoption. The use of e-commerce was strongly correlated with both the financial and non-financial success of MSMEs during the period of COVID- 19. Additionally, MSMEs found being as a mediator for the association between ECA and the financial performance. The results of this study added to the knowledge and contribute to the existing literature review of technology adoption through analyzing the determinants of ECA and the e-commerce's role in performance of firm during a global pandemic. The results are valuable for MSME managers and policymakers, highlighting the critical significance of e-commerce implementation for business growth and long-term continuation. Policymakers can also use these findings to develop policies and strategies for promoting e-commerce application in Saudi Arabia. Furthermore, this study provides a significant contribution to the development of the framework of Technology-Organization-Environment (TOE) for MSMEs.

Keywords: E-commerce, Adoption, Performance, MSMEs, COVID-19 Pandemic
JEL Classifications: D00; D22; L25; L81

1. INTRODUCTION

The period of COVID-19 epidemic was crucial for many businesses models that moved online from traditional modes. It has disrupted many industries and businesses forever. The pandemic caused various economic and social upheavals (Cruz-Cárdenas et al., 2021). Most countries have faced different hurdles over the years (Dash et al., 2024; Donthu and Gustafsson, 2020). Many cases from different industries and sectors have attempted to measure its impact. Behavioral sciences were not left behind (Islam et al., 2021). The micro, small, and medium enterprises (MSMEs) industry was one of the worst-case scenarios that impacted negatively by the COVID-19 spread (Al-Harbi and Ahmad, 2023; Rahman et al., 2020). Most MSMEs faced tough times regarding sales and related revenues (Rahman et al., 2020). Profits became meager, and many enterprises experienced losses. The adoption of

e-commerce became a new trend, although initially, it was done by force. Later, it became the normal mode. Saudi Arabia was chosen as the focus country for the following reasons. As per the latest data (Statista, 2024), MSMEs constitute 28.7% of the GDP of country in 2023 and are projected to touch 35-40% by the year 2030 (Statista, 2024; Akinwale and Alshraim, 2024). In addition, the GDP growth rate puts Saudi Arabia in the second level of the largest economy in the world (Arab News, 2023). Also, as per the Saudi Census (2022), 70% of the citizens are lower than 40 years, and millennials represent about one-third, making it one of the youngest economies in the globe. Saudi Vision 2030 mandates that the economy explores non-oil revenue generation and digital transformation of existing industries, including promoting MSMEs. As a developing and young economy, Saudi Arabia is adapting to the latest technologies (Olaopa and Alsuhaibany, 2023). The implementation of e-commerce can be on of the most crucial and critical indicators of digital transformation. Saudi Arabia adopted e-commerce extensively in the last 5 years (Almtiri et al., 2023; Arab News, 2023). The country has recently launched several initiatives to become one of the most technologically advanced nations globally, in line with the strategic goals of Vision 2030—a blueprint for Saudi Arabia's economic and social transformation (Dash et al., 2024; Olaopa and Alsuhaibany, 2023). However, Saudi MSMEs, especially those vulnerable, have suffered disproportionate impacts from the COVID-19 pandemic. Given this context, analyzing how Saudi MSMEs can adopt technological applications like e-commerce to promote their businesses and performance is crucial. E-commerce research is very limited to big businesses, neglecting the MSME sector. Hence, the findings of this study are essential to assess the MSMEs' adoption of e-commerce and determine the determinants and the consequences of it in Saudi Arabia (Salah and Ayyash, 2024).

This study, grounded in the technology–organization–environment (TOE) paradigm, seeks to examine the impact of e-commerce adoption (ECA) on the performance of MSMEs in Saudi Arabia and to identify the determinants affecting e-commerce adoption during the epidemic. Three critical perspectives pertinent to MSMEs were examined as drivers of e-commerce adoption, while both financial and non-financial performances were analyzed as outcomes of e-commerce adoption (Abed, 2020; Amini and Bakri, 2015; Tornatzky and Fleischer, 1990). Furthermore, non-financial performance is evaluated as a mediator between E-commerce adoption and financial performance. In accordance with the aforementioned aims, the research questions are described below:
RQ1: What are the drivers that impact the adoption of e-commerce (ECA) in the Saudi Arabian context?
RQ2: What are the consequences of e-commerce adoption (ECA) on MSMEs in Saudi Arabia?
RQ3: Does the MSMEs' non-financial performance mediate the association between e-commerce adoption (ECA) and the financial performance in Saudi Arabia?

The following part deals with the proposed hypotheses' theoretical background and literature review. Section three explains the study's methods. Section four outlines the statistical results and empirical findings. It is followed by a detailed discussion section and then the implications and further studies in the same field.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Theoretical Background and Prior Attempts

Numerous theories have sought to examine the uptake of e-commerce through diverse methods. Commencing with the Theory of Planned Behavior (TPB) (Ajzen and Fishbein, 1980), several additional theories or frameworks, including the Technology Acceptance Model (TAM) (Davis et al., 1989) and the Diffusion of Innovation (DOI) model (Rogers, 2010), have also concentrated on the adoption of new technologies, specifically e-commerce. Several case studies have proven that these models are not robust enough to explain and predict the antecedents of e-commerce adoption. It has led several studies to combine specific models to have more significant explanatory power (Armbrust et al., 2010). However, since the Technology–Organization–Environment Framework (TOE) (Tornatzky and Fleischer, 1990) integrates multidimensional factors of an organization while investigating technology adoption and dissemination, many studies consider it to have more significant explanatory potential than these earlier adoption models (Scott and Walczak, 2009). It has proved to be one of the most widely used and well-established frameworks for new technology research connected to organizational adoption (El-Haddadeh et al., 2021). As its name indicates, TOE outlines three dimensions: technological, organizational, and environmental, impacting the organization's adoption and implementation of an innovation or a new technology. "Technological dimension refers to internal and external technologies that are significant to the company" (Borgman et al., 2013). This context comprises the company's current practices, equipment, and available technologies outside the company (Beshdeleh et al., 2020). "Organizational dimension refers to descriptive metrics about the organization, such as its scope, size, and management structure" (Rosli et al., 2012). The market factors, competitors, and regulatory environment are all part of the "environmental context" (Tornatzky and Fleischer, 1990). The TOE model was proved in the literature to be more predictive and complete than many other organizational technology adoption theories, such as the DOI theory, because it emphasizes the environmental context more (Oliveira and Martins, 2011).

