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An Impact of E-Commerce Adoption on Small and Medium-Sized Enterprises (SMES)

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Abstract
The present review examines how small and medium-sized businesses (SMEs) are affected by the adoption of e-commerce, stressing the SMEs' theoretical underpinnings, verifiable evolution, and influencing variables. SMEs faced early difficulties due to restricted access to technology, but in the late 1990s, they were able to take advantage of opportunities provided by the internet and e-commerce platforms. Their growth was fueled by improvements in infrastructure, user-friendly interfaces, and secure payment gateways. Using the Technology, Organization, and Environment (TOE) paradigm for theoretical analysis, it is possible to identify key drivers such as technology preparedness, perceived benefits, and competitive pressure, and barriers such as insufficient digital skills and financial restrictions. Big data, machine learning, artificial intelligence, and e-commerce have all come together to optimize SME operations, open up new marketing opportunities, and improve consumer interaction. Advances in computerized technology, coordinated factors, and consumer expectations will fuel the development in SMEs' adoption of e-commerce in the future. New technologies like blockchain, augmented reality, and computer generated reality will open up new avenues for development and market expansion.

Keywords: *E-Commerce,Adoption, SmallMedium,Enterprises (SMES), Organization, Environment*

I. INTRODUCTION

The fast development of e-commerce technologies in recent decades has drastically changed the landscape of commercial operations [1]. In this digital transformation, small and medium-sized enterprises (SMEs) have become key actors. They use online platforms to increase their market reach, improve operational efficiency, and seize new development prospects. A significant transition from conventional brick-and-mortar setups to more flexible and scalable digital company structures is seen in the use of e-commerce by SMEs [2].

Adoption of e-commerce involves a wide range of operations, from creating a website and online entertainment presence to consolidating advanced e-commerce systems that streamline store network management, customer relationship management, and exchange processing. Because of this adoption, market access has become more democratic, putting SMEs on an even playing field when competing against multinational rivals and larger enterprises [3].

Adoption of e-commerce by SMEs is important for reasons other than operational efficiency. It has radically changed the way these businesses interact with stakeholders, suppliers, and consumers, resulting in more meaningful and individualized exchanges [4]. E-commerce helps SMEs expand into new markets, diversify their revenue sources, and make the best use of their resources by lowering operational expenses and geographical restrictions.

The road to accepting e-commerce is not without difficulties, though. SMEs frequently encounter challenges such upfront investment expenses, technology impediments, cybersecurity issues, and the requirement for personnel upskilling [5]. To tackle these obstacles, a proactive approach to utilizing technology breakthroughs, investment in digital infrastructure, and strategic planning are necessary [6].The purpose of this study is to investigate the complex effects of SMEs' adoption of e-commerce, checking out at the advantages and disadvantages of this revolutionary process. It aims to offer insights into the tactics that SMEs can use to optimize the advantages of e-commerce while minimizing potential hazards by evaluating empirical data and case studies [7]. The study will also emphasize the consequences for policy and offer suggestions for creating an environment that would allow SMEs to prosper in the digital economy.

1.1 Contextualizing the Digital Transformation

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The world of business is undergoing a significant digitization, with agile, technology-driven approaches quickly replacing traditional company models. The fast expansion of e-commerce, which has become the pillar of contemporary trade, is essential to this change. In this evolution, Small and Medium-sized Enterprises (SMEs) play a crucial role, using e-commerce platforms more and more to expand their market reach, optimize their operations, and seize new growth opportunities [8]. Data support this trend: Recent reports state that during the past ten years, SMEs have adopted e-commerce at a substantially higher rate than in previous years, with a notable increase seen in a variety of industries and geographical areas worldwide. The ease of use of digital technologies, the scalability provided by online platforms, and the capacity to interact with a larger consumer base by overcoming geographic constraints are the main factors driving its adoption. The transformational influence on competitiveness, innovation, and market penetration is becoming more and more apparent as SMEs continue to incorporate e-commerce into their company strategy, highlighting the growing significance of digital business models in influencing the direction of international trade [9].

