

The Role of IT Factors and IT Governance in E-commerce Adoption and Performance among Chinese Manufacturing SMEs

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Abstract:

This study investigates the key IT factors influencing the adoption of E-commerce platforms in small and medium-sized manufacturing enterprises (SMEs) in China, and examines their subsequent effect on organizational performance and efficiency. The research also assesses the moderating role of IT governance in shaping these relationships. Utilizing a framework based on well-established technology adoption models, such as the Diffusion of Innovations (DOI), Technology Acceptance Model (TAM), and the Technology-Organization-Environment (TOE), the study identifies critical factors including relative advantage, compatibility, simplicity, IT knowledge, information security, and network security. The findings highlight the significant role of IT governance in maximizing the benefits of E-commerce adoption, demonstrating that strong IT governance practices can optimize technological investments and ensure alignment with business objectives. Empirical results suggest that the implementation of E-commerce platforms positively impacts organizational performance, especially through features such as direct payment systems, search functionalities for buyers and sellers, and enhanced marketing capabilities. Recommendations for both E-commerce developers and users emphasize the importance of secure, compatible, and innovative solutions that integrate seamlessly with existing organizational systems. Additionally, the study underscores the need for government support and tailored E-commerce solutions to accelerate adoption among SMEs. This research contributes to the body of knowledge on E-commerce adoption by providing empirical evidence on the factors that influence it and their impact on organizational performance, offering insights to enhance competitiveness and operational efficiency in China's manufacturing sector.

Keywords: E-commerce adoption, IT governance, Manufacturing SMEs, Technology adoption, Organizational performance

INTRODUCTION

The rapid advancement of Information and Communication Technologies (ICT) is transforming how businesses operate, create value, and engage with society. This technological revolution has prompted organizations globally to reassess their business models and operational strategies. Companies are increasingly adopting internet-based technologies, recognizing their potential to enhance efficiency, accuracy, and cost-effectiveness. By leveraging these technologies, businesses can streamline their processes, gain a competitive edge, and access new markets (Tarofder, Azam, & Jalal, 2017). This shift is particularly significant in a globalized economy, where digital infrastructure plays a crucial role in business success.

At the core of this digital transformation is Electronic Commerce (E-commerce), which encompasses various online transactions facilitated by internet technologies. E-commerce has become a vital force in driving economic growth and innovation, especially in countries like China. The Chinese

government recognizes the strategic importance of E-commerce, particularly in fostering development within the Small and Medium Enterprise (SME) sector (Cheng, 2022). SMEs are essential to China's economic and policy objectives, contributing significantly to growth, job creation, and regional development (Ministry of Industries and Commerce, 2021). These enterprises play a pivotal role in transforming underdeveloped regions into economic hubs.

ICT enables SMEs to overcome traditional barriers, empowering them to compete on a global scale. By adopting internet-based technologies, SMEs can streamline their operations, expand their market reach, and innovate their business models. E-commerce platforms allow SMEs to access new markets, driving growth while enhancing operational efficiency. These platforms improve transaction transparency, reduce costs, and increase profitability, making them indispensable to the success of SMEs (Tham et al., 2017; Pambreni et al., 2019; Herath et al., 2023). E-commerce facilitates a broader customer base, targeting specific market segments and enabling personalized offerings. Additionally, it optimizes inventory management, enhances supply chain efficiency, and improves customer relationship management.

Despite the numerous advantages, SMEs face several challenges when adopting digital technologies. These include limited resources, insufficient technological infrastructure, low digital literacy, and cybersecurity concerns. To fully realize the potential of E-commerce, it is essential for policymakers, industry stakeholders, and support organizations to provide resources, training, and guidance (Choy & Chen, 2020). Overcoming these obstacles is critical for SMEs to effectively integrate digital solutions and contribute to sustainable economic development.

The rapid evolution of ICT has far-reaching implications, particularly with the integration of Cloud Computing, Mobile Computing, Big Data, Artificial Intelligence (AI), and the Internet of Things (IoT). These technologies are transforming how businesses operate and create value. Machine Learning (ML), a key component of data analytics, offers valuable insights that support decision-making and strategic planning (Karmaker Santu, Sondhi, & Zhai, 2021). Major IT service providers like Microsoft and Amazon have made ML tools widely accessible, enabling organizations to optimize their operations (Bhatnagar, 2018). As these technologies continue to advance, they provide businesses with tools to reduce costs, enhance process optimization, and drive innovation (Fukui, 2022).