Prior studies have verified the TOE framework in numerous situations in e-commerce. Among the various sorts of technologies, TOE was applied to analyze e-commerce adoption and dissemination (Hsu et al., 2014; Low et al., 2011; Senyo et al., 2018). Lin and Lin (2008) studied the internal implementation of e-business and the external dissemination of e-business usage. Technological context comprises Information Systems (IS) expertise and IS infrastructure constructs. Organizational contexts are expected benefits of e-business and organizational compatibility. At the same time, environmental context factors include trading partner readiness and competitive pressure. Liu (2011) examined the adoption of e-commerce development as an innovative business method. The technological aspects of this paradigm are human capital and support suppliers; then, business size and information management level constitute the organizational characteristics. E-commerce security and user satisfaction are environmental variables, and lastly, the firm

property is employed as a control variable. More studies have explored the adoption of e-commerce in conjunction with various emergent support technologies or, in specific scenarios, using the TOE framework. Chandra and Kumar (2018) used the TOE Model to investigate the variables that drive organizational adoption of augmented reality in e-commerce. They suggested many factors impacting the deployment of augmented reality technology in Singapore, India, and the USA to improve the customers' purchasing experiences. They used technological competence and relative advantage as technological factors. Financial strength, decision-makers knowledge, and top management support are all organizational elements. Competitive pressure and consumer readiness are environmental variables. Technological readiness significantly influences a business's capacity to deal with volatility, whereas environmental constraints push enterprises to embrace and advance e-commerce. Additionally, organizational readiness does not impact the firm's e-commerce readiness since the company does not consider this element (Priambodo et al., 2021). Based on the literature, we chose technical infrastructure. (Jennex and Olfman, 2004) and business infrastructure (Molla and Licker, 2005), enterprise resources (Molla and Licker, 2005), firm size (Dholakia and Kshetri, 2004; Huy and Filiatrault, 2006), partner pressure (Sila, 2013), competitive pressure (Sila, 2013), and government support (Looi, 2005) as the various contexts in this study.

2.2. Proposed Hypotheses

Technological resources (Molla and Licker, 2005; Zhu et al., 2002) and IT people resources (Golden et al., 2004; Jennex et al., 2004; Purcell et al., 2004) significantly influenced e-commerce adoption (ECA). Molla and Licker (2005) elucidated the organization's resources through the dual factors of technology and IT human resources. "Various technological resources, for example, production techniques, information and communication resources, production, logistics, marketing, and e-commerce technologies, affect how an MSME works and adapts in an online environment." Ultimately, the adoption of e-commerce is dependent on these resources. Earlier studies found technological resources crucial for e-commerce adoption in SMEs (Gibbs and Kraemer, 2004; Sánchez-Torres et al., 2021; Agarwal and Wu (2015); Kuruwitaarachchi et al. (2020); Ariansyah et al. (2021); Taneja (2021); Mohdhar and Shaalan (2021); Hossain et al. (2023) and Shahadat et al. (2023); IT skills and human resources are the required complimentary resources that enhance the technological resources of the MSMEs (Golden et al., 2004; Jennex et al., 2004; Purcell et al., 2004). Hence, TR and ITSHR are positively related to adopting ECA in MSMEs. Thus, it is proposed that:

H_1: Technological resources are positively associated with the adoption of e-commerce by MSMEs

H_2: The utilization of IT skills and human resources is positively associated with MSMEs' adoption of e-commerce.

Technical infrastructure affects both clients and providers. Organizations may develop applications and websites using technical infrastructure to ensure that networks, hardware, and software are accessible to serve e-commerce businesses (Kabanda, 2011). Earlier studies found that e-commerce adoption is hugely affected by the technical infrastructure of the MSMEs (Jennex et al., 2004), Awa et al. (2015), Rumanyika and Mashenene (2014), Kurnia et al. (2015), Al-Somali et al. (2015), Walker et al. (2016), and Al-Tit (2020). Business infrastructure ensures the viability of B2B providers and facilitates long-term business relationships. This variable ensures the establishment of business and payment protocols, the availability of legal counsel for contracts and other necessities, the effectiveness of communication and marketing, and the provision of resources for the B2B supplier to sustain its operations (Jennex et al., 2004). For example, some studies (Jennex et al., 2004; Walker et al., 2016; Abed, 2020) found that a firm's capacity to deal with rapid changes, encouraging policies of e-commerce initiatives, and other readiness factors are closely associated with e-commerce adoption.

Thus, it is proposed that:

H_3: Technical infrastructure is positively associated with the MSMEs' adoption of e-commerce.

H_4: Business resources are positively associated with the MSMEs' adoption of e-commerce.

Upon examining the research about determinants of e-commerce adoption among small and medium-sized firms (SMEs), we identified that the most critical environmental factors include external pressures from competition, business partners (such as customers and suppliers), and government support (Sila, 2013). Government support is critical for information technology adoption, especially e-commerce (Abou-Shouk et al., 2016; Awiagah et al., 2016; Religia et al., 2021). Many studies proved that governmental intervention affected significantly and positively the adoption of e-commerce by SMEs (Salem and Nor, 2020). Competitive pressure is a term that refers to the degree to which an organization feels pressure from its competitors (Zhu et al., 2002). Numerous studies have proved that technical innovation is a critical factor in an organization's ability to stay competitive (Wamba et al., 2020). The business partner pressure indicator measures the extent to which suppliers and customers exert pressure on a corporation to implement an e-commerce strategy (Maqueira-Marín et al., 2017). Several studies show a strong association between partner pressure and e-commerce adoption (Hamad et al., 2018; Maqueira-Marín et al., 2017). Hence, supplier and customer pressure are seen as an antecedent variable that positively influences SMEs' adoption of e-commerce. In this context, Walker et al. (2016) demonstrated that external pressure had significantly predicted e-commerce adoption by Slovakian SMEs. Furthermore, they recognize external pressure as both social factors and government support for information technology is critical and suggested that SMEs demand more support than large firms. Some recent research studies (Sila, 2013; Ghobakhloo et al., 2011; Shahadat et al. 2023; Hussain et al., 2020; Bhardwaj et al., 2021; Nekmahmud et al., 2022) have identified competition and business partners pressure as significant for e-commerce adoption by SMEs.