1.2 Benefits of E-commerce Adoption for SMEs

Adopting e-commerce is essential for Small and Medium-sized Enterprises (SMEs) to enhance their global market reach and competitiveness. SMEs may reach a large, diversified client base that would be difficult to reach through traditional brick-and-mortar channels and overcome regional restrictions by creating an online presence [10]. In addition to expanding market potential, this worldwide accessibility enables SMEs to customize their products to appeal to particular customer groups, which enhances customer targeting and engagement. Furthermore, e-commerce enables notable improvements in efficiency in a number of areas related to SME operations. By automating order processing, payment systems, and inventory management, digital platforms simplify business operations and save operating expenses and administrative workloads [11]. Real-time interaction tools also improve customer service by allowing SMEs to quickly respond to questions, fix problems, and build clientele. E-commerce also makes it possible for supply chain management to be streamlined by enhancing communication, collaboration, and responsiveness amongst partners, distributors, and suppliers. Together, these efficiency improvements give SMEs the ability to compete more successfully in the global market, spurring innovation, growth, and long-term company expansion [12].

1.3 Challenges and Barriers

Small and medium-sized enterprises (SMEs) face a number of important obstacles when implementing e-commerce, which may hinder their ability to expand and remain competitive. The significant upfront costs associated with building and maintaining a strong e-commerce infrastructure, which includes digital marketing, website creation, and safe payment methods, are one of the main challenges [13]. Technological complexity is another issue that many SMEs encounter. They frequently lack the internal knowledge and resources needed to successfully traverse and integrate cutting-edge e-commerce systems. Furthermore, cybersecurity concerns are a major worry for SMEs since they put them at risk for fraud, data breaches, and cyberattacks, which jeopardize customer confidence and business continuity. Together, these difficulties prevent SMEs from fully reaping the benefits of e-commerce adoption in terms of efficiency and market reach. As a result, SMEs could find it difficult to effectively compete with larger businesses that have access to more capital and technology capabilities [14]. To overcome these obstacles, SMEs must engage in cybersecurity measures, invest in digital skills training, and strategically plan to reduce risks and use e-commerce as a driver for long-term growth and increased competitiveness in the digital economy.

II. HISTORICAL DEVELOPMENT OF E-COMMERCE IN SMES

A journey has been molded by technology improvements, economic changes, and altering consumer behaviors that has been marked by the verifiable development of e-commerce in small and medium enterprises (SMEs). Beginning with limited access to technology and resources, small and medium-sized enterprises (SMEs) experienced issues in implementing e-commerce. The advent of the internet and e-commerce stages in the late 1990s achieved a huge change that provided small and medium-sized enterprises (SMEs) with new opportunities to access worldwide markets [15]. In the early 2000s, developments in internet infrastructure, user-friendly interfaces, and secure payment gateways were the main thrusts behind the expansion of e-commerce among small and medium-sized enterprises (SMEs). These advancements lowered the hurdles to entry, making

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it possible for small and medium-sized enterprises (SMEs) to fabricate online shops and effectively execute exchanges. With the advent of computerized marketing devices, small and medium-sized enterprises (SMEs) have gained even more power to target niche niches and improve client interaction[16].

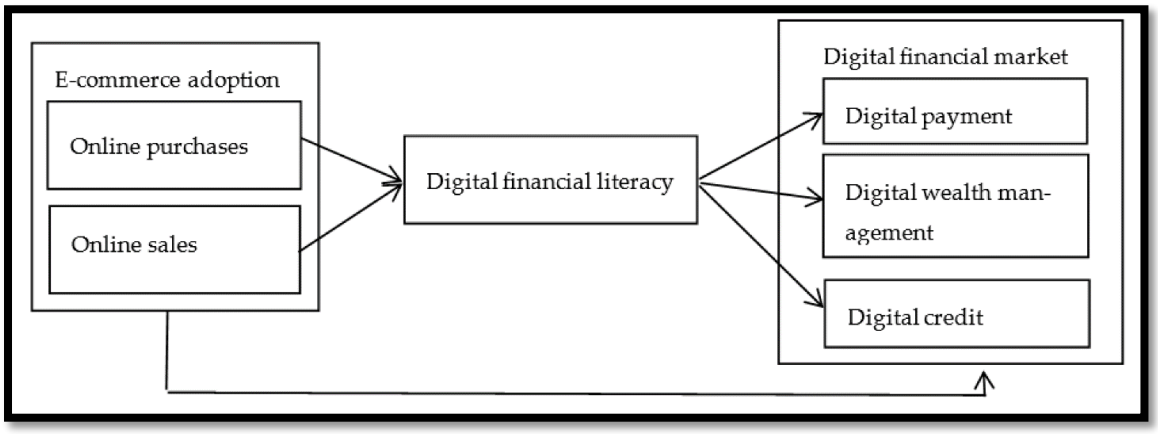

Figure 1:E-Commerce Adoption [17]