Cloud computing, mobile communication, AI, and IoT are converging, creating synergies that power digital transformation across industries. Organizations that leverage these technologies gain a competitive advantage by utilizing data-driven insights, enhancing operational efficiency, and delivering personalized customer experiences. However, challenges such as data privacy, security concerns, and ethical issues must be addressed. Ensuring interoperability and seamless integration of different platforms and devices is essential to maximizing the value of technological innovations (Meng, 2019; Udriyah et al., 2019; Sharma & Lijuan, 2020; Horani et al., 2023).

Small and Medium-sized Enterprises (SMEs) are widely recognized as critical drivers of economic growth, particularly in emerging economies. Research by Carey (2021) and Wang (2022) underscores the essential role SMEs play in fostering economic development. In the European Union, SMEs account for 99 percent of enterprises and contribute nearly two-thirds of total employment (Frantz et al., 2021). Similarly, in China, SMEs represent the largest segment of enterprises and contribute significantly to the nation's economic output (Wang, 2022). According to the World Bank (2021), SMEs are the largest providers of employment and play a vital role in the Gross Domestic Product

(GDP) of emerging economies, emphasizing their importance in driving economic activity, fostering innovation, and creating jobs.

In China, SMEs, particularly in the manufacturing sector, are key contributors to employment and GDP (Ministry of Industries and Commerce, 2021). Despite their significant presence, their overall contribution to China's economic output remains relatively low (Ministry of Finance, 2022). To address this gap and enhance SME performance, the Chinese government has introduced a National Policy Framework to support SME growth (Ministry of Industries and Commerce, 2021).

E-commerce, defined as business transactions facilitated by the internet and related technologies, is a key driver of SME development in China and globally (Afshar Jahanshahi, 2012; Maryeni et al., 2012; Soto-Acosta, Popa, & Palacios-Marques, 2022). It fosters globalization by enabling SMEs to access international markets, thereby facilitating investment and business expansion (Savrul et al., 2020). E-commerce adoption enhances business performance by improving operational efficiency, expanding market reach, and optimizing customer interactions (Awa, Awara, & Lebari, 2021; Zheng, Arunatileka, & Gnige, 2004; Li & Xie, 2012; Rahayu & Day, 2021). However, despite these benefits, the adoption of E-commerce among SMEs often falls short due to organizational challenges such as resource limitations, digital infrastructure gaps, and a lack of technical expertise (Hajli et al., 2020; Mustol & Chan, 2022; Savrul et al., 2020).

In China, over 70 percent of SMEs face challenges in fully adopting E-commerce, highlighting the need for improved digital resources and infrastructure (Jaylin, 2022). Entrepreneurs, particularly young ones, express frustration over the limited availability of technological tools and resources to integrate E-commerce platforms into their business models. Furthermore, the availability of suitable internet protocol-based E-commerce solutions remains a significant hurdle for many SMEs (Suriyapperuma et al., 2022).

Information Technology Governance (ITG) plays a crucial role in overcoming these challenges. ITG ensures the effective and efficient use of IT resources to meet organizational goals (Geetha, 2020). Proper governance frameworks are essential for improving business performance by optimizing the use of technology, streamlining operations, and enhancing overall efficiency (Shanmugam, 2022). Effective IT governance helps SMEs leverage E-commerce platforms more efficiently, fostering growth, competitiveness, and long-term sustainability in the digital era.

In conclusion, the integration of ICT and E-commerce platforms is reshaping the business landscape, providing SMEs with new opportunities for growth and competitiveness. However, addressing the barriers to adoption, such as limited resources, digital literacy, and cybersecurity concerns, is critical for SMEs to fully capitalize on these technological advancements. By implementing robust IT governance strategies, SMEs can optimize their digital transformation, improve performance, and contribute to sustainable economic development.

LITERATURE REVIEW

Small and Medium Enterprises (SMEs) are critical for fostering economic growth, employment, innovation, and efficient utilization of domestic resources. In China, SMEs are particularly significant, playing an essential role in the informal sector and contributing to economic stability and growth. Research underscores the contribution of SMEs to employment, tax revenues, exports, innovation, and regional development (Chenhao, 2019). SMEs employ approximately 75% of China's workforce and account for 52% of the nation's Gross Domestic Product (GDP) (Zheng & Lawson, 2007; Ministry of

Industries and Commerce, 2021). They are also instrumental in promoting gender equality and youth empowerment by providing more opportunities for women and young people. Government initiatives, such as low-interest loans for women entrepreneurs, incentivize female participation in the SME sector. Moreover, the Chinese government has made significant budget allocations, indicating a strong commitment to the growth of SMEs (Ministry of Finance, 2021).