Thus, it is proposed that:

H_5: Government support is positively associated with MSMEs' adoption of e-commerce

H_6: External pressure is positively associated with the MSMEs' adoption of E-commerce.

According to Kinkel et al. (2022), there is a strong positive association between a company's size and the degree to which it leverages AI technology. According to the study, this outcome is based on the argument that big organizations have more human and financial resources than smaller firms. Larger firms have higher e-commerce adoption rates in SMEs during pandemic due to their sufficient resources (Lim and Trakulmaykee, 2018). The firm size is a significant factor in e-commerce acceptance in SMEs as larger enterprises are more advanced in adopting e-commerce faster than smaller ones (Balaid et al., 2014). Additionally, multiple studies have shown that larger firm size positively helps e-commerce adoption (Lim and Trakulmaykee, 2018; Balaid et al., 2014; Oktora et al., 2020; Ali et al., 2022; Shahadat et al. 2023)). So, it is proposed that:

H_7: Firm size is positively associated with the MSMEs' adoption of E-commerce.

Ilmudeen et al. (2019) describe the performance as the main output of each strategic activity launched by a business. It is also a measure of the company's success in meeting the goals that have been set (Basuony, 2014; Zizlavsky, 2014). Previous studies have indicated a significant connection between the use of technology (i.e., e-commerce, social media, mobile payment systems, cloud computing) and MSME performance (Khayer et al., 2020; Kwabena et al., 2021; Ramdansyah and Taufik, 2017). A firm's performance is broadly divided into financial and non-financial performances. Furthermore, current studies argue that e-commerce may significantly affect firms' financial and non-financial performance (Ali and Siddiqui, 2021; Sombultawee and Boon-Itt, 2020). For example, Hua et al. (2015) observed that e-commerce costs positively affect company performance. Ramdansyah and Taufik (2017) showed that SME performance is significantly and positively influenced by e-commerce. The firm's performance is described by the aspects of efficiency, coordination, and trade growth. Both financial and non-financial performances are the consequences of e-commerce adoption (ECA) (Abed, 2020; Amini and Bakri, 2015; Tornatzky and Fleischer, 1990). It has a strong association with non-financial performance. Earlier studies established the effects on different parameters of non-financial performance. For example, its impact on better efficiency and transparency (Gunawan et al., 2023; Xia and Zhang, 2010), high productivity (Falk and Hagsten, 2015; Smith, 2012), social and environmental responsibility (Gao et al., 2023; Oláh et al., 2019) have been well-established. At the same time, ECA also affects financial performance. Numerous studies already established this effect in previous studies. For example, ECA reduced total costs (Gao et al., 2023; Sheikh et al., 2018), and enhanced market share and sales (Gao et al., 2023; Masud et al., 2022; Wulandari and Koe, 2022; Šaković Jovanović et al., 2020). In addition, it helped in raising profits (Wulandari and Koe, 2022; Effendi and Subroto 2021; Sombultawee and Boon-Itt, 2020). To sum up, it can be concluded that ECA positively impacts the performance of the MSMEs. Therefore, it is proposed that:

H_8: E-commerce adoption positively impacts MSMEs' non-financial performance.

H_9: E-commerce adoption positively impacts MSMEs' financial performance.

However, the role of non-financial performance is crucial in shaping financial performance, and it acts as a mediator between ECA and financial performance. Although indirectly, many studies perceive those non-financial performances (qualitative indicators) (as a consequence of ECA) play a massive role in shaping financial performances (Salah and Ayyash, 2024). ECA improves many non-financial performance indicators such as internal quality, operational processes, innovativeness, productivity, transparency, image, and sustainability, all contributing to better financial results. Many MSMEs have adopted e-commerce tools and techniques to reach potential customers, leading to enhanced financial performance. This finding is aligned with the findings of previous studies (Islam and Alharthi, 2020; Islam et al., 2017). Hence, it is proposed that:

H_{10}: Non-financial performance positively impacts MSMEs' financial performance

H_{11}: Non-financial performance significantly mediates the relationship between e-commerce adoption and MSMEs' financial performance.

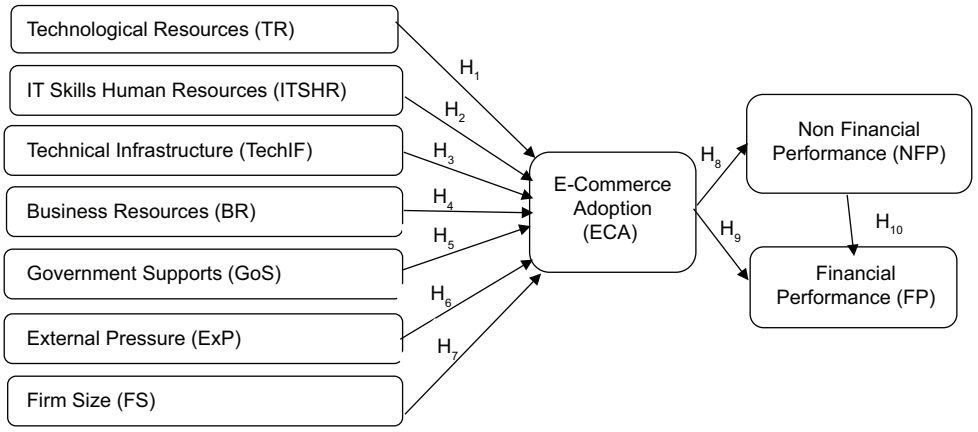
Figure 1 shows the conceptual framework of the study.

3. RESEARCH METHODOLOGY

3.1. Construct Measurement and Psychometric Properties

This study primarily relies on constructs that were developed and justified earlier, with minor adjustments in wording for

Figure 1: Conceptual framework of the study



some response choices to enhance clarity. The tools utilized by different researchers underwent careful verifying in this study. Before commencing the core analysis, a survey questionnaire was constructed following the procedure outlined by Mishra et al. (2016). A full set of the survey questionnaire was mailed to two specialists of MSMEs for review and requested them to evaluate the degree to which they felt these items accurately represented their corresponding notions on a 3-point Likert scale where "3" indicates "to a large extent"; "2" indicates "to some extent"; and "1" indicates "not at all." The questionnaire included only the questions that were rated as "3" by both professionals. The items chosen to represent the key characters of the recommended model are outlined in Table 1, along with information on their initial sources. All variables in this study are assessed employing various items, aligning with the established practice that multi-item scales offer greater reliability compared to single-item measures (Nunnally and Bernstein, 1978). For most constructs, responses are captured using a 5-point Likert scale, allowing respondents to indicate their level of assent or dissent with statements. However, the e-commerce adoption construct differs in its measurement method, with responses recorded using a binary scale of "yes" or "no," reflecting the presence or absence of e-commerce adoption by the respondents.