In the 2000s, e-commerce platforms emerged to support various business models, including business-to-consumer (B2C), business-to-business (B2B), and the growing trend of mobile commerce (m-commerce)[18]. Additionally, all through this era, small and medium-sized enterprises (SMEs) utilized e-commerce for sales as well as for customer relationship management, store network integration, and data analytics to optimize their operations and improve their competitiveness. E-commerce plans for small and medium-sized enterprises (SMEs) were disrupted by the presentation of mobile technologies and social media during the 2010s. Small and medium-sized enterprises (SMEs) are able to harness social networks for item discovery, consumer feedback, and targeted marketing thanks to the emergence of social commerce as a potent tool. Mobile applications and responsive design become essential as a result of the developing trend among consumers to shop utilizing their mobile devices, specifically smartphones and tablets.

In recent years, the convergence of e-commerce with artificial intelligence (AI), machine learning, and big data analytics has further transformed the operations of small and medium-sized enterprises (SMEs). Chatbots driven by artificial intelligence, tailored recommendations, and predictive analytics let small and medium-sized enterprises (SMEs) provide smooth purchasing experiences and optimize inventory management. Access to scalable infrastructure and software-as-a-service (SaaS) arrangements has been democratized as a result of distributed computing, which has leveled the playing field for small and medium-sized enterprises (SMEs) in comparison to larger competitors. As we plan ahead, we can see that the future of e-commerce in small and medium-sized enterprises (SMEs) is positioned for proceeding with development led by advancements in digital technology, coordinated factors, and the demands of consumers. The integration of augmented reality (AR), virtual reality (VR), and blockchain technologies is expected to further transform the e-commerce landscape, offering small and medium-sized enterprises (SMEs) new opportunities for innovation and market expansion.

III. THEORETICAL FOUNDATIONS

3.1 TOE Framework

In 1990, Tornatzky and Fleischer introduced the TOE framework to explain how businesses adopt innovation. The Technology, Organization, and Environment (TOE) framework, as its name suggests, considers three key variables.

The TOE framework has been used to explain the adoption of various technologies, such as interorganizational systems, e-business, e-commerce, Enterprise Applications, open-source systems, and other application systems. Although technological factors are crucial for the adoption and use of the Internet, the TOE framework emphasizes the equal importance of organizational and environmental factors. Technologies both internal and external to the company and their adoption are referred to as technology variables [19].

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The term "organizational variables" refers to the resources, employee communication method, and descriptive features of the business. Environmental variables include the internal environment and the external environment, which includes rivals and market factors.

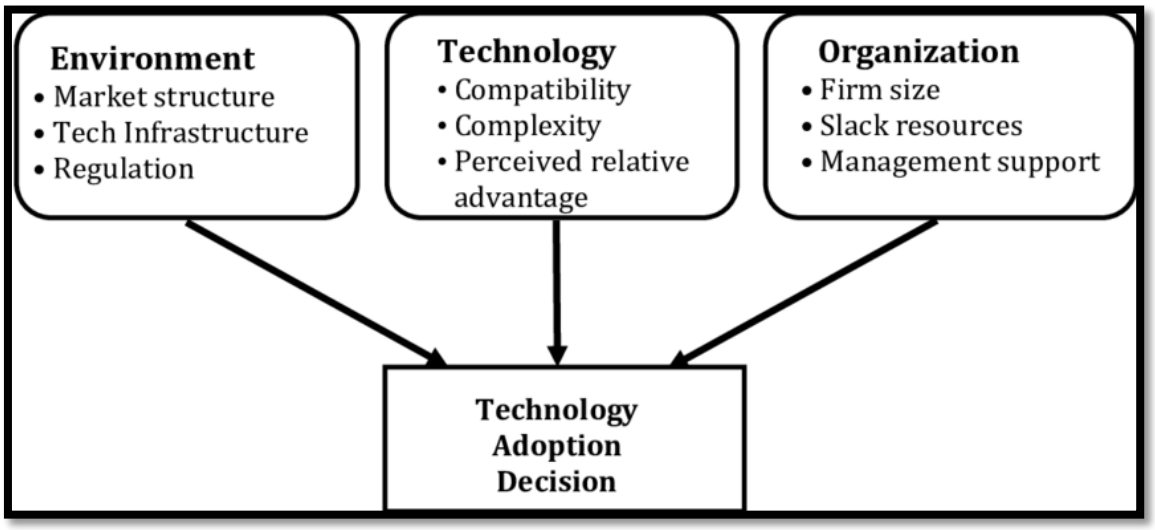

Figure 2:TOE Framework [20]