However, despite their importance, SMEs in China face numerous challenges, particularly financial constraints and taxation issues, which hinder their growth (Levy, 1993). Surveys conducted among SMEs in Russia and Bulgaria highlight barriers such as unprepared suppliers, limited land access, and production constraints (Pissarides, Singer, & Svejnar, 2003). These challenges are often context-specific, varying with the country's level of development and geographical location (International Labour Office, 2021). According to the Asian Development Bank, SMEs in China encounter barriers including lack of resources, high transaction costs, limited networks, and difficulties in innovation and research and development (Yoshino & Taghizadeh-Hesary, 2022). To overcome these obstacles, comprehensive measures are necessary, including policy interventions, financial support, technological assistance, and capacity-building initiatives (Lawe, 2019; Wickremasinghe, 2011).

The adoption of information technology, particularly Electronic Commerce (E-commerce), is crucial for the success and growth of SMEs. E-commerce, which refers to the buying and selling of goods and services via electronic data transmission (Grandon & Pearson, 2004), offers several advantages that can significantly impact SMEs. E-commerce reduces transaction costs, integrates global supply chains, and enhances communication and business efficiency (Morteza et al., 2011). It enables 24/7 operations, reduces the cost of communication, and allows businesses to automate their processes, resulting in greater efficiency and competitiveness. Furthermore, e-commerce provides SMEs with global reach and the ability to innovate in product offerings and customer engagement (Meng, 2019; Dan, 2022).

Despite these advantages, many SMEs face challenges in adopting e-commerce, such as a lack of knowledge, inadequate legal infrastructure, security concerns, and limited internet access (Meng, 2019). Addressing these challenges requires significant efforts to improve IT infrastructure, provide necessary training, and develop suitable legal frameworks (Fatimah, Putra, & Hasibuan, 2022). Nonetheless, e-commerce is increasingly seen as essential for enhancing SME performance and promoting sustainable development (Abebe, 2020). Moreover, the evolution of technologies such as Cloud Computing, Mobile Computing, Artificial Intelligence (AI), and the Internet of Things (IoT) further revolutionizes business operations, driving economic growth and increasing SME competitiveness (Vermesan & Friess, 2020). These technologies enable better efficiency, flexibility, and real-time data access, which are vital for SMEs to stay competitive in an increasingly digital world (Masiyev et al., 2012; Bai, 2011; Dlamini & Johnston, 2022).

Despite the benefits, many developing countries, including China, face challenges in adopting e-commerce. A key barrier is the need for SMEs to overcome globalization constraints to compete on a global scale. To address these issues, SMEs must receive support to leverage e-commerce for competitive advantages (Ghobakhloo, Aranda, & Amado, 2011). Addressing the challenges related to infrastructure, policy, and culture is crucial for promoting e-commerce adoption and allowing SMEs to fully capitalize on the digital economy.

Despite the critical role of SMEs in economic development, limited research has been conducted on the adoption of e-commerce among SMEs in rapidly developing countries like China. Kurnia et al.

(2019) note that although SMEs represent 90% of firms globally, their e-commerce adoption remains relatively low. Feng & Lin (2012) suggest that e-commerce adoption among SMEs is still in its early stages and needs to progress incrementally. E-commerce facilitates electronic transactions for various business purposes, offering significant benefits such as improved communication, automated transactions, better service delivery, and streamlined buying and selling processes (Boateng et al., 2008; Ngai et al., 2012). These advantages make e-commerce an attractive option for SMEs in developing countries, as it can enhance productivity, reduce costs, and improve market reach (Rajapakse et al., 2022; Zhou & Azam, 2024). However, challenges such as infrastructure quality, availability, and cost are major barriers to e-commerce adoption for SMEs in these regions (Ghobakhloo et al., 2011). Additionally, economic, social, political, and cultural factors further complicate the adoption process (Rahayu & Day, 2021).

At the initial stages, e-commerce adoption can help SMEs streamline business processes such as inventory management, sales tracking, and customer interactions, which can pave the way for business growth. Research suggests that addressing infrastructure, policy, and cultural challenges is essential for facilitating e-commerce adoption (Rahayu & Day, 2021). Tailored strategies must focus on overcoming barriers such as perceived complexity, lack of organizational resources, and infrastructure limitations (Ghobakhloo et al., 2011; Premkumar & Roberts, 1999).