Technology resources (TR) has been a subject of varied measurement approaches in literature, with researchers proposing different metrics to assess its facets (Gibbs and Kraemer, 2004; Sharma et al., 2004; Molla and Licker, 2005; Todd and Javalgi, 2007). In this study, we adopt the construct of TR for MSMEs, employing 7 items as developed by Gibbs and Kraemer (2004). Similarly, the measurement of IT skills human resources (ITSHR) has seen diverse perspectives across studies (Bakos, 1998; Jennex et al., 2004; Golden et al., 2004; Molla and Licker, 2005). In this study, we utilized 2 items from Molla and Licker (2005) to measure ITSHR adoption among MSMEs. The study used the number of employees as a measure of the firm size, a widely used method in the literature (Thong, 1999). This study also used the number of employees to measure the firm size. Despite the varied approaches in measuring technical infrastructure (TchIF) (Bakos, 1998; Kabanda, 2011; Rashid and Al-Qirim, 2001; Jennex et al., 2004), this study employs three items from Jennex et al. (2004) to assess the construct. Similarly, the dimensions of the construct of business infrastructure (BusIF) vary across studies (Jennex et al., 2004; Sharma et al., 2004; Molla and Licker, 2005). Hence, we employ the BusIF construct developed by Molla and Licker (2005), comprising 6 items. The measurement of external pressure (ExP) has also seen variations in literature (Frohlich and Westbrook, 2001; Rasid and Al-Qirim, 2001; Priambodo et al., 2021; Kuzic et al., 2002; Sila, 2013). In this study, we utilize the ExP construct developed by Sila (2013), encompassing 6 items addressing customer/supplier pressure and competitive pressure.

Table 1: Types of MSMEs based on number of employees.

Types of MSMEs	Number (Percentage)
Micro Enterprise	118 (23)
Small Enterprise	257 (50.1)
Medium Enterprise	138 (26.9)

Source: The authors' estimation

Furthermore, government support is considered with a construct developed by Looi (2005), consisting of 4 items.

The measurement items for the construct of e-commerce adoption (ECA) exhibit diversity across studies (Awa et al., 2015; Šaković Jovanović et al., 2020). We used the ECA construct developed by Gibbs and Kraemer (2004), encompassing 7 items addressing e-commerce adoption. The measurement of financial performance (FP) has shown variation across studies, reflecting the diverse nature and complexity of business structures (Haber and Reichel, 2005; Saeidi et al., 2015; Horváthová, 2010; Tzempelikos, 2015; Islam et al., 2015; Agyabeng-Mensah et al., 2020). Islam et al. (2015) proposed a measurement framework for financial performance encompassing five items. Our study employs the FP construct developed by Islam et al. (2015), which consists of 5 items designed to provide a comprehensive assessment of the financial aspects of performance. Similarly, the non-financial performance (NFP) construct has been approached diversely across studies (Islam et al., 2015; Chong, 2008; Ittner and Larcker, 1996; Hoque, 2005). Our study adopts the NFP construct developed by Islam et al. (2015), comprising 27 items, to comprehensively assess non-financial aspects of performance.

3.1.1. Psychometric properties

Drawing on established validation of the scales utilized in previous studies, our study employed PLS-SEM software to conduct an in-depth analysis of the psychometric properties. It encompasses various procedures for instance factor analysis computation, assessing the structural stability of the dataset, and conducting analyses of internal consistency ratings. The validity and reliability of constructs including ECA, TR, ITSHR, TechIF, BusIF, GoS, ExP, NFP (excluding 16 items that were omitted from the final analysis due to outer loading values of <0.70) and FP were rigorously examined through the study's analysis process.

3.2. Data Collection and Sample

A survey method utilizing an online questionnaire was chosen for this research because of its manifold advantages, comprising cost-effectiveness, efficiency, speed, and ease of administration . The questionnaire underwent meticulous development, drawing upon insights from prior research in the field. Initially, it was crafted grounded on a wide evaluation of existing literature and subsequently refined with feedback from two academics who are specialists in the domains of e-commerce and economics. Following ethical clearance from the institution's ethics committee, the questionnaire went through a pre-testing phase that involved five individuals, consisting of three owners and two managers from MSMEs. The employee count serves as a proxy metric for assessing company size in this study. Modifications were implemented based on specialists' comments to enhance the clarity of all items in the survey instrument. The polished survey tool was thereafter disseminated to the intended participants. We randomly selected 1000 respondents engaged in MSMEs from two databases: the "Small and Medium Enterprise General Authority (2020)" and the "Saudi Arabia Business Directory (2020)." Reminder emails were sent two times to the potential respondents after the initial survey instrument was dispatched. After two follow-up attempts, the final dataset comprises responses from 513 MSME

owners (32.2%), chief executive officers (37.4%), and managers (32.4%). Sixty-two percent of respondents were aged 25-54 years and possessed some level of post-secondary education (80%). The study employed 513 replies for statistical analysis, resulting in a response rate of 51.3%, considered good for web-based surveys (Hair et al., 2014). Additionally, the distribution of the sample is detailed in Table 1. It illustrates the distribution of enterprises according to our MSME classification criteria, revealing that 23% of respondents qualify as Micro Enterprises (employing 1-5 individuals), 50.1% as Small Enterprises (employing 6-49 individuals), and 26.9% as Medium-sized Enterprises (employing 50-249 individuals). These figures underscore that over 70% of MSMEs in our study fall within the Micro and Small Enterprise categories.