3.2 Technology

Technological factors, such as user awareness in utilizing adopted technology (e.g., technical knowledge and vendor support) and necessary resources (e.g., internet infrastructure, user time, and developers), are more closely linked to perceived behavioral control. Internal and external technologies that are relevant to enterprises are sometimes referred to as technology variables[21].In other research, three indicators—relative advantage, perceived complexity, and compatibility—are linked to technology characteristics. The degree to which innovation is assumed to be a superior idea than one that is being replaced is known as relative advantage. Innovations with distinct and obvious benefits in terms of operational (e.g., cutting operating expenses) and strategic (e.g., raising sales) efficacy are more likely to be adopted. Adoption of innovations is seen to be more difficult in situations where perceived complexity is present, meaning that technical understanding of e-commerce is necessary in order to embrace. Compatibility becomes crucial to the acceptance and usage of information technology, in this case e-commerce, because perceived compatibility is linked to the role of technology in the user's work.

3.3 Organization

Organizational factors include the resources and features of the business, such as the number of spare resources, internal communication channels, staff hierarchies, and firm size. According to earlier studies, the characteristics that are most frequently utilized to look into how innovation adoption decisions are influenced in organizations—including SMEs—are those related to the organization [22]. Organizational size, information technology expertise, and support from upper management are among the indicators that are linked to organization characteristics. Since top management offers direction for resource allocation, service integration, and process reengineering, it plays a crucial role in the adoption of information technology. When upper management sees the advantages of e-commerce, they are more inclined to support the resources required to embrace it and persuade staff members to make adjustments. Additionally, employee technology knowledge is crucial to an organization's ability to adopt or reject e-commerce for small and medium-sized businesses (SMEs). This is because employee technology knowledge must adapt to the numerous changes in information technology.

Larger firms are generally more likely to innovate according to size of organization indicators, but many other studies challenge this since an organization's size can also be explicitly linked to the availability of particular resources.

3.4 Environment

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Opportunities and environmental threats encourage an organization's propensity for innovation. According to Duan et al, the corporate environment is a broad space in which businesses operate. According to Gono et al, the business environment in which SMEs operate has a significant impact on their adoption of information technology. Organizations are more susceptible to adopting e-commerce when it comes to its implementation because competitors get more adept at or accustomed to using it [23]. According to certain research, signs of trading partners' pressure and competition pressure make up environment factors.

Organizations are frequently compelled to adopt technology by rivals in order to remain competitive in a dynamic environment. Businesses will be enticed to expand their e-commerce adoption in order to obtain a competitive edge when they witness rivals utilizing e-commerce technologies. SMEs are therefore more inclined to embrace e-commerce when there is greater industry competition. The trading partner pressure indicator measures the impact and pressure suppliers and customers place on a business to adopt e-commerce. As more people in Indonesia use the internet, there is more pressure on SMEs to adopt information technology, in this case e-commerce**.**

IV. THE THEORETICAL FRAMEWORK

4.1 Influence of Technology on E-Commerce Adoption

Three indications are linked to technological variables: perceived complexity, compatibility, and relative advantage. The degree to which adopting new innovations is believed to be able to benefit an organization more than sustaining older ones is known as relative advantage[24]. Relative advantage has been found to be a key factor of technology adoption in some research. Conditions where innovation adoption is deemed to be relatively difficult or not to use are indicated by complexity indicators. On the off chance that people find technological applications hard to use and comprehend, their lack of technical expertise about e-commerce can hinder acceptance; then again, if e-commerce technology is simple to use, innovation adoption is more probable.