Several factors influence e-commerce adoption, including perceived benefits, compatibility with existing business practices, management support, and competitive pressures. For example, in countries like Vietnam and Malaysia, the adoption of e-commerce has been influenced by low trust in online transactions and the importance of perceived benefits (Huynh et al., 2012; Kurnia et al., 2019). Research in China also highlights the importance of ICT adoption levels in determining e-commerce uptake (Zheng & Lawson, 2007). In other regions, such as Tanzania, socio-cultural norms and skepticism towards technology hinder adoption, though the provision of ICT expertise and training can mitigate these barriers (Kabanda & Brown, 2021).

Relative advantage is a key concept in e-commerce adoption, referring to the perceived benefits organizations and customers gain from implementing e-commerce technologies. For customers, the advantages of e-commerce include convenience, accessibility, and potential cost savings compared to traditional shopping methods (Morteza & Sai, 2019). These benefits are important drivers of customer adoption, ultimately contributing to the success and growth of digital commerce. On the service provider side, e-commerce enables streamlined operations, reduced costs, improved efficiency, and the ability to gain a competitive edge (Maryeni et al., 2012). By facilitating faster transactions and supporting just-in-time decision-making, e-commerce also opens doors for SMEs to expand into new markets (Premkumar & Roberts, 1999). However, many SMEs underutilize e-commerce due to a lack of awareness about its potential advantages (Zheng et al., 2023; Sudha et al., 2023). Increasing awareness is therefore crucial for encouraging e-commerce adoption.

Compatibility, another important factor in e-commerce adoption, refers to how well e-commerce technologies integrate with an organization's existing infrastructure and practices. Compatibility ensures that the new technology aligns with current business operations, minimizing disruptions and facilitating smoother implementation (Premkumar & Roberts, 1999). Research consistently shows that compatibility influences e-commerce adoption, as solutions that align with organizational culture and business practices are more likely to be embraced (Rahayu & Day, 2021).

Lastly, complexity, or the perceived difficulty of implementing and using e-commerce technologies, is a significant barrier for many SMEs, especially those with limited IT expertise. Complex systems can be intimidating, leading to resistance among employees and inefficiencies (Maryeni et al., 2012). Simplifying e-commerce systems and offering user-friendly interfaces are essential for overcoming these challenges and promoting digital transformation (Suh & Han, 2003). Efforts to reduce complexity can increase acceptance and enhance organizational efficiency.

IT expertise is also crucial for the successful adoption and implementation of e-commerce technologies. Organizations that lack IT knowledge may not fully recognize the benefits of new technologies, leading to hesitancy in adopting e-commerce solutions (Premkumar & Roberts, 1999; Ajmal & Yasin, 2012). SMEs often face challenges in recruiting and retaining skilled IT professionals, exacerbating the skills gap and hindering the adoption of digital technologies (Alam & Noor, 2019). Addressing this gap through training and strategic partnerships is vital for enabling SMEs to unlock the benefits of e-commerce.

Information and network security are fundamental to e-commerce, especially regarding financial transactions and data exchange. Security encompasses confidentiality, authentication, message integrity, and privacy. Despite ongoing efforts to improve security measures, concerns around security continue to inhibit widespread e-commerce adoption (Awa et al., 2021). Addressing these security concerns is critical to promoting e-commerce adoption and ensuring safe and secure transactions. Overall, overcoming the barriers to e-commerce adoption and addressing the technological, organizational, and infrastructural challenges are essential for SMEs in developing countries to fully benefit from the digital economy.

Theories Used in Technology Adoption

Understanding the adoption and diffusion of innovative technologies such as E-commerce is critical for organizations seeking to leverage digital solutions to enhance their operations. Various theoretical models have been developed to explore the factors influencing technology adoption. These models collectively provide valuable insights into the complexities of E-commerce adoption, helping to identify key factors that drive its successful implementation and offering strategies for organizations to navigate these challenges.

The Diffusion of Innovation (DOI) theory, proposed by Everett Rogers in 1962, offers a foundational framework for understanding how innovations spread within a society. According to DOI, the adoption rate of an innovation is influenced by five key attributes: relative advantage, compatibility, complexity, trialability, and observability. These attributes determine how quickly and widely an innovation is adopted. In the context of E-commerce, relative advantage refers to the perceived benefits of adopting digital platforms over traditional methods, while compatibility addresses how well the innovation aligns with existing practices. Complexity pertains to the perceived difficulty of using the innovation, and trialability refers to the ability to experiment with the innovation before committing fully. Observability relates to the extent to which the results of using the innovation are visible to others. Research has shown that attributes like relative advantage and compatibility play a significant role in the decision-making process for E-commerce adoption, particularly among small and medium-sized enterprises (SMEs) (Kendall et al., 2001; Khong et al., 2019).