3.3. Data Analysis Technique

Our research employed the partial least squares structural equation modeling (PLS-SEM) method for data analysis due to many strong justifications. Firstly, PLS-SEM provides the intensity and statistical significance of each path, enabling the investigator to analyze structural models encompassing multiple variables with direct and indirect relationships to ascertain variations in predictors. Secondly, PLS-SEM is acknowledged as a highly useful research approach for evaluating and handling interactions, thus reducing type 2 error (Lowry and Gaskin, 2014). It also been recognized as a useful procedure for consumer behavior and environmental issues (Ebrahimi et al., 2022), and this technique used by many investigations related to SMEs (Troise et al., 2022; Abalala et al., 2021; Islam and Alharthi, 2020; Alharthi and Islam, 2021). Thirdly, it is suggested by statistical experts as a suitable technique for relatively complex model with small data size and data are non-parametric in nature (Hair et al., 2021; Sarstedt et al., 2019), meaning it does not have a normally distributed trend and can be applied in small-sample studies. Notably, PLS-SEM has gained significant attention among various domains comprising marketing, strategic management, operations management, and human resources (Hair et al., 2016). We used SmartPLS 4.1 software and the bootstrapping procedure with 5,000 trails for model estimation, and a two-tailed test is used to evaluate significance in conjunction with the bootstrapping procedure.

4. RESULTS AND EMPIRICAL FINDINGS

4.1. Evaluation of Measurement Models

We evaluated the notions' validity and reliability by analyzing reliability, convergent validity, and discriminant validity. Table 2 illustrates that all outside loadings exceeded the criterion of 0.70. Furthermore, the average variance extracted (AVE) for all structures surpassed the 0.50 criterion, as seen in Table 3. Table 3 further demonstrates that the values of $\sqrt{AVE}$ exceeded the correlations among the variables, hence affirming discriminant validity. This table presents Cronbach's Alpha and composite reliability values for each construct, all exceeding the 0.70 criterion. The data shown in Tables 2 and 3 demonstrate the internal consistency and validity of the latent components (Hair et al., 2021; Manley et al., 2021). Consequently, the findings of this study are considered to be reliable and precise. Furthermore, the discriminant validity was also assessed by inspecting the heterotrait-monotrait (HTMT) ratio of correlations between the constructs (Hair et al., 2017). The values in Table 4 further support the model's discriminant validity, as all HTMT values fall well below the more conservative threshold of 0.90 (Franke and Sarstedt, 2019).

4.2. Assessment of Structural Model

Evaluating the structural model consists of evaluating the relevance and importance of the path coefficients and the Variance Inflation Factor (VIF) between constructs. We examine each group of predictors within the structural model to identify potential collinearity. Table 5 demonstrates that the model showed no signs of collinearity, with all independent variables having VIF values less than 5, deemed ideal (Sarstedt et al., 2019; Hair et al., 2017).

The bootstrap approach is a standard technique to investigate the mediation hypotheses, which has been developed by Preacher and Hayes (2008). For this reason, we utilized this widely used bootstrap approach for hypothesis testing. The bootstrapping procedure for 5,000 trails presented in Table 6. Bootstrapping results indicated that all latent variables are positively correlated with each other, except for business infrastructure and external pressure. Among these variables, three of them have a direct and significant relationship with the adoption of ECA, which are TR, TechIF and FS ($\beta = 0.110$, $P < 0.05$; $\beta = 0.070$, $P < 0.05$; $\beta = 0.176$, $P < 0.01$ respectively), and such results supported H_1, H_3 and H_7. Furthermore, ECA is found to have a significant positive relationship with both FP and NFP ($\beta = 1.160$, $P < 0.01$; $\beta = 0.398$, $P < 0.01$), which supported H_8 and H_9. Additionally, the result demonstrates a positive and significant relationship between NFP and FP ($\beta = 0.217$, $P < 0.01$), which supports H_{10}. All the other constructs are found to have a significance value of >0.05. From another viewpoint, higher levels of external pressure ($\beta = -0.042$) and business infrastructure ($\beta = -0.019$) lead to lower levels of ICT adoption in Saudi's MSMEs. The bootstrapping investigation further revealed that NFP significantly mediates the relationship between ECA and FP ($\beta = 0.086$, $P < 0.01$) in Saudi's MSMEs, thus supporting H_{11}.

5. DISCUSSION

The operational processes of businesses have undergone significant transformation due to the COVID-19 pandemic. In particular, the MSME industry was seriously affected by COVID-19 (Rahman et al., 2020). Rahman et al. (2020) found that nearly all MSMEs experienced substantial declines in both sales and profits at the beginning of the pandemic. Several reasons led the authors to choose Saudi Arabia as the empirical context. Firstly, MSMEs are pivotal to Saudi Arabia's economy, constituting approximately 28.7% of the country's GDP in 2023 (Statista, 2024), with potential for further contribution. Moreover, Saudi Arabia, as an emerging economy, is making significant strides in technology adoption. The country has recently launched several initiatives aimed at becoming one of the most technologically advanced nations globally, which is in line with the strategic goals of Vision 2030—a blueprint for Saudi Arabia's economic and social transformation. However, Saudi MSMEs, especially those vulnerable, have suffered disproportionate impacts from the COVID-19 pandemic.