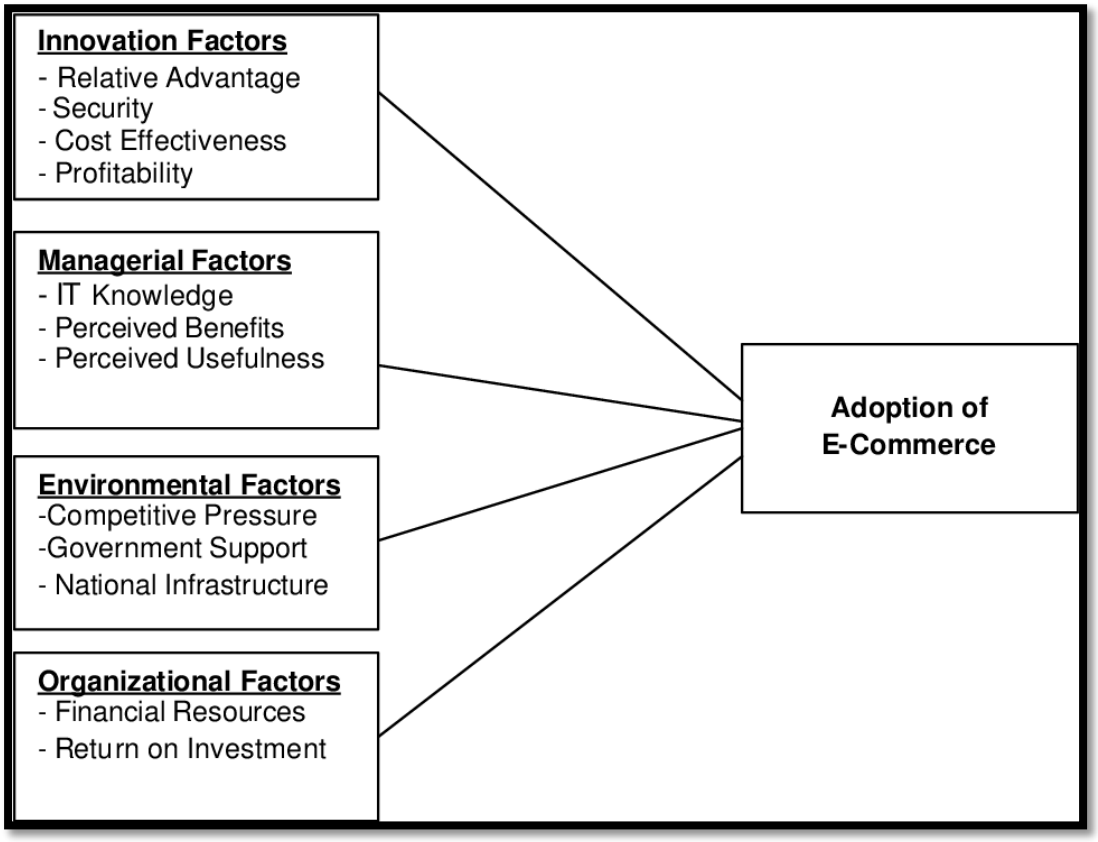

Figure 3: Adoption of E-Commerce [25]

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The readiness of users with prior experience, the current technological infrastructure, and the intended work patterns of the company are all considered compatibility indicators. Managers must determine whether using new technology will support internal objectives and business procedures. Compatibility has a decent and considerable impact on SMEs' adoption and use of e-commerce, according to earlier studies[26].

According to certain research, SMEs' adoption of e-commerce is significantly impacted by technological factors. More research is required to clarify this because, despite the findings of many studies showings that technology has a significant impact on e-commerce adoption, other studies also indicate that technological variables do not significantly influence SMEs' adoption of information technology (e-commerce).

4.2 Influence of Organization on E-Commerce Adoption

Organizational size, information technology expertise, and top management support indicators are all correlated with organizational characteristics.

Top management support refers to the extent to which organizational leaders understand the fundamentals of e-commerce. It involves securing sufficient financial and technological resources to implement information technology advancements. According to certain research, SMEs' adoption of e-commerce and their extensive usage of the internet are favorably connected with management support [27]. Employee IT knowledge indicators have a critical role in an organization's ability to embrace or not adopt ICT and e-commerce among SMEs, in addition to top management backing According to earlier research, SMEs' use of ICT and e-commerce is significantly influenced by the employees' familiarity with these topics. It has been reported that businesses of all sizes are aggressively using technology to enhance their position and competitive advantage. The size of the business is one of the three most significant predictors of technology adoption.