The Technology Acceptance Model (TAM), developed by Fred Davis in 1989, focuses on two primary factors that influence technology adoption: perceived usefulness and perceived ease of use. TAM

suggests that individuals are more likely to adopt a technology if they believe it will improve their performance (usefulness) and if it is easy to use (ease of use). This model has been widely applied to understand the adoption of E-commerce technologies, highlighting the importance of designing user-friendly and beneficial digital solutions. Over time, TAM has been expanded to incorporate additional factors that influence technology acceptance. For example, TAM2, introduced by Venkatesh and Davis (2000), includes variables such as subjective norm, image, job relevance, output quality, and result demonstrability. These additional constructs offer a more comprehensive understanding of the factors that shape an individual's perceptions of technology and their likelihood of adopting it.

The Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. in 2003, integrates elements from several existing models, including TAM. UTAUT identifies four core constructs that influence technology acceptance: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy refers to the belief that using the technology will improve job performance, while effort expectancy pertains to the perceived ease of using the technology. Social influence refers to the extent to which individuals are influenced by the opinions of others when deciding whether to adopt a technology, and facilitating conditions relate to the availability of resources and support needed to use the technology effectively. UTAUT also incorporates four moderating variables, gender, age, experience, and voluntariness of use, that can influence the relationship between the core constructs and behavioral intentions. This comprehensive framework provides valuable insights into the factors driving E-commerce adoption across different organizational contexts and user groups.

The Theory of Planned Behavior (TPB), developed by Icek Ajzen in 1985, emphasizes the role of attitudes, subjective norms, and perceived behavioral control in shaping individuals' intentions and behaviors. TPB posits that people are more likely to engage in a behavior if they perceive it as favorable, socially supported, and within their control. This theory has been applied to explore the determinants of E-commerce adoption, offering a nuanced understanding of how attitudes and social influences affect technology adoption decisions. By integrating TAM and TPB, researchers can gain a more comprehensive view of technology adoption, incorporating both individual perceptions and social factors. TPB has been applied in various contexts, such as consumer decisions, health-related behaviors, and environmental actions, highlighting its versatility in predicting human behavior across diverse domains. This integrated approach is particularly useful for understanding the complex interplay of factors that influence the adoption of E-commerce technologies in organizations.

The Resource-Based View (RBV), developed by Jay Barney in 1991, provides a different perspective on technology adoption by focusing on the role of organizational resources and capabilities. According to RBV, organizations can leverage their unique resources, such as IT infrastructure, human capital, and financial assets, to gain a competitive advantage. This view highlights the importance of internal capabilities in facilitating the successful adoption and implementation of E-commerce technologies. Organizations with strong technological infrastructure and skilled personnel are better positioned to adopt and integrate digital solutions, enhancing their ability to compete in the digital economy.

In addition to these individual theories, the Technology-Organization-Environment (TOE) framework, introduced by Tornatzky and Fleischer in 1990, offers a comprehensive approach to understanding technology adoption in organizations. The TOE framework examines three critical elements that influence innovation adoption: technology, organization, and environment. Technology refers to the

characteristics of the innovation itself, such as its relative advantage and compatibility with existing systems. Organizational factors include the company's resources, management capabilities, and internal processes, which can either facilitate or hinder the adoption of new technologies. Environmental factors encompass external elements such as market conditions, regulatory frameworks, and competition, which can influence an organization's decision to adopt technology. The TOE framework provides a structured way for organizations to assess the feasibility of adopting a new technology, considering the interplay between technological, organizational, and environmental factors.

Each of these models offers valuable insights into the factors that influence E-commerce adoption and diffusion. By examining the individual, organizational, and external factors that shape the adoption process, organizations can better understand the challenges and opportunities associated with implementing digital technologies. These frameworks can help identify the barriers that SMEs face when adopting E-commerce, such as limited resources, lack of technological expertise, and external market pressures. They also highlight the importance of creating an environment that supports innovation and facilitates the successful integration of new technologies.