Table 2: Survey with references

Constructs	Items	Loading	Source
e-commerce Adoption (ECA)	Internet use for advertising and marketing (EC1)	0.989	Gibbs and Kraemer (2004)
	Internet use for online sales (EC2)	0.989	
	Internet use for customer service and support after-sales (EC3)	0.973	
	Internet use for online purchases (EC4)	0.989	
	Internet use for interchange of working data with dealers (EC5)	0.944	
	Internet use for interchange of working data with commercial clients (EC6)	0.989	
	Internet use for official coalition of similar business operations with dealers or other collaborators (EC7)	0.935	
Technology Resources (TR)	Our firm is having email technology (TR1)	0.810	Gibbs and Kraemer (2004)
	Our firm is having public websites (TR2)	0.899	
	Our firm is having intranet technology (TR3)	0.896	
	Our firm is having extranet technology (TR4)	0.874	
	Our firm is having electronic data interchange (EDI) technology (TR5)	0.840	
	Our firm is having electronic fund transfer (EFT) technology (TR6)	0.873	
	Our firm is having call center technology (TR6)	0.862	
IT Skills of Human Resources (ITSHR)	The majority of our workforce is proficient in computer skills (ITSHR1)	0.944	Molla and Licker (2005)
	The majority of our workforce has easy access to computers (ITSHR2)	0.963	
Technical Infrastructure (TechIF)	Telecom infrastructure is standard (TechIF1)	0.893	Jennex et al. (2004)
	Modern PCs, along with updated computer hardware and software, are accessible (TechIF2	0.949	
	Employees technical proficiency is at the expected level (TechIF3)	0.925	
Business Resources (BR)	"Our people are open and trusting with one another (BR1)"	0.822	Molla and Licker (2005)
	"Communication is very open in our organization (BR2)"	0.853	
	"Our organization exhibits a culture of enterprise-wide information sharing (BR3)"	0.901	
	"We have a policy that encourages grassroots E-commerce initiatives (BR4)"	0.891	
	"Failure can be tolerated in our organization (BR5)"	0.882	
	"Our organization is capable of dealing with rapid changes (BR6)"	0.807	
Government Support (GoS)	During the COVID-19 pandemic, the government was assisting in reducing internet costs and establishing e-commerce facilities (GoS1).	0.876	Looi (2005)
	During the COVID-19 pandemic, government support is vital to inspiring me to utilize e-commerce (GoS2)	0.889	
	During the COVID-19 pandemic, the government consistently updates us on the positive aspects of e-commerce (GoS3)	0.843	
	The government is providing comprehensive support to ensure consumer's rights in in e-commerce transactions (GoS4)	0.778	
External Pressure (ExP)	"My main trading partner usually sets the mode of communication (e.g., fax, e-mail, etc.)" (ExP1)	0.847	Sila (2013)
	"My main trading partner decides on pricing, delivery schedules, etc." (ExP2)	0.871	
	"My main trading partner decides on the rules and regulations for using an inter-organizational system in order processing" (ExP3)	0.848	
	"My main trading partner decides on what information systems applications are to be exchanged with my firm" (ExP4)	0.828	
	"An industry moves to utilize the Internet for interorganizational communications would put pressure on my firm to do the same" (ExP5)	0.806	
	"There is a trend in my organization to more utilize the Internet for business-related activities and business communications" (ExP6)	0.815	
Financial Performance (FP)	Our organization has benefited financially by reducing overall costs (FP1)	0.744	Islam et al. (2015)
	Our organization has benefited financially by increasing profit (profits growth) (FP2)	0.954	
	Our organization has benefited financially by boosting sales (sales growth) (FP3)	0.949	
	Our organization has benefited financially by increasing Return on Asset (ROA) (FP4)	0.935	
	Our organization has benefited financially by increasing market share (FP5)	0.918	
Non-financial Performance (NFP)	Internal efficiency of our organization has improved (NFP1)	0.832	Islam et al. (2015)
	Transparency of our organization has improved (NFP2)	0.854	
	Productivity of our organization has improved (NFP3)	0.874	
	Social and environmental responsibilities of our organization have improved (NFP4	0.799	
	On-time delivery of our organization has improved (NFP5)	0.804	
	Product or service quality of our organization has increased (NFP6)	0.707	
	Waste of our organization has reduced (NFP7)	0.705	
	Customer's complaints of our organization have reduced (NFP8)	0.716	
	Management's commitment of our organization has increased (NFP9)	0.800	
	Documentation of our organization has improved (NFP10)	0.700	
	Organization's image of our organization has increased (NFP11)	0.704	
Firm Size (FS)	Total number of employees	1.00	Zhu et al., 2002

Source: The authors' estimation. ECA: E-commerce adoption, TR: Technological resources; ITSHR: IT skills of human resources, TechIF: Technical infrastructure, BR: Business resources, GoS: Government supports, ExP: External pressure, FS: Firm size, NFP: Non-financial performance, FP: Financial performance

Table 3: Scale validation – reliability and validity

Constructs	CA	CR	AVE	ECA	TR	ITSHR	TechIF	BR	GoS	ExP	FP	NFP
ECA	0.991	0.991	0.947	0.973								
TR	0.934	0.968	0.749	0.097	0.866							
ITSHR	0.901	0.929	0.909	0.118	0.827	0.954						
TechIF	0.914	0.941	0.851	0.164	0.721	0.733	0.922					
BR	0.930	0.964	0.739	0.078	0.812	0.777	0.718	0.860				
GoS	0.872	0.914	0.719	0.108	0.688	0.637	0.614	0.738	0.848			
ExP	0.915	0.940	0.699	0.078	0.789	0.714	0.721	0.825	0.793	0.836		
FP	0.941	0.941	0.816	0.615	0.216	0.196	0.259	0.227	0.233	0.211	0.903	
NFP	0.934	0.962	0.599	0.196	0.475	0.476	0.435	0.519	0.407	0.524	0.329	0.774

Source: The authors' estimation. ECA: E-commerce adoption, TR: Technological resources, ITSHR: IT skills of human resources, TechIF: Technical infrastructure, BR: Business resources, GoS: Government supports, ExP: External pressure, FS: Firm size, NFP: Non-financial performance, FP: Financial performance

Table 4: Discriminant validity with HTMT

Constructs	ECA	TIF	ITSHR	TechIFF	BR	GoS	ExP	FP	NFP	FS
ECA										
TR	0.191									
ITSHR	0.123	0.896								
TechIF	0.168	0.780	0.816							
BR	0.077	0.878	0.849	0.789						
GoS	0.110	0.753	0.709	0.688	0.815					
ExP	0.078	0.852	0.786	0.788	0.845	0.883				
FP	0.636	0.223	0.211	0.274	0.240	0.254	0.227			
NFP	0.170	0.517	0.896	0.469	0.568	0.451	0.580	0.321		
FS	0.377	0.014	0.036	0.126	0.036	0.086	0.034	0.196	0.061	

Source: The authors' estimation. ECA: E-commerce adoption, TR: Technological resources, ITSHR: IT skills of human resources, TechIF: Technical infrastructure, BR: Business resources, GoS: Government supports, ExP: External pressure, FS: Firm size, NFP: Non-financial performance, FP: Financial performance

Table 5: Output of VIF test

Constructs	ECA	FP	NFP
TR	2.577		
ITSHR	3.833		
TechIF	2.749		
BR	4.522		
GoS	2.915		
ExP	4.714		
FS	1.044		
ECA		1.040	1.000
NFP		1.040	

Source: The authors' estimation. ECA: E-commerce adoption, TR: Technological resources, ITSHR: IT skills of human resources, TechIF: Technical infrastructure, BR=Business resources, GoS=Government supports, ExP=External pressure, FS=Firm size, NFP=Non-financial performance, FP=Financial performance