According to research discoveries SMEs' considerable adoption of information technology is known to be influenced by their firm size.

Organizational factors have a major impact on SMEs' adoption of e-commerce, according to several research. However, according to other research, organizational preparedness has no bearing on the uptake of e-commerce technology. Awa and Ojiabo's findings, which showed that organizational characteristics had no discernible effect on SMEs' adoption of information technology, further corroborate this. Additional investigation is required to elucidate this gap.

4.3 Influence of Environment on E-Commerce Adoption

The two indicators that make up environmental variables are the pressure from trading partners and competition. Competitive pressure is the degree to which the business perceives pressure from rivals in the industry [28]. As competitors begin to use e-commerce technology, businesses will be compelled to use it more widely in order to obtain a competitive edge. This will increase industry competition and the likelihood that SMEs will use e-commerce. The degree of influence and pressure that businesses receive via relational channels, including suppliers and consumers, to use e-commerce systems is known as trading partner pressure. Pressure from trading partners is viewed as a significant predictor of SMEs' adoption of e-commerce and to positively impact SMEs' adoption of IT.

According to some research, environmental factors have a big impact on how different e-commerce systems are used. Yeng et al.'s research indicates that environment variables have little bearing on the uptake of different e-commerce systems.

What indications can be used for the TOE framework can be found based on earlier research that was previously described. Table 1 displays the data from each indicator.

Table 1: An overview of the major research on SMEs' adoption of e-commerce

Authors	Construct	Methods	Service Context	Key Findings
Hossain et al. (2022) [29]	Patterns of SMEs' adoption of e-commerce in South Asian nations during COVID-19	Quantitative surveys and qualitative interviews	SMEs in multiple South Asian nations	Drivers: necessity to sustain operations, increased customer demand, availability of digital infrastructure. Challenges: limited digital skills, inadequate technological infrastructure, financial constraints. Insights for policymakers and business

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www.ijhssm.org

				practitioners.
Mohd Zain et al. (2020) [30]	Key drivers influencing e-commerce adoption among SMEs in the business service sector	Surveys and case studies	Business service sector SMEs	Drivers: perceived benefits, technological readiness, competitive pressure, government support. Perceived benefits include increased market reach and improved customer service. Importance of government support. Practical implications for promoting digital business practices.
Hossain et al. (2023) [31]	Role of technological factors in promoting e-commerce adoption among SMEs	Advanced statistical techniques	SMEs	Key factors: internet connectivity, availability of e-commerce platforms, cybersecurity measures, technological support services. Importance of continuous technological innovation and upgradation. Insights for businesses and policymakers.
Ocloo et al. (2020) [32]	Important variables affecting SMEs' use of B2B e-commerce	Mixed-method approach (quantitative surveys and qualitative interviews)	Small and medium-sized manufacturing enterprises	Key factors: organizational readiness, perceived benefits, external pressure, technological infrastructure. Challenges: high implementation costs, security concerns. Insights for enhancing competitive advantage through digital transformation.
Sujatha & Karthikeyan (2021) [33]	Determinants of e-commerce adoption among SMEs in India	Structured survey method	SMEs across various sectors in India	Critical determinants: technological readiness, perceived ease of use, perceived usefulness, external support. Importance of supportive external environment and tailored training programs. Practical implications for fostering e-commerce adoption.

Presenting an understanding of each indication is crucial in order to facilitate the creation of operational definitions for subsequent research.

V. CONCLUSION

Small and medium-sized businesses (SMEs) have been significantly impacted by the advent of e-commerce, which has changed customer behavior and technical improvements to reshape SMEs' operations and market reach. SMEs may now compete in international marketplaces thanks to the historical shift from restricted technological access to a strong internet infrastructure and user-friendly e-commerce platforms [34]. The TOE framework emphasizes that although barriers including a lack of digital skills and financial limitations still exist, the adoption of e-commerce is largely driven by technology readiness, perceived benefits, and competitive pressure. SME capabilities have been further improved by the integration of AI, ML, and big data analytics, resulting in individualized client experiences and effective inventory management. Looking ahead, SMEs' e-commerce will continue to rise as a result of the ongoing development of digital technologies, improvements in logistics, and rising customer expectations [35]. Blockchain, augmented reality, and virtual reality are examples of emerging technologies that open up new possibilities for market expansion and innovation, helping SMEs stay competitive in the digital age.

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