In conclusion, the adoption of E-commerce technologies is influenced by a complex set of factors, including individual perceptions, organizational capabilities, and external environmental conditions. The theoretical models discussed here, DOI, TAM, UTAUT, TPB, RBV, and TOE, offer valuable insights into the drivers and barriers to E-commerce adoption. By applying these models, organizations can gain a deeper understanding of the factors that influence their technology adoption decisions and develop strategies to overcome the challenges they face. This holistic approach to understanding E-commerce adoption is essential for organizations seeking to thrive in the digital age and harness the benefits of digital commerce.

FINDINGS AND DISCUSSIONS

The findings from the data analysis provide a comprehensive understanding of the factors influencing the adoption of e-commerce platforms by Small and Medium Enterprises (SMEs) in the manufacturing sector in China, and their subsequent impact on organizational effectiveness and performance. These insights are particularly valuable as they offer a nuanced perspective on the key determinants of e-commerce adoption within this context, as well as their implications for the broader business environment. When placed in the context of existing literature, the findings contribute to enhancing the understanding of technology adoption processes and offer practical insights for SMEs looking to improve their competitiveness in the digital economy.

One of the key factors identified in the study as crucial for the adoption of e-commerce platforms is Relative Advantage. This factor, which refers to the perceived benefits that adopting e-commerce technologies offers over traditional business methods, was found to be significant in driving the decision to implement digital platforms. This aligns with previous research on technology adoption, which emphasizes the importance of perceived benefits in influencing adoption decisions (Rogers, 2003; Venkatesh et al., 2003). For instance, businesses are more likely to adopt new technologies if they believe that these innovations will provide a competitive edge or improve operational efficiencies. The study also identified Compatibility as another key factor, highlighting the importance of how well e-commerce platforms fit with existing business practices and systems. This is consistent with earlier studies that suggest the ease with which new technologies integrate into an organization's workflow

plays a critical role in their successful adoption (Rogers, 2003). Similarly, Simplicity emerged as a key factor, with respondents noting that the ease of use and straightforward nature of the technology influenced their willingness to adopt it. This underscores the importance of designing user-friendly e-commerce solutions that do not require extensive retraining or complex technical expertise (Venkatesh et al., 2003).

Another important factor that emerged from the analysis was Security. Although security concerns did not play a significant role in the adoption decision, they were still noted as a consideration by some respondents. This finding suggests that while security might not be the primary determinant in adopting e-commerce platforms, it remains an underlying factor that businesses must address. This is consistent with research highlighting the importance of ensuring secure digital transactions and data protection in fostering confidence in e-commerce systems (Zhu et al., 2006). For SMEs, addressing security concerns could be an important step in enhancing trust and facilitating smoother adoption processes. The study also revealed that Information Technology (IT) governance plays a crucial role in driving organizational effectiveness and performance post-adoption. IT governance, which refers to the processes and structures that ensure IT resources are aligned with organizational goals and are being used optimally, was found to be instrumental in ensuring that e-commerce technologies contribute to business success. This aligns with the literature on IT governance, which suggests that effective governance frameworks are critical in ensuring that organizations can fully capitalize on their IT investments (Weill & Ross, 2004; Luftman et al., 2007). The study's findings indicate that organizations that have strong IT governance structures are better equipped to navigate the complexities of e-commerce adoption, and can leverage these technologies to enhance business performance.

However, the study also identified several technological barriers faced by SMEs in adopting e-commerce platforms. These barriers include issues related to digital infrastructure, lack of technical expertise, and limited resources to implement and maintain new technologies. These findings align with previous studies that have highlighted the challenges SMEs face in adopting new technologies, particularly in terms of their ability to invest in and manage IT resources effectively (Molla & Licker, 2005; Ramdani et al., 2009). The study suggests that targeted interventions, such as training programs, government incentives, or partnerships with technology providers, could help overcome these barriers and improve the digital readiness of SMEs.

The demographic analysis of the study sample revealed some interesting trends that may influence technology adoption. Most respondents were male (81.2%), which reflects the gender distribution commonly found in technology-related fields. Moreover, a significant proportion of the respondents were young, with nearly half aged between 20 to 30 years. This youthful inclination towards technology adoption is consistent with previous research suggesting that younger individuals are more likely to embrace new technologies due to their familiarity with digital tools and platforms (Venkatesh & Morris, 2000). Additionally, the educational background of respondents indicated a relatively high level of educational attainment, with many holding undergraduate degrees. This higher level of education may facilitate better engagement with new technologies, as individuals with higher education levels tend to have better digital literacy and a greater capacity to adapt to new systems (Crespo et al., 2016).