Table 6: Path coefficients

Relationships	Beta	P-values	Confidence intervals		Decision	
			LLCI	ULCI	F^2	
TR -> ECA	0.110	0.021	0.139	0.284	0.071	Supported
ITSHR -> ECA	0.031	0.434	−0.055	0.099	0.001	Not Supported
TechIF -> ECA	0.070	0.038	−0.009	0.110	0.006	Supported
BR -> ECA	−0.019	0.646	−0.101	0.064	0.000	Not Supported
GoS -> ECA	0.023	0.496	−0.046	0.087	0.001	Not Supported
ExP -> ECA	−0.042	0.311	−0.112	0.051	0.002	Not Supported
FS-> ECA	0.176	0.000	0.140	0.212	0.144	Supported
ECA -> FP	1.160	0.000	1.040	1.280	0.546	Supported
ECA -> NFP	0.398	0.000	0.224	0.572	0.040	Supported
NFP -> FP	0.217	0.000	0.141	0.292	0.078	Supported
ECA-> NFP -> FP	0.086	0.000	0.051	0.126		Supported

Source: The authors' estimation. ECA: E-commerce adoption, TR: Technological resources, ITSHR: IT skills of human resources, TechIF: Technical infrastructure, BR: Business resources, GoS: Government supports, ExP: External pressure, FS: Firm size, NFP: Non-financial performance, FP: Financial performance

Given this context, it is considered essential to examine how Saudi MSMEs can integrate technological platforms like e-commerce to maintain their operations and performance. Therefore, this research seeks to explore the impact of e-commerce adoption (ECA) on the performance of MSMEs in Saudi Arabia and determine the factors that influenced e-commerce adoption during the pandemic.

First, seven variables have been identified as determinants that affect Saudi Arabian MSMEs in adopting e-commerce. These findings confirm the significance of key determinants tested in prior e-commerce adoption studies by showing that the adoption of e-commerce is positively influenced by the technological resources, IT skills of human resources, technical infrastructure, government support, and the firm size. In contrast, an inverse relationship was found between external pressure and business resources with e-commerce adoption. The study path results demonstrate that technological resources positively influence e-commerce adoption in MSMEs in Saudi Arabia. This indicates that technological resources are a key determinant of e-commerce adoption among MSMEs in this region, which fully supports and validates the hypothesis (H_1). Our findings align with previous research studies conducted by Gibbs and Kraemer (2004), Sánchez-Torres et al. (2021); Agarwal and Wu (2015); Kuruwitaarachchi et al. (2020); Ariansyah et al. (2021); Taneja (2021); Mohdhar and Shaalan (2021); Hossain et al. (2023) and Shahadat et al. (2023). These studies have consistently identified technological resources as a significant enabler of e-commerce adoption in SMEs, as technological resources form the foundation for e-commerce initiatives. Taneja (2021) and Mohdhar and Shaalan (2021) claimed that technological resources are the backbone of any e-commerce enterprise all over the globe. Agarwal and

Wu (2015) also stated that the more advanced the technological resources in a developing country, the quicker the adoption of e-commerce. While all firms in our sample have access to Internet technology, we propose that a more comprehensive technological infrastructure—encompassing tools like email, intranets, extranets, public websites, EDI, EFT, and call centers—boosts the extent to which these firms leverage the Internet throughout their value chains. The availability of technological resources is crucial for adopting e-commerce. Therefore, as technological resources increase, the expansion of e-commerce among MSMEs also increases, and vice versa.

Second, the study result reveals that technical setup is an essential aspect in e-commerce adoption in MSMEs in Saudi Arabia. Thus, technical infrastructure positively affects e-commerce adoption, which is supporting the third hypothesis (H_3). Such result is consistent with earlier studies conducted by Jennex et al. (2004), Awa et al. (2015), Rumanyika and Mashenene (2014), Kurnia et al. (2015), Al-Somali et al. (2015), Walker et al. (2016), and Al-Tit (2020). For example, Al-Somali et al. (2015) confirmed that technological resources and technical infrastructure encourage e-commerce adoption in SMEs in Saudi Arabia. Kurnia et al. (2015) claimed that technical infrastructure is one of the pertinent factors determining the adoption of e-commerce by SMEs. Awa et al. (2015) also confirmed that SMEs with greater levels of technical skills show more probability to adopt e-commerce in Nigeria. Moreover, Walker et al. (2016) revealed that technical infrastructure, particularly technical expertise or technical skills, was crucial for discerning e-commerce adoption in Slovakian SMEs. Al-Tit (2020) discovered that technical expertise and telecommunications are the important drivers of the adoption of ecommerce in SMEs. Similarly, empirical findings from the study conducted by Rumanyika and Mashenene (2014) showed that inadequate telecommunication infrastructure and lack of technical experts are significant obstacles of e-commerce adoption among SMEs in Tanzania. In fact, technological resources and infrastructure can equip MSMEs with the ability to address challenges and achieve a successful implementation by offering end-user training, promoting innovative e-commerce practices, and preparing them to be more adaptable to change.

Third, the firm size is identified in this study as a key determining factor of e-commerce adoption by MSMEs in Saudi Arabia. The findings show that larger firms are considerably more inclined to adopt e-commerce, indicating a positive correlation between firm size and e-commerce adoption. Thus, the seventh hypothesis (H_7) is supported, and this result is consistent with several earlier as well as recent studies (Lim and Trakulmaykee, 2018; Balaid et al., 2014; Oktora et al., 2020; Ali et al., 2022; Shahadat et al. 2023). For example, the results of the study performed by Lim et al. (2018) revealed that larger firms have higher rates of e-commerce adoption in SMEs during pandemic conditions due to their sufficient resources. Balaid et al. (2014) confirmed that firm size is a significant factor in e-commerce acceptance in SMEs as they found that the larger enterprises are more advanced in adopting e-commerce faster than smaller ones. Similarly, Shahadat et al. (2023) found that firm size plays a key role in e-commerce adoption among SMEs in emerging economies.

Fourth, interestingly, the results of our data analysis show that external pressure does not have positive and significant correlations with e-commerce adoption in MSMEs. This result indicates that external pressure is not recognized by Saudi Arabia MSMEs as factors that influence them in adopting of e-commerce technology. Hence, in this study, the sixth hypothesis (H_6) is not supported. The lack of a significant negative relationship between external pressure and e-commerce adoption aligns with previous research (Thong, 1999). It is suggested that excessive external pressure hinders technology integration, as it drives firms to chase new technologies without fully utilizing their current systems. The negative but insignificant relationship between external pressure and e-commerce adoption in Saudi's MSMEs may be due to a combination of cultural resistance to change, perceived risks, costs associated with e-commerce, and a lack of adequate support and resources. Additionally, the resilience of MSMEs to external pressures, a market structure that may not strongly incentivize e-commerce, and an insufficiently supportive regulatory environment could all contribute to the observed relationship, indicating that external pressure alone is not a decisive factor in driving e-commerce adoption in MSMEs. Another possible explanation for the negative association between external pressure and ecommerce adoption could be that most customers in Saudi Arabia are identified as online shoppers with a traditional way. These customers visit online sites only to view products and, if interested, place their orders through conventional methods such as telephone, fax, WhatsApp text, email or in person. Consequently, MSMEs are not required to implement high-tech or extended e-commerce technologies. These findings are particularly interesting because they are in stark contrast to the findings of some recent research studies (Sila, 2013; Ghobakhloo et al., 2011; Shahadat et al. 2023; Hussain et al., 2020; Bhardwaj et al., 2021; Nekmahmud et al., 2022), which have identified competition and business partners pressure as significant for e-commerce adoption by SMEs.

Fifth, this study reveals that e-commerce adoption among Saudi Arabian MSMEs is not influenced by business resources. Therefore, the fourth hypothesis (H_4) is not supported in this research. The negative but insignificant relationship between business resources and e-commerce adoption in Saudi's MSMEs could be caused by various factors, such as lack of readiness of dealing with rapid changes, lack of encouraging policies for e-commerce initiatives. MSMEs may find it challenging to allocate funds toward e-commerce initiatives due to competing priorities and might lack the basic resources to invest in technology infrastructure and digital marketing. Additionally, a lack of awareness about the benefits of e-commerce and uncertainty about its effectiveness may further hinder adoption. Thus, while business resources are essential, their availability alone may not strongly influence e-commerce adoption among Saudi MSMEs. This finding is opposed to the majority studies (Jennex et al., 2004; Walker et al., 2016; Abed, 2020). For example, these studies reveal that firm's capacity of dealing with rapid changes, encouraging policies of e-commerce initiatives and other readiness factors are closely associated with e-commerce adoption.

Sixth, the results of our PLS-SEM analysis also demonstrate that ECA has a significant positive impact on the financial performance

of MSMEs, supporting the ninth hypothesis (H_9). This finding aligns with previous research, which has shown that e-commerce adoption by MSMEs leads to improved financial outcomes. In other words, most earlier studies have suggested a direct connection between e-commerce adoption and a firm's financial performance. For example, e-commerce adoption reduced overall costs (Gao et al., 2023; Sheikh et al., 2018), increased market share (Gao et al., 2023; Masud et al., 2022), increased sales (Wulandari and Koe, 2022; Šaković Jovanović et al., 2020; Eurostat, 2020); increased profits (Wulandari and Koe, 2022; Effendi and Subroto 2021; Nurlinda et al., 2020), and increased return on assets (Masud et al., 2022). The authors of these studies argued that e-commerce adoption allows MSMEs to boost their overall financial performance. It serves as a platform for interacting with business partners, which contributes to enhanced financial outcomes for the firm (Hussain et al., 2020).

Seventh, our study also found that ECA has a significant positive effect on the non-financial performance of MSMEs, thereby supporting the eighth hypothesis (H_8). This finding is compatible with some studies that reveal that ECA is clearly and considerably linked with better efficiency and transparency (Gunawan et al., 2023; Xia and Zhang, 2010); high productivity (Falk and Hagsten, 2015; Smith., 2012), company impression, and management's commitment (Tolstoy et al., 2022; Daud et al., 2022); better product and service quality (Daud et al., 2022; Khin and Ho, 2020); and social and environmental responsibility (Gao et al., 2023; Khan and Uddin, 2023). The authors of these studies stated that e-commerce is a useful trade instrument, particularly for marketing and selling a diverse range of global products and services. It offers significant benefits to companies, including improved efficiency, reduced inventory, increased sales, enhanced customer reach, and access to new markets. Consequently, more companies are implementing e-commerce strategies.

Eighth, the study further found a significant positive influence of non-financial performance on financial performance in SMEs and supported the tenth hypothesis (H_{10}), which is aligned with the findings of previous studies (Islam et al., 2017; Theron and Dowden, 2017). Finally, the empirical findings revealed a strong and significant mediating effect of firms' non-financial performance on the relationship between e-commerce adoption and financial performance, thereby supporting the tenth hypothesis (H_{11}). Our statistical analyses showed that adopting e-commerce improves an organization's internal quality, operational processes, innovation, efficiency, transparency, social responsibility, corporate image, and environmental considerations, all of which contribute to improved financial outcomes. Many MSMEs have adopted e-commerce tools and techniques to reach potential customers, leading to enhanced financial performance. This finding is aligned with the findings of some previous studies (Islam et al., 2017; Islam and Alharthi, 2020; Islam et al., 2015). We believe that this research is the first to explore how e-commerce adoption has enhanced both financial and non-financial returns for MSMEs during the COVID-19 pandemic. The results indicate that it is crucial for MSMEs to establish and initiate e-commerce practices to enhance operational and business performance, subsequently leading to improved financial outcomes. Our findings could motivate MSMEs to embrace e-commerce, thereby enhancing the overall performance of their firms.

6. CONCLUSION

This study carries important implications, as its results are anticipated to assist MSME owners and managers in their endeavors to adopt e-commerce during times of crisis. Additionally, the findings encourage businesses to strengthen their technical resources and infrastructure to boost both financial and non-financial performance. Furthermore, authorities like Ministry of Commerce, Saudi Central Bank (SAMA) and Ministry of Communication and Information Community can benefit from this study to regulate and develop e-commerce in Saudi Arabia.

Further research can compare between three periods: before, during and after COVID-19. In addition, more studies can be conducted to give a comparison of the determinants and impacts of e-commerce adoption on MSMEs between countries or regions such as GCC countries. Also, more studies can be conducted to measure the impacts of COVID- 19 pandemic on the consumer behavior and over the periods of crises.

7. ACKNOWLEDGMENT

The project was funded by the Deanship of Scientific Research (DSR), King Abdulaziz University, Jeddah, Saudi Arabia under the grant no. (G: 167-849-1443). The authors, therefore, acknowledge with thanks the DSR for technical and financial support.

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