In the descriptive analysis, factors such as Relative Advantage and Network Security were perceived differently in terms of their importance to e-commerce adoption. Relative Advantage received the highest mean score, indicating that it was considered the most critical factor when deciding to adopt e-commerce technologies. This finding is consistent with the assertion that businesses are more likely to adopt innovations that they perceive will provide substantial benefits in terms of operational efficiency, cost reduction, or market expansion. On the other hand, Network Security had the lowest mean score, suggesting that security was not as pressing a concern among the respondents. While security is still an important factor, this finding may indicate that businesses are willing to overlook it to some extent in favor of other, more pressing considerations, such as perceived benefits and ease of integration.

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were employed to further examine the underlying structure of the data. These analyses revealed that the constructs related to e-commerce adoption exhibited strong internal consistency, indicating that the identified factors were reliable and robust. However, some minor adjustments were made to enhance the reliability of the constructs. The study identified nine key factors influencing e-commerce adoption, each accounting for more than 50% of the total variance, which highlights the complexity of the adoption process. This suggests that the adoption of e-commerce platforms is influenced by a multitude of factors, and a comprehensive approach is necessary to understand and address the various determinants at play (Azam et al., 2021; Azam et al., 2023).

Furthermore, the study explored the mediating role of e-commerce application in influencing organizational outcomes. Relative Advantage and Simplicity were found to have partial and full mediation effects, respectively, demonstrating their significant roles in shaping the impact of e-commerce adoption on business performance. In contrast, Security did not exhibit a mediating effect, suggesting that while security concerns are important, they do not directly influence organizational outcomes in the same way as factors such as Relative Advantage and Simplicity.

In conclusion, the study provides valuable insights into the factors that influence e-commerce adoption among SMEs in the manufacturing sector in China. The findings underscore the importance of factors such as Relative Advantage, Compatibility, Simplicity, and Security in driving technology adoption decisions. They also highlight the critical role of IT governance and the barriers faced by SMEs in overcoming technological challenges. These insights contribute to the broader literature on technology adoption, offering practical recommendations for improving SME competitiveness in the digital age. By addressing the identified factors and overcoming technological barriers, SMEs can make informed decisions about e-commerce adoption, enhancing their operational efficiency and market positioning in the digital economy.

CONCLUSION AND RECOMMENDATIONS

This study delved into the key Information Technology (IT) factors influencing the adoption of E-commerce platforms in small and medium-sized manufacturing enterprises (SMEs) in China, with a particular focus on the role of IT governance. The findings underscore the significant impact of several determinants, including Relative Advantage (RA), Compatibility and Simplicity (Com_Sim), and Security, in driving E-commerce adoption. These factors were found to align with established technology adoption frameworks such as the Diffusion of Innovations (DOI) theory, the Technology Acceptance Model (TAM), and the Technology-Organization-Environment (TOE) framework.

Among these factors, Relative Advantage emerged as the most crucial determinant, reinforcing the idea that businesses are more likely to adopt technologies that offer clear, perceivable benefits over traditional methods. This aligns with the central tenets of DOI, which emphasize the relative benefits of new technologies as a primary factor in their adoption (Rogers, 2003). The positive influence of RA indicates that the perceived benefits of E-commerce platforms, such as improved efficiency and enhanced operational performance, play a vital role in encouraging SMEs to embrace these technologies.

Compatibility and Simplicity were also identified as critical factors influencing E-commerce adoption in SMEs. The compatibility of new technologies with existing business systems and practices is crucial for seamless integration, especially in the manufacturing sector, where operations are closely tied to machinery, processes, and workflows. Ensuring that new technologies fit well within existing frameworks is essential for maintaining continuity in operations. In addition, simplicity, or the ease of use of E-commerce platforms, was seen as an important factor. Manufacturing SMEs often require technology solutions that can be implemented with minimal disruption to daily operations, making user-friendly and easily integrated platforms essential. These findings are consistent with the broader literature on technology adoption, which suggests that for technology to be successfully implemented, it must be easily understood and integrated into current business processes (Venkatesh et al., 2003). The importance of these factors is further reinforced by China's National HR and Employment Policy, which emphasizes creating employee-friendly environments that ease technological transitions (Madihahewa, 2020). Therefore, proper planning and training for employees are critical components in ensuring that manufacturing SMEs can smoothly adopt and leverage E-commerce platforms.

Security concerns also emerged as a significant factor in the adoption of E-commerce platforms. In particular, the issues of trust and perceived risk were highlighted as key barriers to adoption. For SMEs, ensuring the security of transactions and the protection of sensitive business data is critical for fostering trust among customers and business partners. The study found that organizations need to invest in robust security measures, including secure payment systems and comprehensive data protection protocols, to ensure business continuity and mitigate risks. This aligns with the Unified Theory of Acceptance and Use of Technology (UTAUT2) and the Extended DOI, which emphasize the role of security in technology adoption (Chong, 2019). When businesses perceive that an E-commerce platform offers strong security features, they are more likely to adopt it, as it reduces the perceived risks associated with digital transactions and enhances confidence in the technology.

The study also explored the positive relationship between the application of E-commerce platforms and organizational performance. E-commerce platforms provide SMEs with several advantages, including the ability to process direct payments, facilitate buyer-seller interactions, and enhance marketing efforts. These advantages contribute to improved operational effectiveness and overall business performance. By offering SMEs access to a wider market, reducing transaction costs, and streamlining business processes, E-commerce platforms provide a competitive edge that can significantly enhance an organization's position in the digital marketplace. As the manufacturing sector in China continues to embrace digital technologies, investing in E-commerce platforms that offer these features becomes increasingly essential for SMEs to remain competitive in a fast-evolving business environment.

One of the most significant findings of the study was the moderating role of IT governance in maximizing the benefits of E-commerce adoption. IT governance refers to the processes, structures, and practices that ensure IT resources are used efficiently and aligned with organizational goals. The study found that organizations with strong IT governance frameworks were better equipped to optimize the impact of E-commerce adoption. Effective governance ensures that technological investments are strategically aligned with business objectives, enabling SMEs to leverage E-commerce solutions for enhanced performance. This finding is consistent with research highlighting the importance of IT governance in maximizing the value derived from technology investments (Weill & Ross, 2004). For SMEs to fully capitalize on the potential benefits of E-commerce, they must have well-defined IT governance policies that ensure strategic alignment between technology and business objectives.

The study's findings also offer several practical recommendations for both E-commerce solution developers and organizations looking to adopt these platforms. For developers, the focus should be on creating innovative, flexible, and scalable solutions that can cater to the unique needs of different business models and environments. Incorporating features such as real-time customer feedback mechanisms and predictive analytics would allow businesses to better anticipate market trends and tailor their solutions accordingly. By developing E-commerce platforms that can easily adapt to the changing needs of SMEs, developers can expand market share and drive further adoption.

For organizations adopting E-commerce, selecting solutions that are not only secure but also compatible with existing systems is paramount. Businesses should prioritize solutions that offer comprehensive features, including seamless integration with current operations and robust security protocols. Furthermore, organizations should adopt clear and well-structured adoption plans that include detailed implementation strategies, effective stakeholder communication, and training programs to ensure a smooth transition to E-commerce platforms. Providing employees with the necessary tools and knowledge to effectively use new technologies will increase the likelihood of successful adoption and utilization. By embracing integrated E-commerce solutions, manufacturing SMEs can significantly enhance their operational efficiency, expand their market reach, and improve their overall competitiveness.

Government policies and initiatives that support the development of SMEs and encourage the adoption of E-commerce technologies are also essential. Tailored support services, such as grants, tax incentives, and access to customized E-commerce solutions, can address the unique challenges faced by SMEs in adopting new technologies. These initiatives can play a key role in fostering a more conducive environment for digital adoption, helping SMEs overcome barriers related to financial constraints and lack of technical expertise.

In conclusion, this study contributes valuable empirical evidence to the literature on E-commerce adoption in SMEs, particularly in the context of the manufacturing sector in China. By examining key factors such as Relative Advantage, Compatibility, Simplicity, and Security, the study enhances our understanding of the drivers of E-commerce adoption. Additionally, the role of IT governance in optimizing the benefits of E-commerce platforms highlights the importance of strategic alignment between technology and organizational goals. These insights offer practical implications for both E-commerce solution developers and SMEs, providing guidance on how to maximize the benefits of digital technologies. As the digital transformation of the manufacturing sector continues, SMEs in China can enhance their competitiveness and achieve significant improvements in performance by

adopting advanced E-commerce solutions and implementing effective IT governance strategies. Future research should continue to explore additional moderators and mediators to further our understanding of the complex relationships between technology adoption, IT governance, and business performance across various organizational contexts.

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